Autodesk® MotionBuilder® 2011

User's Guide

Autodesk®

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Published by: Autodesk, Inc.

111 McInnis Parkway

San Rafael, CA 94903, USA

Document Title:	Autodesk MotionBuilder 2011 User's Guide
Date:	10 March 2010
Document Version:	2010.03.10.03
Build Version:	2010.03.10.03

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Part 1: MotionBuilder Interface

As with most software, MotionBuilder, includes standard interface items that let you perform general tasks.

For example, you can use the MotionBuilder menu bar to open recently saved files, select keyboard configurations, create custom layouts, and access the MotionBuilder Help. You can use the Preferences window to customize the MotionBuilder settings.

This section discusses the basic interface of MotionBuilder and includes topics on the MotionBuilder menu bar, setting Preferences, and creating custom layouts.

This section also discusses common interface items that consist of windows, fields, or other interface items that appear in more than one place within MotionBuilder.

There are minor differences in how the MotionBuilder user interface displays on various system layouts (i.e. monitor resolution of 1280, 1024, or 1600).

NOTE The screenshots shown were taken from MotionBuilder running the Windows XP operating system with the monitors set at a resolution of 1280 x 1024. Therefore, the screenshots may not match how the MotionBuilder user interface is displayed on your system.

The following common interface items are discussed.

- Color window on page 2
- Asset Selection list on page 7
- MotionBuilder menu bar on page 13
- Viewer window on page 49
- Asset browser on page 79
- Navigator window on page 91
- Python Editor on page 101

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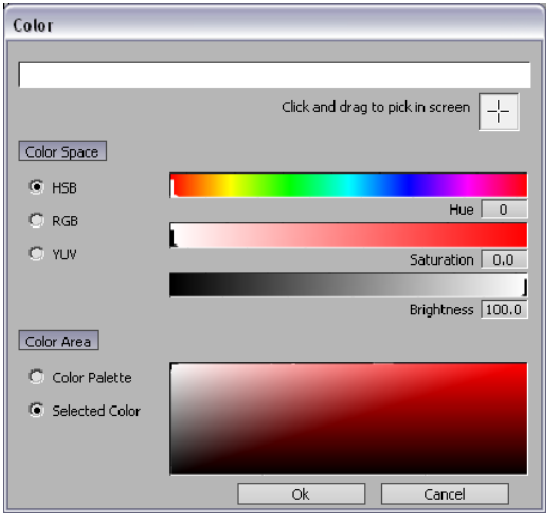
- Preferences on page 129

Color window

Use the Color window to change the color of lights, models, materials, shading effects, and any other object or any other asset with a color property.



Color window

The Color window is split into three areas:

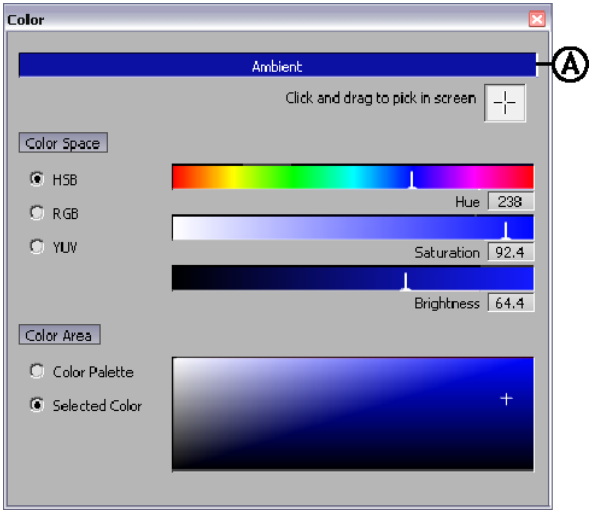
- Current color area on page 2
- Color space area on page 4
- Color area on page 6

Current color area

The Current color area lets you view the color that is currently active in MotionBuilder, for example, the color of a selected object in the Viewer window.

Whenever you make changes to the color selection using the Color picker, Color Space, or Color areas, the changes are reflected in the Current color area.

The Current Color area also identifies the name of the setting to which you are applying the color. For example, if you select an object with a blue Ambient Material setting in a scene, the Current Color area displays the color blue and is labelled “Ambient”, as shown in the following figure.



Color Window: *A.* **Current Color area**

Use the Color picker to select a pixel from objects displayed in the Viewer window.

To pick a color:

- Click and drag the Color picker anywhere on your screen and release your mouse button once you find the color you want.
  The selected pixel in your screen is “captured” and reflected in the Current Color field.

For example, click and drag the Color picker over a colored light and release your mouse once you find the color you want. The color in the Current Color field changes as you move over the colored light’s beam. Locate the color you want and click to capture it.

Color space area

The Color Space area lets you change the current color using one of three different color spaces. Use the Color Space area to define your color selection with more precision.

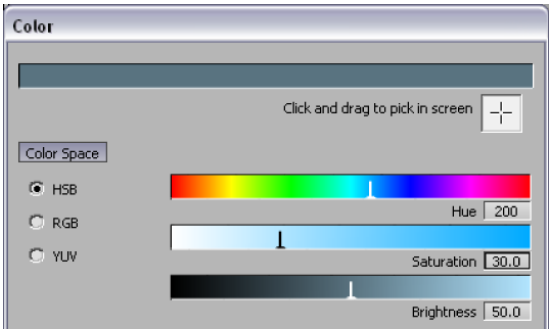
The Color Space area is divided into three Color Space settings, one for each color mode:

- HSB
- RGB
- YUV

Switch to any of these three color modes by selecting the corresponding option beside the color sliders.

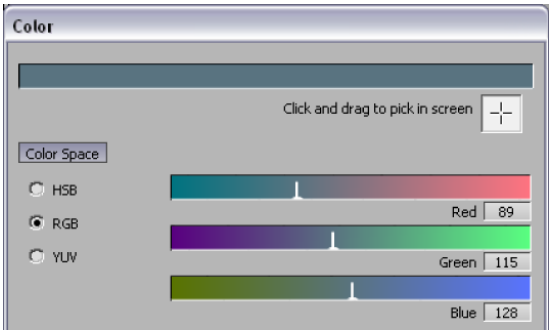
Drag the Color Indicator across the Color bars to select a color. You can also create colors by double-clicking the Value field found under the Color bars and entering a value.

Depending on the color space selected, changes to the current color may create a color shift in each color bar.



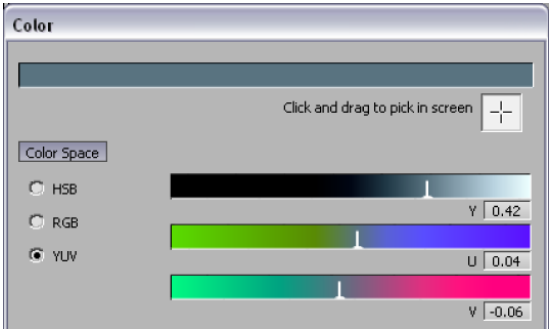
Hue, Saturation, Brightness (HSB) Color space

The HSB Color space defines pixels according to the hue, saturation and brightness values. Use the Hue slider first to select the color, then use the Brightness and Saturation sliders to adjust the contrast. Changing the Hue also repositions the Saturation and Brightness color bars. Changing the Saturation also changes the Brightness bar.



Red, Green, Blue (RGB) Color space

The RGB color space defines pixels according to red, green, and blue channel values. RGB is an additive color system and is used when working with computer monitors or other light-emitting devices.



YUV Color space

The YUV color space defines pixels based on the luminance and chrominance values. Y is the luminance component, U and V are the chrominance components or color signals.

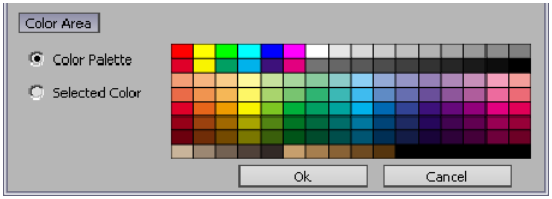
The following table provides the color space settings

Color Space settings	Description
HSB	Select the HSB option to choose your color using a a mix of hue, saturation, and brightness. The Hue color bar shows the entire spectrum of available colors.

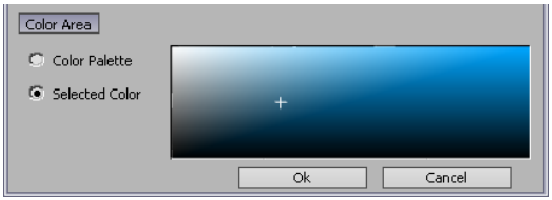
Color Space settings	Description
RGB	Select the RGB option to choose a color using a mix of red, green, and blue. The three color bars switch to show the red, green, and blue spectrum.
YUV	Select the YUV option to choose a color using a mix of Y, U, and V values. The three color bars switch to represent the Y, U, and V spectrum. YUV is a standard color mode used for television transmission.

Color area

The Color area lets you change the current color using an interactive color palette that you can modify after you select a color swatch. You can also select the color from a palette of color swatches. Both options are shown in the following figures.



Color area Color Palette



Color area Selected Color

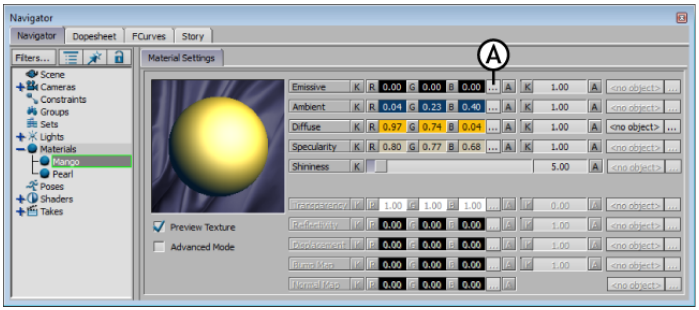
Using the Color window

Use the Color window to change the color of lights, models, materials, shading effects, and any other object or any other asset with a color property.

To use the color window:

1 Click the Color (...) button in any window next to an option that lets you change the color of an object.

For example, you can open the Color window from the Emissive, Ambient, Diffuse, or Specularity color areas of the Material settings pane by clicking the Color (...) button.



Material Settings *A.* **Color button**

2 The Color window appears.

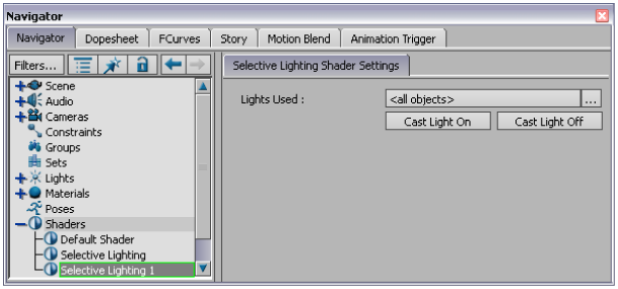
3 Set your color using one of the three methods:

- Choose a the Color mode (HSB, RGB, or YUV), and adjust the colors
- Select between the Color palette and Selected Color options.
- Use the Color Picker to select colors from objects already displayed in the Viewer window.

4 Once you have selected a color, close the Color window using the X button in the upper right corner.

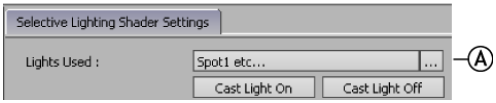
Asset Selection list

The Asset list is an interface item that lets you specify one or more assets. The Asset list is found next to the Asset field in many Navigator window panes, for example the Selective Lighting Shader settings.



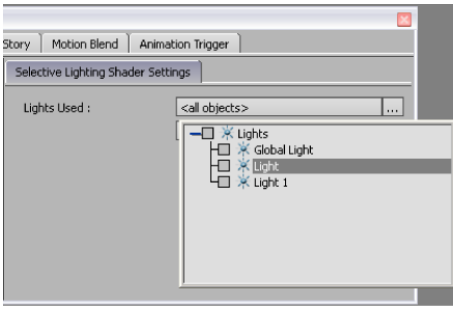
Selective Lighting Shader Settings

Access the Asset list through the Asset list button (...) that appears next to the field.



Asset Selection List *A.* **button**

When you click the Asset list button, a list of all the corresponding assets added to your scene displays.



Assets used in the scene

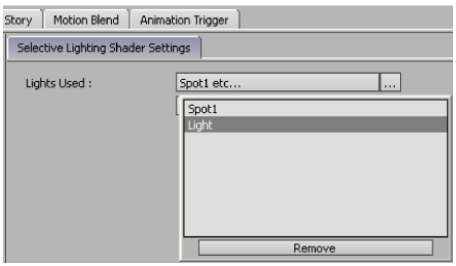
The Tree/List options let you choose which way you want to view the contents of the Asset list.

Select Tree to make the Asset list display in a tree hierarchy with check boxes that are either activated or disabled. Select List to make the Asset list for the

selected objects display as a list. Unlike the Tree display, the List display only shows selected objects.

Option	Behavior
Check Whole Branches	Select Check Whole Branches to select the item and all its child items when selecting/deselecting something in the Asset list.
Find First Checked Child	Select Find First Checked Child if the tree hierarchy is collapsed. It expands the tree to the first selected child item.
Find Child by Name	Select Find Child by Name to open the Find Child by Name search window. Enter the name of a specific asset or object in the search window to have MotionBuilder locate it.
Expand Branch	Select Expand Branch to completely expand the branch of the item selected.
Select Branch	Use the Select Branch option to select all the items included in the item's hierarchy in the Asset list and in the Viewer window.
Select Object	Use the Select Object option to select the object in the Asset list and in the Viewer window.

If you right-click the Asset list, a contextual menu appears with options for selecting and organizing the Asset list.



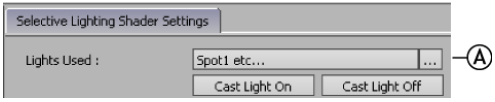
Asset list

Selecting assets using the Asset Selection list

The Asset list is an interface item that lets you specify one or more assets.

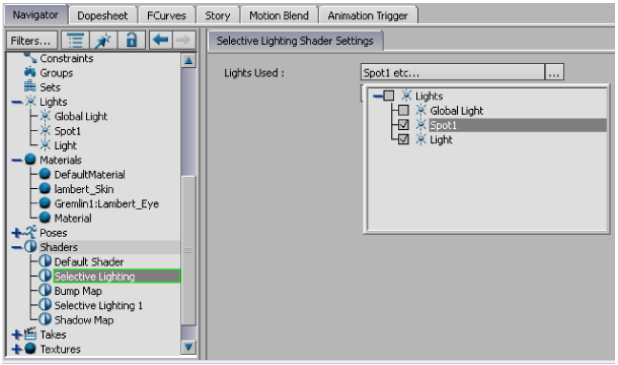
To select items from the Asset Selection list:

1 Click the Asset List (...) button.



Asset Selection List *A.* **button**

The Asset list appears with assets appropriate to the asset you are selecting. For example, if you are using the Lights Used Asset list, all the lights used in the scene are displayed.



Assets used in the scene

2 Activate the option that corresponds to each asset you want to select.

NOTE If you want to select all items contained in the list, activate the option next to the root folder. For example, in the preceding image, the root folder is the Lights folder.

When multiple assets are selected, only the first asset is listed, followed by “etc”.

Removing assets from the Asset Selection list

To remove items in your Asset list:

1 Double-click the Asset field.

A list appears with all the assets you have assigned.

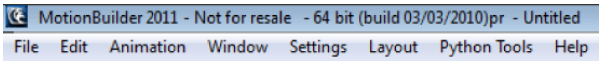
2 Select the items that you want to remove from the list.

3 Click Remove.

MotionBuilder menu bar

1

The MotionBuilder menu bar lets you select commands to perform various operations, show and hide windows, and access help.

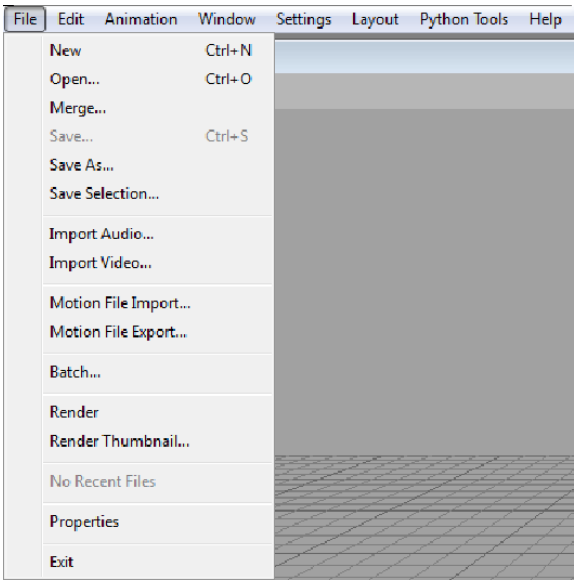


MotionBuilder menu bar

- File menu on page 13
- Edit menu on page 22
- Animation menu on page 28
- Window menu on page 30
- Settings menu on page 34
- Layout menu on page 36
- Version Control menu on page 39
- Help menu on page 40

File menu

The File menu contains options for clearing the scene, opening and saving *.fbx* files, batch processing, and rendering files. The File menu also lets you import and export to other file formats.



File menu options

File > New

Clears the MotionBuilder scene of all models, elements, devices, takes, and other assets. If you choose New without saving your MotionBuilder scene, a dialog box appears asking if you first want to save your scene.

File > Open

NOTE Changes to the file IO are not reflected in this section for the Beta 1 release. For an overview of the file IO changes, see File I/O Support.

Displays the Open File dialog box, letting you choose an *.fbx* file to open. After you select a file and click Open, the Open Options dialog appears, enabling you to select assets, settings, and takes to open, as well as prepend namespaces to all objects included in the incoming file. See Opening an .fbx file on page 195.

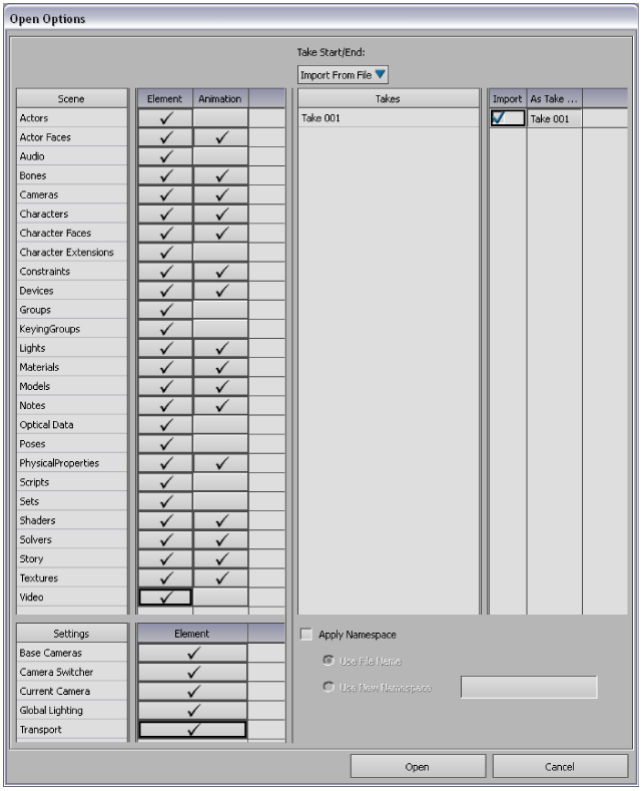
To open .fbx files saved in MotionBuilder:

1. Choose File > Open.

   The Open File dialog appears.

2. Select a file and click Open.

The Open Options dialog appears.



Open Options dialog box

See the Open Options dialog box on page 225.

To open FBX, 3DS, DAE, and OBJ files:

- Choose File > FBX Plug-in Import
  See Opening a file from another 3D package on page 198.

To open motion files:

- Choose File > Import
  See Opening a motion (MoCap) file on page 200.

File › Merge

NOTE Changes to the file IO are not reflected in this chapter for the Beta 1 release. For an overview of the file IO changes, see File I/O Support.

Displays the Open File dialog box, letting you choose an *.fbx* file to open. After you select a file and click Open, the Merge Options dialog box appears, enabling you to select assets, settings, and takes to merge, append, or discard, and to prepend a namespace to all objects included in the incoming file. See Merging assets from .fbx files on page 233.

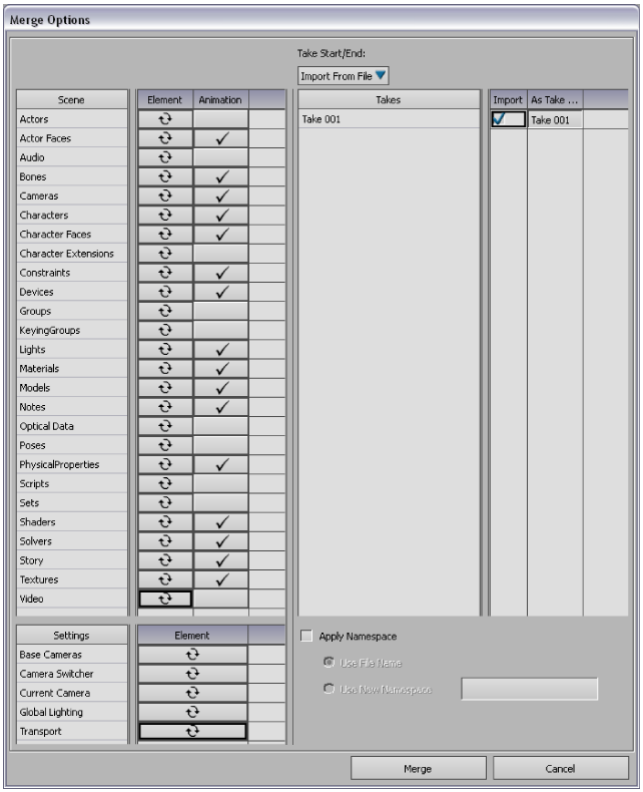
To merge assets or an .fbx file with the current scene:

1. Choose File > Open.

   The Open File dialog appears.

2. Select a file and click Open.

   The Merge Options dialog appears.



Merge Options dialog box

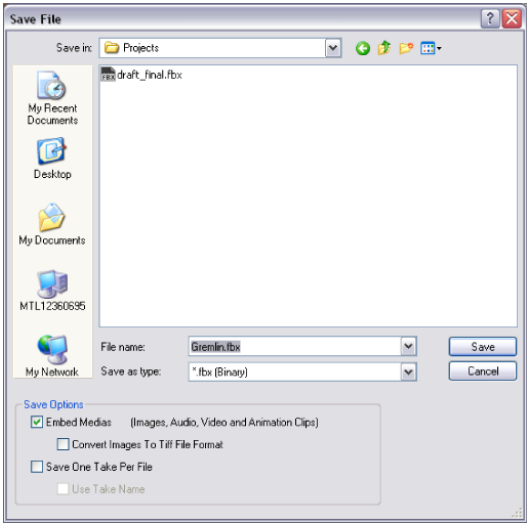
See Merge Options dialog box on page 237.

File > Save

Saves the current MotionBuilder scene with the same name as the last *.fbx* file that was opened or saved. If you are working on a scene that is yet to be saved, selecting Save is the same as selecting Save As.

File > Save As

Opens the Save File dialog box, letting you save the current MotionBuilder scene using a new file name.



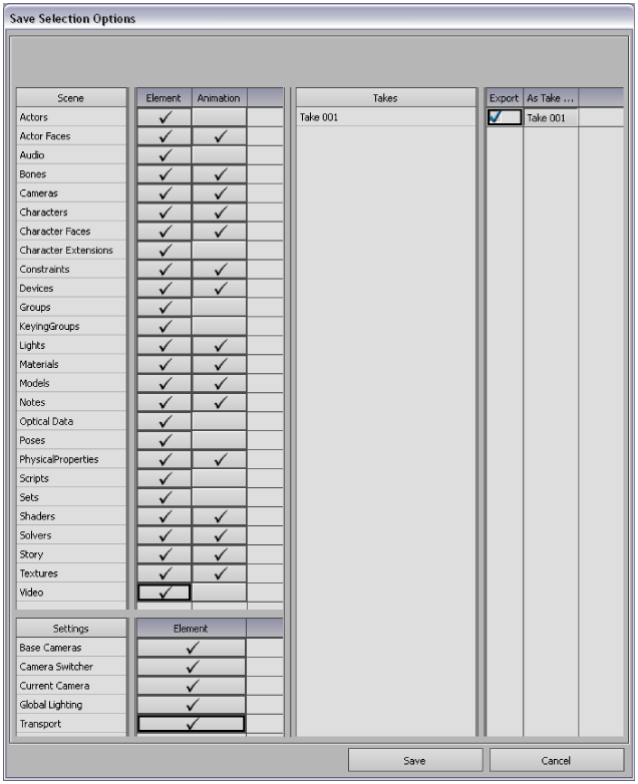
Save File dialog box

Enter the name of the *.fbx* file to be saved in the File name field. You can specify Saving options such as embedding media and saving one take per file.

Clicking Save opens the Save Options dialog that lets you specify which assets, settings, and takes are to be saved. See Saving on page 249.

File › Save Selection

Saves an *.fbx* file containing only the selected assets. To ensure that the appropriate assets are selected, select the entire branch of the asset you are saving in the Scene browser.



Save Selection Options dialog box

NOTE You can resize the Save Selection Options dialog box.

For example, if you want to save a model and the constraint used by the model, you must select both the model and constraint before using File > Save Selection. Otherwise, only the model is saved.

NOTE If you save a constraint using the File > Save Selection function, it loses the connections to its Source and Constrained objects when it is re-loaded. If this happens, manually reconnect the constraint after you re-load it. You can also save the Source and Constrained objects with the constraint when you use the Save Selection option. When you merge the constraint with a scene, discard or merge the loaded models.

File › Import Audio

Opens the Audio Clip File Open dialog box, which lets you select a *.wav* file. Click Open to load the selected *.wav* file as an audio asset.

File › Import Video

Opens the Video Clip File Open dialog box, which lets you import an *.avi* file or image file. The selected video clip or image file is loaded as a video asset.

File › Motion File Import

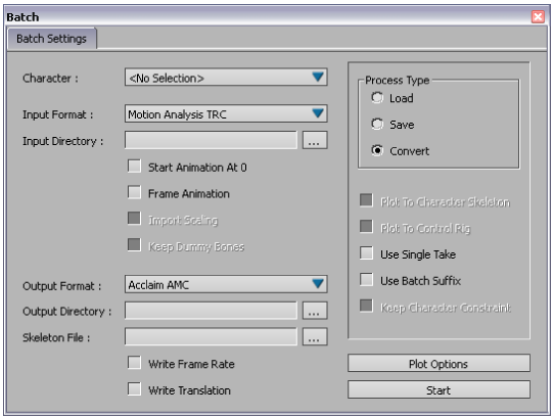
See File I/O Support.

File › Motion File Export

See File I/O Support.

File › Batch

Opens the Batch window, which lets you convert multiple data files between different formats. You can batch load a series of data files onto your current character, or save all your takes to a specified data format.



Batch window

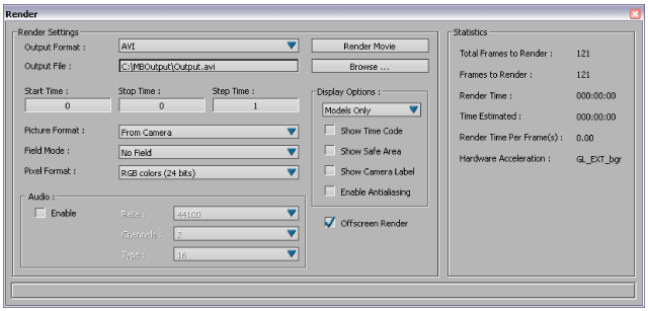
When loading Acclaim files, you can retain dummy nodes. You can also write translation of all nodes when saving both Acclaim and Biovision files.

You can also use the Batch window to save all takes mapped to a selected Actor, Character asset, or Control rig as separate motion files, and convert files from one format to another. Unused fields are disabled, depending on

the current mode, which can be either set to Load, Save, or Convert. For more information, see Batch processing on page 297.

File > Render

Opens the Render window, which lets you render your takes as *.avi* or *.swf* files (Flash®), or as a series of *.tif*, *.tiff*, or *.tga* files.



Render window

Depending on the file type that you select, additional options and windows may display. For information on all options and instructions on how to use the Flash renderer, see Rendering on page 307.

File > Render Thumbnail

Opens the Thumbnail Preview window, which lets you create thumbnail images for *.fbx* files. Thumbnail images appear as custom icons in the Asset browser.

Thumbnail Preview window

You can also create custom thumbnails using a specially named *.tif* image. See Assets on page 379.

File > Recent Files

Displays the locations and names of the last four files that were used by MotionBuilder. Files are only added to the list if they were either opened or saved with the Open, Save, or Save As items in the File menu. Files dragged from the Asset browser are not added to the list.

File > Properties

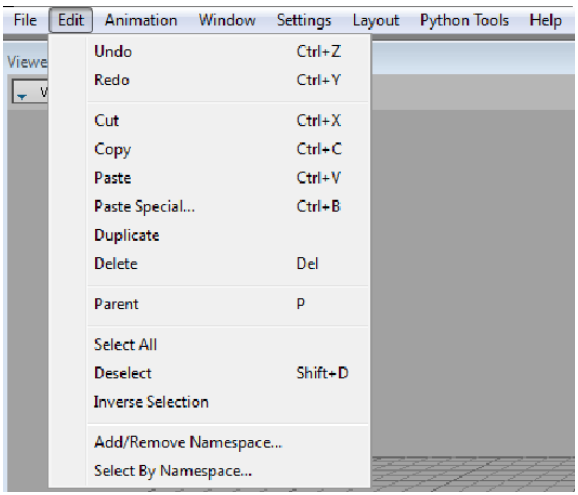
Displays the *.fbx* files properties for the loaded file. You can also change information such as Subject, Title, Author, Comments, and other file properties. Changed information is updated when the *.fbx* file is saved.

File > Exit

Closes the current MotionBuilder session. A dialog box appears, letting you confirm that you want to end your MotionBuilder session.

Edit menu

The Edit menu contains items for cutting, copying, duplicating, and pasting assets. You can also undo and redo commands, parent objects, insert assets, manage your selections, and select transformations.



Edit menu options

Edit > Undo/Redo

The Undo option clears the last action performed, and the Redo option restores the last action cleared. MotionBuilder supports multiple levels of undo and redo. You can set the levels of undo in the Preferences window. See Preferences on page 129.

For a list of functions that cannot be undone, see Unsupported Undo functions on page 27.

Edit > Cut

Cuts the current selection and removes it from the MotionBuilder scene, storing the selection in memory. In some windows, the selection may be keyframes (Transport Controls) or models in the MotionBuilder scene (Viewer window).

Edit > Copy

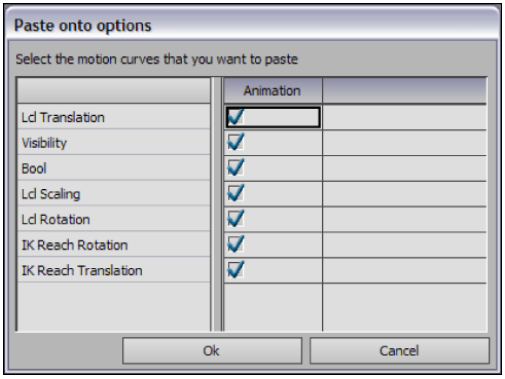
Copies selected objects to the clipboard. You can only copy one selection at a time. If you copy or cut another selection, the contents of the clipboard are overwritten.

Edit > Paste

Pastes the contents of the clipboard. For paste to work properly, make sure that you are pasting in the proper window. For example, if you are pasting a selection of keyframes, make sure the FCurves window, Transport Controls, or Dopesheet windows are open and have focus. For example, if you attempt to copy keyframes into the Motion Blend window, nothing happens.

Edit > Paste Special

Opens the Paste onto options dialog box, letting you choose which properties of a cut or copied selection you want to paste.



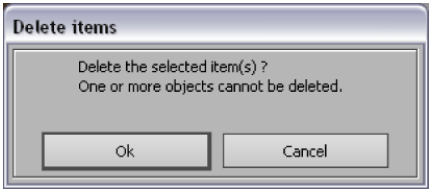
Paste onto options dialog box

Edit > Duplicate

Duplicates the selected objects in the Viewer window. Not all assets can be selected and duplicated in the Viewer window. For some assets, such as Materials, can only be duplicated within the Scene browser.

Edit > Delete

Deletes the currently selected objects. Unlike cut objects, deleted objects cannot be restored. A dialog box warns you when you attempt to delete objects.



Delete Items dialog box

Edit > Parent

Activates Parenting mode in the Viewer window, letting you create your own hierarchies. The selected model becomes the parenting object. See Parenting and hierarchies on page 400.

Edit > Select All

Selects all objects in the MotionBuilder scene.

Edit > Deselect

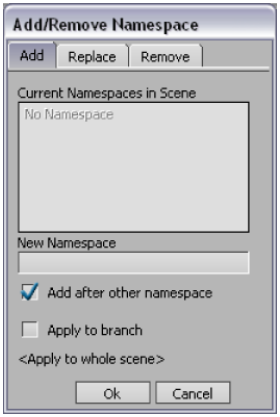
Deselects all objects in the MotionBuilder scene.

Edit > Inverse Selection

Inverts the selection by switching all selected objects and deselected objects.

Edit > Add/Remove Namespace

Opens the Add/Remove Namespace dialog box, which displays all the namespaces in the current scene and enables you to you add, replace, or remove prefixes to the objects listed, prepend namespaces to current namespaces and to all objects within a branch.



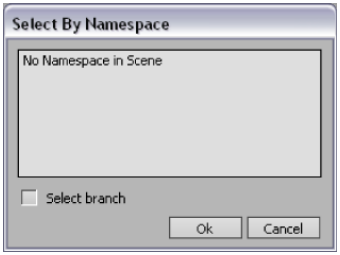
Add/Remove Namespace dialog box

For more information about namespaces, see Namespace on page 359.

For more on how to add/remove namespaces in the scene, see Creating hierarchy namespaces on page 367, Replacing namespaces in a hierarchy on page 369, and Deleting namespaces in a hierarchy on page 372.

Edit > Select by Namespace

Opens the Select by Namespace dialog box which lets you select objects or branches based on their namespaces. See Selecting objects or branches by their namespaces on page 26.



Select by Namespace dialog box

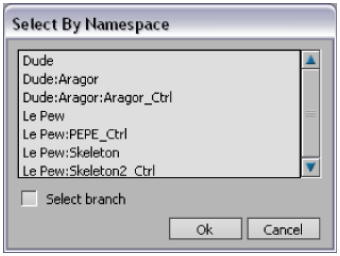
Selecting objects or branches by their namespaces

You can select objects or branches based on their namespaces with the Select by Namespace dialog box.

To select objects by their namespaces:

1 Select Edit > Select by namespace from the menu bar.

The Select by Namespace dialog box appears.



Select by Namespace dialog box

2 Click the namespace of the object you want to select or *Ctrl*-click to select multiple namespaces.

3 Click OK.

Once the search is complete, all objects with that namespace are highlighted.

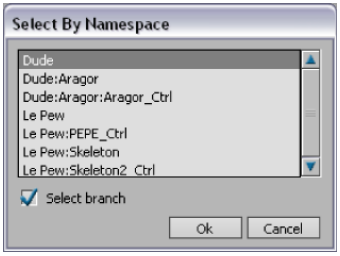
To select branches by their namespaces:

1 Select Edit > Select by namespace from the menu bar.

The Select by Namespace dialog box appears.

2 Click a namespace or *Ctrl*-click to select multiple namespaces.

3 Activate Select branch.



4 Click OK.

Once the search is complete, all branches (suchs as the Scene branch, Characters branch, Control Rigs branch, Constraints branch, Material branch, Poses branch, Shaders branch, Textures branch...) with that namespace are highlighted.

Unsupported Undo functions

An undo/redo function has been created for almost every action in MotionBuilder.

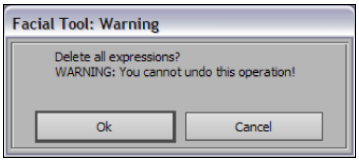
Press Ctrl- Z to undo any of the following:

- Editing, duplicating, renaming, selecting, parenting, and animating (including transformation and key animation,) of objects.
- Applying assets to objects, for example shaders or textures
- Changing properties (even in tools that do not support the Undo function, such as the Dynamic editor)
- Constraints (except Expressions constraints)
- FCurve animation
- Shader manager
- Relations constraints
- Applying poses to characters

The following tools and actions have no Undo function:

- Characterization and Actor setup, including modification to animation using the Dynamic editor (except edits made to FCurves)
- Creating Control rigs
- Deleting a Character Extension
- Editing groups and sets
- Adding custom properties
- Expressions constraints
- Skin tool
- Face tool
- Audio tool
- Video tool
- Midi tool
- Voice device

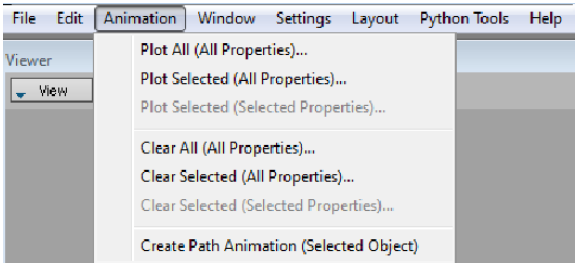
If an action cannot be undone, a dialog box appears to warn you.



Deletion warning example

Animation menu

The Animation menu in the MotionBuilder menu bar lets you plot animation, clear animation, and create an Animation path.



Animation menu options

Animation > Plot All (All Properties)

Selecting Plot All (All Properties) opens the Plot Properties window that lets you plot animation on all properties, for all objects in your scene.

Animation > Plot Selected (All Properties)

Selecting Plot Selected (All Properties) opens the Plot Properties window that lets you plot on all properties for only the selected object in your scene. This means that before selecting this option, you must select the objects that you want to plot.

Animation > Plot Selected (Selected Properties)

Selecting Plot Selected (Selected Properties) opens the Plot Properties window that lets you plot animation on selected properties for only the selected objects in your scene. This means that before selecting this option, you must select the objects and the properties you want to plot.

Animation > Clear All (All Properties)

Clears animation from all properties, for all objects in your scene.

Animation > Clear Selected (All Properties)

Clears animation from all properties for only the selected object in your scene. Before selecting this option, you must select the objects whose properties you want to clear.

Animation > Clear Selected (Selected Properties)

Clears animation from only the selected properties of selected objects. This means that before selecting this option, you must select the objects and the properties you want to clear.

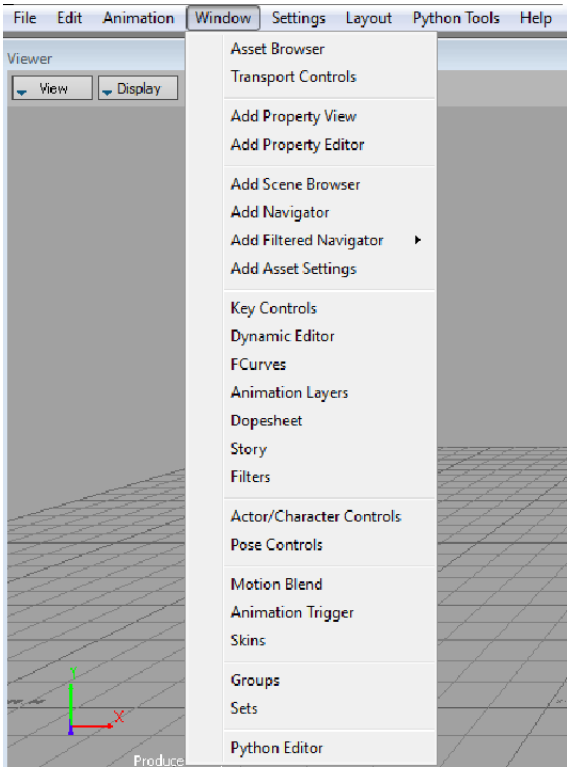
Animation > Create Animation Path (Selected Object)

Creates an animated path using the selected object in the Viewer window. This option lets you animate with a path instead of setting keys in the FCurves windows.

- Clearing animation on page 834
- Creating an animated path with a 3D Curve on page 1113

Window menu

The Window menu is where you can access any of the main MotionBuilder windows.



Window menu options

Window > Asset Browser

Shows the Asset browser that lets you drag assets into your MotionBuilder scene. For more information, see Asset browser on page 79.

Window > Transport Controls

Shows the Transport Controls window that lets you jog, shuttle, and play the current take. The Transport Controls window also lets you manipulate keyframes, take length, and adjust timing options. For more information, see Transport Controls on page 801.

Window > Add Property View

Opens a Properties window which lets you change the values of the selected asset's settings and properties. You can also animate an asset's properties using the Properties window.

You can have multiple Properties windows open simultaneously. By adding multiple Properties windows, you can view and lock more than one asset's properties at the same time. See Properties window on page 765.

Window > Add Property Editor

Opens the Property Editor window which lets you choose the properties you want to have in a (custom) keying group. You can also access this window by clicking Customize in the Asset browser > Properties window.

With the Property Editor you can choose the objects whose properties you want to copy to a keying group, edit the property values, add new properties and change the relationship between the selected object(s) or effector(s) properties.

See Creating a custom keying group on page 839.

Window > Add Scene Browser

Adds a Scene browser. By default, the Scene browser is an integral part of the Navigator window. However, MotionBuilder lets you add additional Scene browsers for specific uses.

For example, if you have a large scene with many assets, constantly scrolling through the assets in your scene can be tedious. Select Add Scene Browser to add a second Scene browser window to your scene and showing another part of the scene's hierarchy. For more information, see Scene browser on page 92.

Window > Add Navigator

Adds a Navigator window, which lets you select and view the settings of all assets in your MotionBuilder scene.

Each Navigator window consists of a Scene browser and Asset Settings pane which shows the selected asset's settings and properties. For more information, see Navigator window on page 91.

Window > Add Filtered Navigator

Adds a Navigator window showing all assets matching the filtered asset selected from the additional submenu.

For example, if you select Add Filtered Navigator > Character, a Navigator window is added that shows only the Character assets in your scene. As with all Navigator windows, the filtered Navigator window consists of a Scene browser and Asset Settings pane.

Window > Add Asset Settings

Adds an Asset Settings window, which lets you view the settings of the selected assets in your MotionBuilder scene. For more information, see Asset Settings on page 99.

Window > Key Controls

Opens the Key Controls window, which lets you create, edit, and step through keyframes associated with the selected object, asset, or property. For more information, see Setting keyframes on page 819.

Window > Dynamic Editor

Opens the Dynamic Editor that lets you modify the interpolation of animation for a selected object, a character effector, properties, and so on. You can modify the interpolation of multiple keyframes at the same time, keyframes at the current time, or an entire keyframe region. For more information, see Dynamic Editor on page 929.

Window > FCurves

Opens the FCurves window, which lets you modify your animation by adjusting its individual keyframes and their interpolation, extrapolation, and tangents. You can also animate using timewarp curves. For more information, see Function curves on page 953.

Window > Animation Layers

Opens the Animation Layer editor, which lets you create, blend, and organize multiple layers of animation. See Animating on Layers on page 873.

Window > Dopesheet

Opens the Dopesheet window, which lets you review and edit your animation. For more information, see Dopesheet window on page 865.

Window > Story

Opens the Story window, which lets you build animation and storyboards using various types of clips. For more information, see Animating within the Story Window on page 1733.

Window > Filters

Opens the Filters window, letting you filter animation data. In order to filter animation data, you must first select a range of keyframes to filter. For more information, see Filtering on page 1009.

Window > Actor/Character Controls

Opens the Actor Controls window or Character Controls window. The window that opens depends on whether an Actor, Character, or a Control rig is selected. For more information, see Control rigs on page 1431.

Window > Pose Controls

Opens the Pose Controls window, which works in conjunction with a character's Control rig and with object poses. Use the Pose Controls to create a library of character poses, configurations and object poses. You can retarget configurations onto any character or object. You can choose to paste selected objects, body parts (such as finger positions) or entire character positions and complex object poses. For more information, see Pose Controls window on page 1492.

Window > Motion Blend

Opens the Motion Blending window, letting you blend takes to create takes. For more information, see Blending Takes on page 1865.

Window > Animation Trigger

Opens the Animation Trigger window, which lets you set up motion clips and trigger them using your keyboard and joysticks. For more information, see Animation Trigger window on page 1920.

Window > Skins

Opens the Skins window, which lets you adjust the weight of vertices relative to one or several bones. For more information, see Skins window on page 1302.

Window > Groups

Opens the Groups window, letting you organize a selection of assets into a group. You can create Groups that include models, elements, sensors, lights, materials, shaders, markers, nodes, textures, constraints, and even other groups.

Groups are used for the selection and organization of items in a scene. For more information, see Groups on page 407.

Window > Sets

Opens the Sets window, letting you organize a selection of assets into a set. Sets are similar to groups as they both can include models, elements, sensors, lights, materials, shaders, markers, nodes, textures, constraints, and so on.

The main difference is that unlike groups, sets are exclusive. This means that while the same asset can appear in many groups, it can only occur once in a set. You cannot copy an asset or object from a set, you can only move it from one set to another.

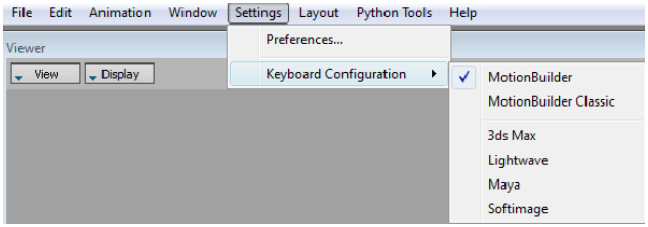
In addition, the visibility of sets can be animated, and the animation stored in sets can be cached. For more information, see Sets on page 413.

Window > Python Editor

The Python Editor window lets you execute individual lines of script. The Python Editor window also lets you execute global scripts and configure MotionBuilder to receive scripts remotely. See Python Editor on page 101

Settings menu

The Settings menu lets you view and define MotionBuilder preferences and select the current Keyboard Configuration.



Settings menu options

Settings > Preferences

Opens the Preferences window, which lets you view and set default and operational settings. See Preferences on page 129.

Settings > Keyboard Configuration

The MotionBuilder keyboard configurations enable you to quickly access MotionBuilder functions and commands and to switch between MotionBuilder keyboard shortcut configurations and other 3D software applications. When you work on a project that requires you to switch from one application to another, you don't need to learn a new set of keyboard shortcuts. All you need to do is change the keyboard shortcut configuration in MotionBuilder to use the appropriate keyboard shortcuts.

For example, if you are using the Autodesk® Softimage® software product and the MotionBuilder software product for your project, if you are not familiar with the MotionBuilder keyboard shortcuts/prefer to use the Softimage keyboard shortcuts while working in the MotionBuilder software, you can change the keyboard shortcut configuration in MotionBuilder to use the Softimage keyboard shortcuts.

MotionBuilder has two sets of keyboard shortcuts (i.e. MotionBuilder and MotionBuilder Classic) as well as four sets of keyboard configurations that simulate the keyboard shortcuts from other popular 3D software applications.

The following keyboard shortcuts are available:

- MotionBuilder (default keyboard shortcut configuration)
- MotionBuilder Classic
- 3ds Max
- Lightwave®
- Maya

- Softimage

For a list and description of keyboard shortcuts supported by MotionBuilder, see also:

- MotionBuilder keyboard shortcuts on page 1930
- MotionBuilder Classic keyboard shortcuts on page 1939
- 3ds Max keyboard shortcuts on page 1948
- Maya keyboard shortcuts on page 1955
- Softimage keyboard shortcuts on page 1963

To switch keyboard shortcut configuration:

1. From the MotionBuilder menu bar, select Settings > Keyboard Configuration.
2. Choose the appropriate keyboard configuration from the contextual menu.

   The keyboard shortcut configuration change comes into effect immediately to simulate the keyboard shortcuts of the selected 3D software application.

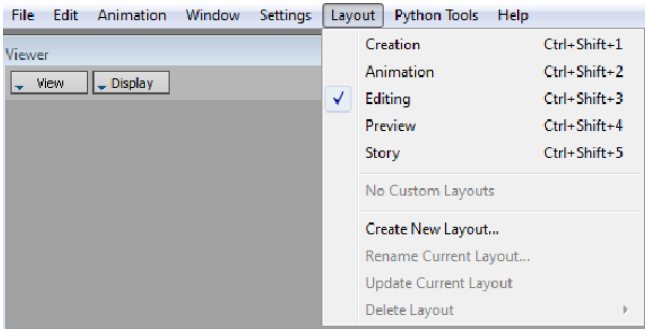
Using keyboard shortcuts

You can use keyboard shortcuts instead of menu commands to perform many operations. For example, to undo an operation, you can choose Undo from the Edit menu, or press *U* or *Ctrl* - *Z*. Keyboard shortcuts appear next to their corresponding commands in the menu bar.

For a detailed list and description of the keyboard shortcuts, see Keyboard Shortcuts on page 1929.

Layout menu

The Layout menu enables you to choose between the predefined Creation, Animation, Editing, Preview, or Story layouts designed for specific tasks, and the custom layouts. By default, the layout is set to Editing.



Layout menu options

NOTE To be able to choose a custom layout, you first need to create a custom layout.

The predefined layouts include the most commonly-used windows for those tasks. For example, the Creation layout, with the large Asset browser, Navigator, and Viewer window, is a suggested layout for creating MotionBuilder scenes.

Similarly, Animation is the suggested layout for animating using the FCurves window and Animation Layer editor, while the Story layout, with a separate Asset Settings window, is convenient for animating within the Story window. The Editing menu gives easy access to the multiple windows you may need while editing the animation in your scene, while the Preview layout has a screen-wide Viewer window for displaying animation.

Each basic layout supports four screen resolutions. If your monitor settings do not match one of these four, MotionBuilder uses the layout version that is closest to your screen resolution. The four screen resolutions are:

You can also use the Layout menu to create, rename, update, and delete layouts.

See also:

- Layouts on page 123

Create Layout

Lets you make your own MotionBuilder window layout. For more information, see Creating, updating, renaming, and deleting a layout on page 124.

Rename Current Layout

Lets you rename the current MotionBuilder window layout. For more information, see Creating, updating, renaming, and deleting a layout on page 124.

Update Current Layout

Lets you change and re-save the current MotionBuilder window layout. For more information, see Creating, updating, renaming, and deleting a layout on page 124.

Delete Layout

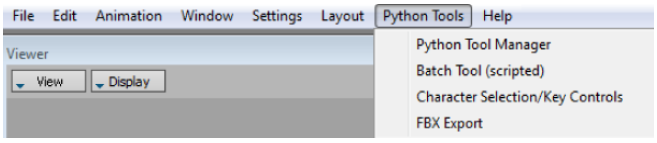
Lets you delete a MotionBuilder window layout by selecting it from a list.

See also:

- Creating, updating, renaming, and deleting a layout on page 124

Python Tools menu

The Python Tools menu contains the Python Tool Manager that contains all the custom MotionBuilder tools created in Manager, the Batch Tool script you can also access via the Python Tool Manager, and the Character Selection/Key Controls tools script.



Python Tools menu

Python Tool Manager

The Python Tool Manager stores a list of all custom MotionBuilder tools you created using Python. If you want to access a custom MotionBuilder tool that is not displayed in the UI, instead of running the script used to create the tool, you can access the tool via the Python Tool Manager.

Batch Tool script

The Python UI-based batch tool script (BatchTool.py) can be found in the MotionBuilder root directory under the bin\config\PythonStartup\ folder.

Character Selection/Key Controls

The Character Selection/Key Controls tool script allows IK, FK, Effectors selection and keying, and allows keying FullBody, Body part and selection without changing the keying mode.

FBX Export

You can save or export *.fbx* files created in MotionBuilder 2011 to an earlier version of FBX by choosing from the main menu Python Tools > FBX Export > FBX 2010.

NOTE FBX files exported via Python Tools > FBX Export > FBX 2010 tool or the FBX Converter tool are FBX SDK files and not MotionBuilder files. This means that anything specific to MotionBuilder will be discarded (story information, Devices, ect).

Version Control menu

The Version Control menu lets you manage your projects by enabling you to get the latest version of a file, check in a file, check out a file, and accessing the history of a file using simplified versions of Microsoft Visual SourceSafe®, Avid® Alienbrain®, or both—Microsoft Visual SourceSafe and Avid Alienbrain version control software products.

NOTE The Version Control menu is only available if you have Alienbrain, SourceSafe, or both software products—Alienbrain and SourceSafe installed.

Get Latest Version

Lets you copy the latest version of a file to the local drive.

Check Out

Lets you open a file for editing. If the file is already checked out by another person, you cannot retrieve it.

Check In

Lets you copy a local version of your file to the project database.

Undo Check Out

Lets you cancel changes made to the file while it was checked out.

Show History

Lets you view an annotated list of all the versions of a file.

NOTE This menu is only available if you are using the Alienbrain version control software.

Show Settings

If you are using the Alienbrain version control software product, it displays the Alienbrain Settings window. See Alienbrain settings configuration on page 357.

If you are using the SourceSafe version control software product, it displays the Microsoft VSS settings window. See VSS settings configuration on page 355.

Disable Version Control Integration

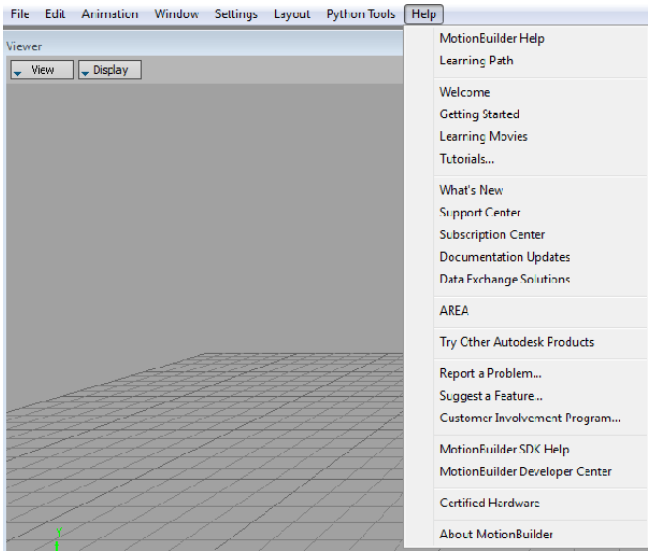
Disables the use a file management system.

NOTE To reactivate version control within the current MotionBuilder session, deselect the Disable Version Control Integration option in the Version Control menu. To reactivate version control in the subsequent MotionBuilder session, after launching MotionBuilder, in the Asset manager selection dialog box, click an asset manager from the list of asset managers and click Select.

For more information, see Version control on page 353.

Help menu

The Help menu contains learning, support, and developer resources, as well as information about the MotionBuilder version and product license installed on your system.



Help menu options

MotionBuilder Help

Accesses the MotionBuilder Help.

Learning Path

Accesses the Autodesk MotionBuilder Learning Path web page (*http://www.autodesk.com/motionbuilder-learningpath*) that provides a centralized access to the many learning and other resources available for MotionBuilder, including installed resources (available within the installed product such as the Essential Skills Movies) and external resources (including web-based and training).

Welcome

Displays the MotionBuilder Welcome screen from which you can access links to the *Getting Started Guide*, the Learning Movies, the tutorials, the *What's New* topic in the Help, and the MotionBuilder Help.

Welcome to MotionBuilder

Getting Started

Launches the *Getting Started Guide*, an illustrated version of MotionBuilder techniques and workflows that are designed to get you acquainted with the software quickly.

Learning Movies

Accesses the learning movies for MotionBuilder. To view learning movies, you must have a internet browser and a Flash player.

MotionBuilder Learning Movies

Tutorials

Accesses the MotionBuilder tutorials included in the MotionBuilder Help.

What's New

Accesses the MotionBuilder Help *What is New in this Release* topic which provides information about and links to new features that are documented in the Help.

Support Center

Accesses the Autodesk Support web page (*http://www.autodesk.com/motionbuilder-support*) where you can find information about Autodesk Professional Services, Training, Community, and Support.

Subscription Center

Accesses the Autodesk Subscription Center web page (*http://www.autodesk.com/subscriptionlogin*) where you have exclusive access benefits and services, including product upgrades, training resources, and technical support.

The Subscription Center features a single Autodesk online ID that enables seamless navigation between Autodesk web sites such as Autodesk Discussion Groups, Autodesk Communities, Autodesk University and Autodesk Labs.

Documentation Updates

Accesses the Autodesk MotionBuilder Documentation web page (*http://www.autodesk.com/motionbuilder2011-documentation*) where you can

download the latest updates to the MotionBuilder documentation. as well as previous versions of the MotionBuilder documentation.

Data Exchange Solutions

Accesses the Autodesk FBX family of tools on the web page (*http://www.autodesk.com/fbx*). The Autodesk FBX technology is a free platform-independent 3D authoring and interchange format that provides universal 3D asset interchange, enabling access to 3D content from most 3D vendors and platforms.

AREA

Accesses the Autodesk 3D animation community (*http://www.the-area.com*) where over 300,000 registered users share their knowledge about some of the Autodesk 3D products, showcase their work, provide tips & tricks, and participate in the discussion forums and blogs.

AREA is the online meeting place for the digital entertainment and visualization community. Register for a free membership and get on-demand access to tutorials, downloads, galleries, and more.

Try Other Autodesk Products

Accesses the Autodesk Products web page (*http://www.autodesk.com/freetrials*) where you can browse for Autodesk products either by industry or in alphabetical order, and where you can purchase or download a trial version of the products. Trial versions let you sample Autodesk software before committing to a full software purchase.

Report a Problem

Accesses the Autodesk Services & Support web page where you can report a bug by filling out the Report a Bug form (*http://www.autodesk.com/motionbuilder-bugreport*).

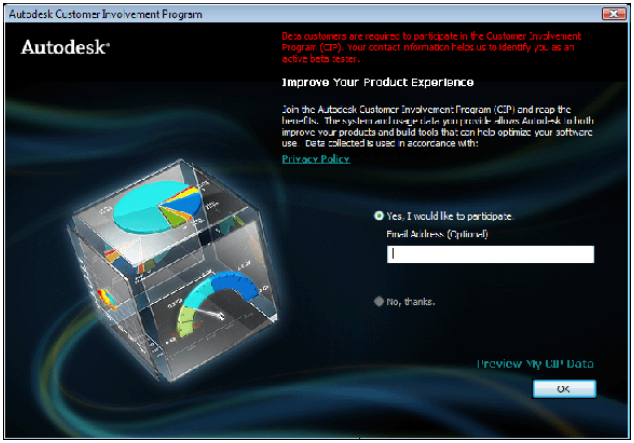
Suggest a Feature

Accesses the Autodesk Services & Support web page where you can submit a feature request by filling out the Suggest a Feature form (*http://www.autodesk.com/motionbuilder-sug*).

Customer Involvement Program

Displays the Customer Involvement Program screen. The program involves the automated collection and sending of system and usage information about

the Autodesk products installed on your machine to Autodesk. It dramatically improves the way Autodesk designs software and measures product performance and quality. It also provides a way for customers to become involved in helping make Autodesk products meet their needs better.



Autodesk Customer Involvement Program (CIP)

You can now preview your CIP data.

To preview your CIP data:

- Click the Preview MY CIP Data at the bottom right corner of the Autodesk Customer Involvement Program window.
  The Autodesk Customer Involvement Program Peer Comparison web page launches.

Previewing your CIP data

The CIP provides usage and system information from your system and compares this data with the averages of other Autodesk software customers. This is a quick way to see how your hardware stacks up.

For additional information on the Customer Involvement Program, please visit: *http://www.autodesk.com/acip/CIP_Privacy_eng.html*.

MotionBuilder SDK Help

Accesses the *MotionBuilder SDK Help* that includes the following:

- *MotionBuilder Open Reality SDK and Python Scripting Developer's Help*
- *MotionBuilder Open Reality SDK Reference Help*
- *MotionBuilder Python Scripting Reference Help*

- *MotionBuilder SDK Samples*

Open Reality SDK is a C++ software development kit [SDK] that enables you integrate new components into MotionBuilder. The Python Scripting provides information about scripting capabilities in MotionBuilder using the Python programming language.

MotionBuilder Developer Center

Accesses the Autodesk MotionBuilder Developer Center web page (*http://www.autodesk.com/developmotionbuilder*) where new users/software developers can get information on how to start programming in MotionBuilder, create plug-ins, and customize MotionBuilder or other Autodesk software products.

Certified Hardware

Accesses the Autodesk MotionBuilder Certified Hardware web page (*http://www.autodesk.com/motionbuilder-hardware*) that provides links to certified systems, graphics cards and drivers, and workstations and laptops.

About MotionBuilder

Displays the MotionBuilder version, build date, copyright, trademarks, patents, and third-party software credits and attributions.

You can also access your MotionBuilder product license information by clicking Product License information at the bottom left of the About MotionBuilder box.

The Product License Information provides the following information:

- License name
- Serial number
- License type
- License behavior
- License ID
- Computer host name
- License expiration date
- License usage type

- License server

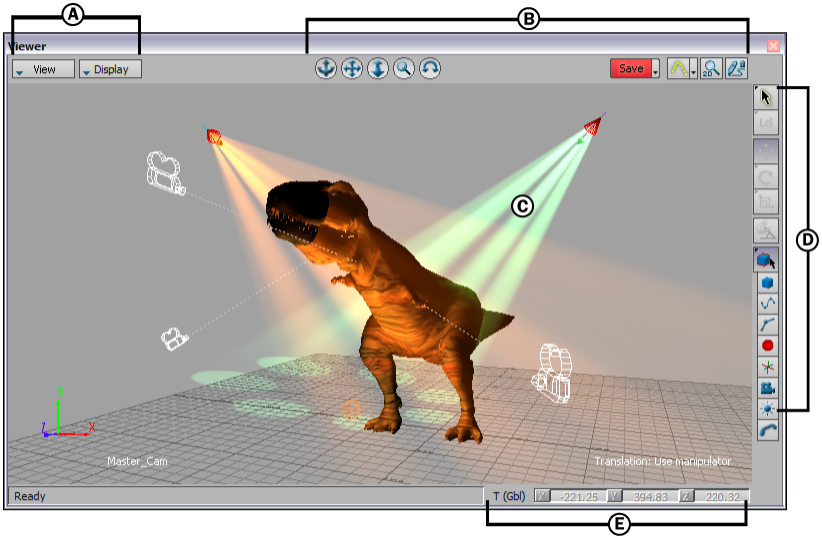
You can elect to save this license information for reference purposes. You can also borrow an Autodesk MotionBuilder license.

For information on license borrowing, refer to the *MotionBuilder Installation and Licensing Guide* located by default in the Autodesk MotionBuilder root directory under the *Documentation* folder on your system.

Viewer window

2

The Viewer window lets you view your scene, select, transform and animate elements, and set various options for displaying the current scene. It is where you use cameras to film, record, and play back your scenes.



Viewer window *A.* **Viewer menus** *B.* **Camera View toolbar** *C.* **Camera view** *D.* **Viewer toolbar** *E.* **Status bar area**

The Viewer window is also the space where your scenes are played, the point of view that is rendered, and the stage on which the animation and models are seen.

When you import a model, it appears in the Viewer window. You can also use the Viewer window to apply most effects, constraints, or devices, by dragging elements into it.

You can also Alt-drag items from the Viewer window into the Navigator window, or other MotionBuilder windows. For example, you can Alt-drag a model into a Simple constraint cell, or drag models onto a Story Animation track.

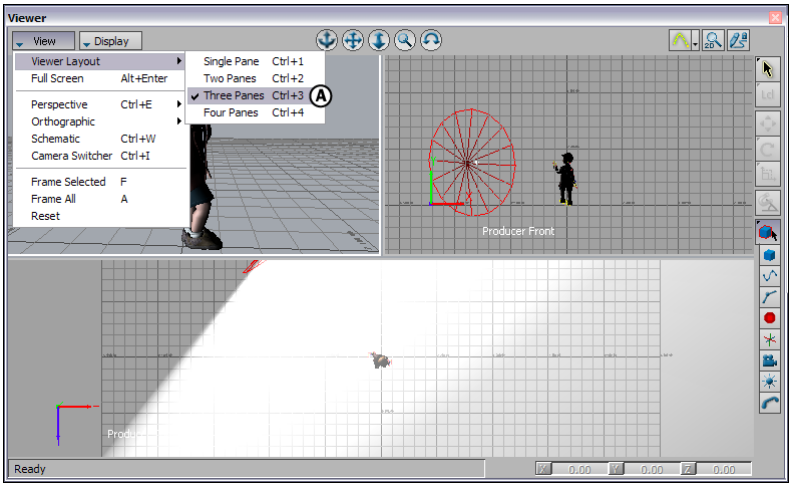
The Viewer window also displays the Schematic view, which lets you view the object hierarchies in your scene. Each hierarchy is represented by nodes and shows either a set of sensors from a device, or the parent-to-child relations of any item in the scene.

The Viewer window has many options that let you control what is displayed.

- Viewer menus on page 52
- Camera View toolbar on page 60
- Camera view on page 63
- Viewer toolbar on page 64
- Status bar area on page 73

Creating multiple views

You can split the viewer window into multiple views. This provides you with up to four different views of your scene and makes it easier to position assets.



Viewer window *A.* **Select View > Viewer Layout > 3 to split the window into three camera views.**

To split the Viewer window into multiple camera views, select View > Viewer Layout from the Viewer window View menu to split the view into one to four panes. You can also move your mouse over the Viewer window and press Ctrl-1, 2, 3, or 4.

Showing and hiding objects in the Viewer window

Press Shift-V to toggle the visibility of selected objects in the Viewer window.

If multiple objects are selected, the visibility of the first object is changed and the same visibility property is applied to the rest of the selected objects.

If you change the visibility of objects with an animated visibility using the Shift-V shortcut, the visibility always refers to the visibility properties set in the FCurves window when playing the file.

Changing the background and grid colors

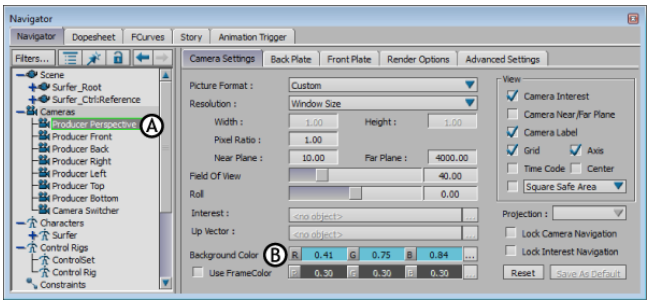
You can change the colors of the background and grid you see in the Viewer window. The scene you see in the Viewer window is always seen through a camera view (see Camera view on page 63). Therefore, the background color depends on which camera you are currently using to view the scene (referred to as the *current camera*).

You can show or hide the scene's grid using the Camera settings as well (see Showing the Viewer window grid on page 443), but change the grid's color from the Preferences window.

See also Camera settings on page 439.

To change the background color:

1. In the Scene browser, double-click on the current camera to view its settings.
2. In the Camera Settings pane, use the Background Color settings to change the color.

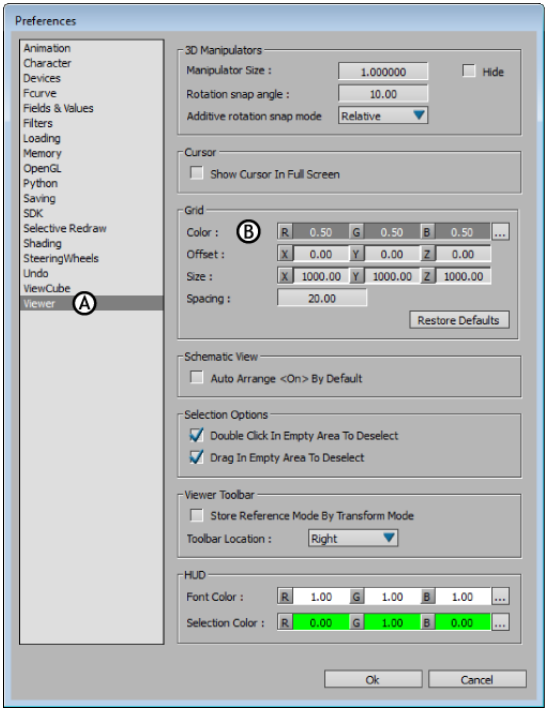


Navigator window *A.* **Current camera selected in Scene browser** *B.* **Background Color settings in Camera Settings pane**

To change the grid color:

1 From MotionBuilder's main menu bar, select Settings > Preferences.

2 In the Preferences window that appears, select Viewer (A), then change the color using the Grid Color settings (B).



Preferences window *A.* **Select Viewer** *B.* **Grid Color settings**

Viewer menus

The Viewer window has two Viewer menus which enable you to control the way your scene is presented in the Viewer window:

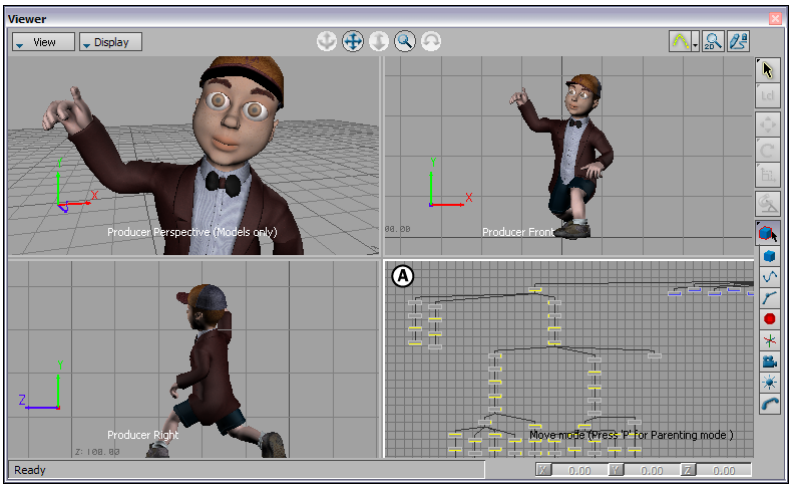
- View menu
- Display menu

View menu

The View menu in the Viewer window contains options that define how you view your scene. You can choose the number of camera views, switch camera views, add cameras, and access other options related to viewing the scene.

Viewer Layout

Lets you select between splitting the Viewer window into one, two, three, or four panes. You can also press Ctrl and numbers 1, 2, 3, 4, from the keyboard.



Viewer window divided into four panes *A.* **The active camera view**

Each pane can use a different camera view, so you can see your scene from different perspectives at the same time. You can also show the Schematic view in any of the Viewer window panes.

When the Viewer window has been split into more than one pane, move your mouse over the pane to activate it. You must make a Viewer window pane active before performing an action such as changing the camera view.

A white outline highlights the currently active Viewer window pane.

Full Screen

Fills the entire screen with the Viewer window, hiding all other windows and menus. To return to the normal Viewer window mode, press Alt-Enter.

Perspective

The Perspective menu lets you set the current Camera view to the following perspective camera views:

Camera View	Description
Producer Perspective	The default camera view which shows the scene with the XZ plane defining the horizon. The Z-axis faces the camera and continues towards the horizon, the X-axis is left to right, and the Y-axis is up and down. This camera view lets you translate an object on all three planes, and lets you zoom, pan, and orbit.
No Cameras	Lists the custom cameras in your scene. When a camera is created, the name of the camera replaces the No Camera indication. Each additional camera is numbered and subsequently listed.
Create New Camera	Creates a new camera and adds it to the current scene.
Rename Current Camera	Opens a dialog box in which you can rename the current custom camera.
Delete Camera	Lets you choose a camera to delete from the available custom cameras in your scene.

Orthographic

The Orthographic menu lets you set the current Camera view to one of the seven Producer cameras. See Producer camera types on page 426.

Schematic

Switches the active Camera view to the Schematic view. See Schematic view on page 392.

Camera Switcher

Lets you switch between custom cameras along a timeline. The Camera Switcher is take-based, which means that you can create a different set of camera switches per take. For more information about the Camera Switcher, see Camera switcher on page 483.

Frame Selected

Frames selected assets in a scene. Click Frame Selected a second time to return the view to its previous perspective.

Frame All

Frames all elements and models in a scene. Click Frame All a second time to return the view to its previous perspective.

Reset

Resets the camera view to its default position. When used with a custom camera, Reset affects the camera's translation.

Display menu

The Display menu in the Viewer window contains options that let you define which assets display and how they are shown in the Viewer window.

Normal

Sets the current camera view to Normal Display mode, which shows all assets. Normal is the default viewing mode.

X-Ray

Sets the current camera view to X-Ray mode, which shows a model's skeleton, Nulls, and elements. In this mode, you can select and edit skeletons normally hidden by models, but you cannot select models.

Models Only

Sets the current camera view to Models Only mode, which displays models only and hides all Nulls, lights, cameras, and other elements.

Hide Selected

Hides selected assets.

NOTE If nothing is selected, the entire scene is hidden.

Show Selected

Shows selected assets.

NOTE If nothing is selected, the entire scene is shown.

Hide Unselected

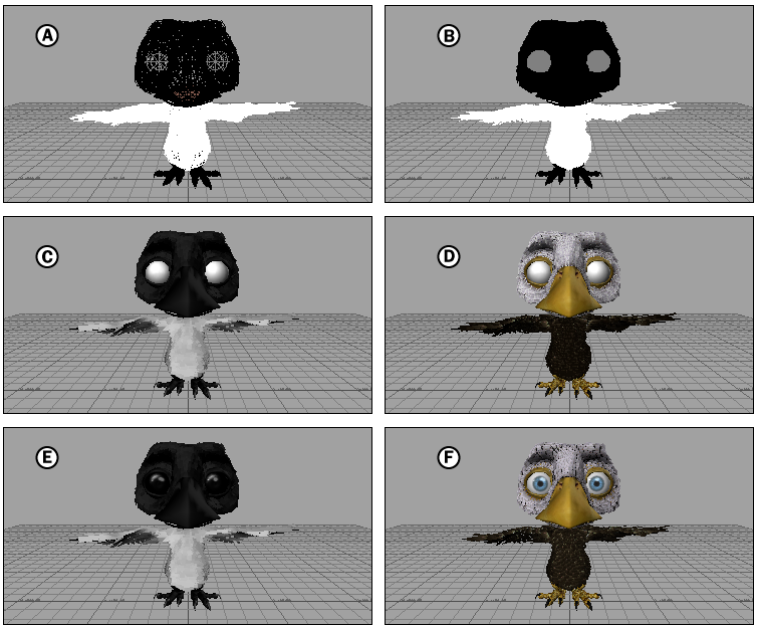
Hides elements and models that are not selected in the scene.

Show Unselected

Shows elements and models that are not selected in the scene.

Models Display

The Models Display menu contains global shading options that apply to the entire scene.



Models Display options *A.* **Wireframe** *B.* **Flat** *C.* **Lighted** *D.* **Shaded** *E.* **Textured** *F.* **Shaded & Textured**

The Models Display options include the following:

Display option	Description
Wireframe	Displays selected objects as wireframe.

Display option	Description
Flat	Displays selected objects using a constant color. This option ignores light sources in a scene, and overrides any custom shading, textures, and materials applied using the Shader settings. See Shader basics on page 587.
Lighted	Displays selected objects using their custom shaders created in the Shader settings. Textures do not display.
Textures	Displays selected objects with their applied textures. This option is available only when the Lighted option is selected, in which case Use Textures is active by default. See Textures on page 549.
Shaders	Displays selected objects using the default shader. This option is available only when the Lighted option is selected, in which case Use Shaders is active by default.
Shaders and Textures	Displays selected objects with both the default shader and their applied textures.

Models Visibility

Hides or shows selected assets in the Viewer window. For example, when Skeleton is disabled, all skeletons are hidden in the Viewer window.

The Visibility menu lets you hide or show Nulls, markers, skeletons, lights, cameras, devices, and models.

Display Normals

Shows and hides all the normals in the scene.

Inverse Normals

Inverts selected normals.

Display Rate

Displays MotionBuilder operational statistics in the top-left corner of the Viewer window.

Because MotionBuilder is a multi-thread application that uses a dual-buffer system, it evaluates the upcoming frame ahead of rendering it.

Setting	Description
Frame rate	MotionBuilder's internal frame rate. Frame rate = ex/60 (Min: 60, Max: 60) 16.7 ms. 60 is the number of frames the video card renders per second. 16.7ms (milliseconds) is the amount of time needed to render one frame. The remainder of the second is used for non-viewer rendering, for example interface interactions.
Evaluation rate	Evaluation rate = ex/227,1 (Min: 160.3, Max 278.1) 4.4ms. 227.1 is the number of evaluations per second, and 4.4ms is the evaluation of the other components outside the Viewer window.
Frame time (ms)	Frame time = ex/16.6 ms (Idle time: 0.1ms) 16.6ms is the total time to compute and display the Viewer window.EvalWait is the time the render thread waits for the Evaluate thread to finish and then starts drawing the next frame. EvalWait: Evaluation Time – (Texture + Render + Swap + Idle) Idle time is the time needed to compute and display the rest of the interface (for example, the Idle time decreases when you switch to Full Screen mode because other elements of the interface are not displayed.
Evaluation	There are two Evaluation settings, Single, and Parallel. Single refers to the mode MotionBuilder uses to evaluate deformations. Single means deformations are being evaluated on one thread only. Parallel refers to the pipeline MotionBuilder uses to evaluate a scene. Parallel means that the application either calculates and displays simultaneously, or is always calculating.

You can change the color of the statistics display. See the HUD preference settings in the Viewer preferences on page 168.

Display Memory Usage

Displays the amount of free memory and of free recording memory. These appear in the top-right corner of the Viewer window.

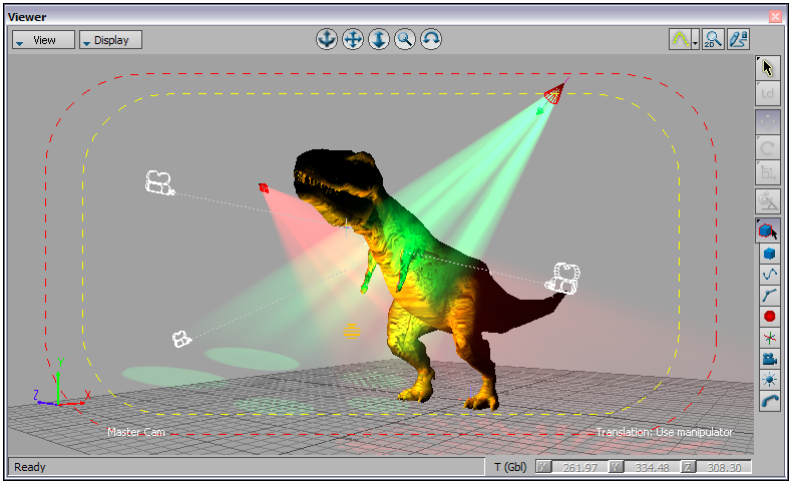
You can change the color of the statistics display. See the HUD preference settings in the Viewer preferences on page 168.

Display Time Code

Displays or hides the current timecode in the Viewer window.

Display Safe Area

Activates Display Safe Area to show the safe display area for all cameras.



Square safe guides display in the Camera view area

The safe display area has two different safe guides: the safe title guide (yellow) indicating the area in which titles should be placed, and a safe action guide (red) indicating the recommended area in which motion and animation should take place.

If you do not observe these areas, titles and animation may be cropped when transferred to video.

You can choose between a square safe area and a round safe area in the Camera settings.

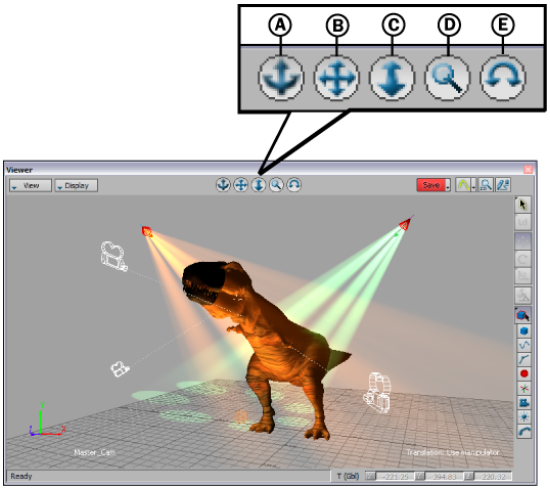
Camera View toolbar

The Camera View toolbar consists of two groups of options found along the top of the Viewer window. The options in this toolbar let you move the current camera to change the view in the Viewer window.

Camera View toolbar *A.* **Navigation buttons** *B.* **Display options**

Navigation buttons

The Navigation buttons let you navigate in the Viewer window by clicking, holding, and moving the mouse. The camera orbits, travels, rolls and so on, as long as you hold the mouse button.



Navigation buttons *A.* **Orbit** *B.* **Travelling** *C.* **Dolly** *D.* **Zoom** *E.* **Roll**

Orbit

Dragging the Orbit button lets you revolve your current camera around the camera interest. You can also Ctrl-Shift-drag in the Viewer window to orbit the camera.

Right-dragging the Orbit button lets you orbit the camera interest around the camera.You can also Ctrl-Shift-right-drag in the Viewer window to orbit the camera interest.

Travelling

Dragging the Travelling button lets you pan the camera and the camera interest. You can also Shift-drag in the Viewer window to pan the camera and the camera interest.

Right-dragging the Travelling button lets you slide the camera without moving the camera interest. You can also Shift-right-drag in the Viewer window to slide the camera.

Dolly

Dragging the Dolly button lets you dolly the camera without moving the camera interest. You can also Ctrl-drag in the Viewer window to dolly the camera.

Right-dragging the Dolly button lets you dolly the camera and the camera interest. You can also Ctrl-right-drag in the Viewer window to dolly the camera with the interest.

Zoom

Dragging the Zoom button lets you zoom in and out. You can also Z-drag in the Viewer window to zoom.

Roll

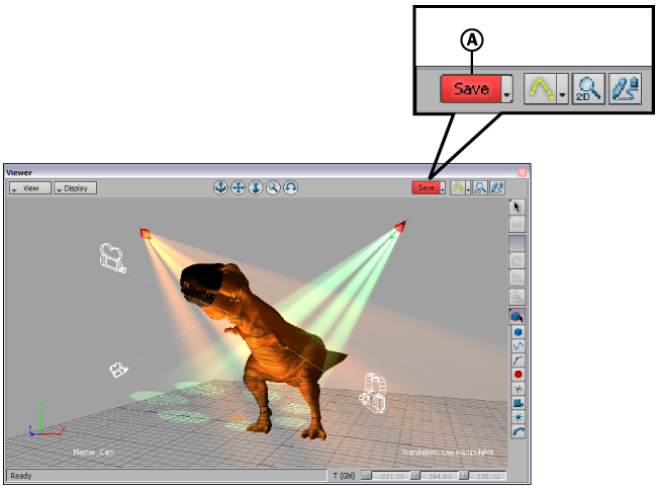
Dragging the Roll button lets you roll the camera from side to side. You can also R-drag in the Viewer window to roll the camera.

Right-dragging the Roll button lets you roll the camera by increments of 15 degrees. You can also R-right-drag in the Viewer window to roll the camera by 15 degrees.

Save reminder

The Save reminder appears at the top of the Viewer window to prompt you to save your file after a specified time has passed.

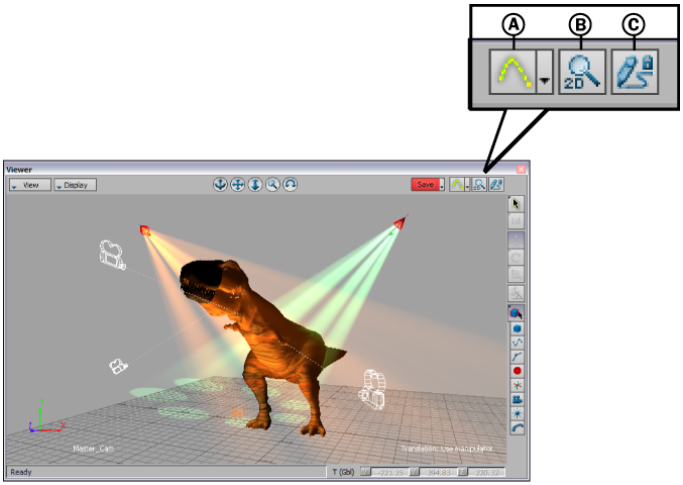
You can specify the saving preferences in the Preferences window. For more information, see the Save Reminder settings in the Saving preferences on page 153.



Viewer window *A.* **Save reminder**

Display options

The last three buttons of the Camera View toolbar (A, B, and C,) are the Display options and let you configure elements of the Viewer window display.



Display Options *A.***Trajectories** *B.* **2D Magnifier** *C.* **Selective Redraw**

Trajectories

To view the trajectory for any animated object, select the object, and click the Trajectories button. Expand the Trajectories menu to view the Trajectories menu options.

2D Magnifier

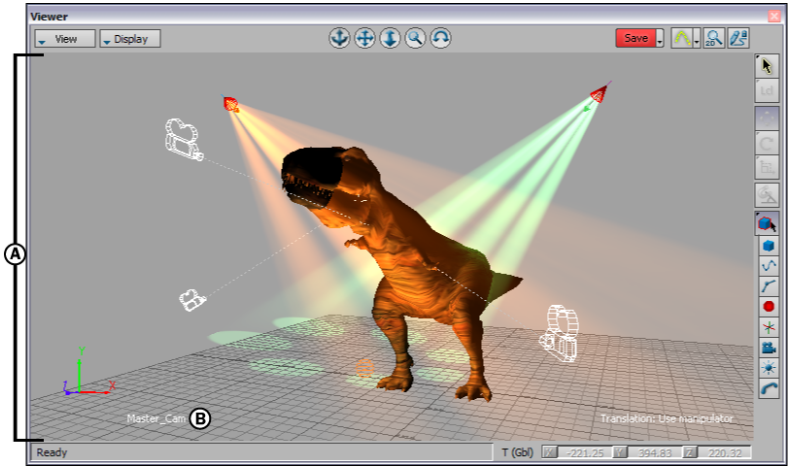
The 2D Magnifier option lets you lock and magnify the current camera view.

Selective Redraw

When the Selective Redraw option is activated it refreshes the current scene in the Viewer window without updating the operations in any other window.

Camera view

The camera view is the central area of the Viewer window and is where the contents of your scene are displayed.



A. **The Camera view is the main part of the Viewer window.** *B.* **The Camera Label indicates the current camera orientation.**

When you open MotionBuilder, the Viewer window displays one active camera view. The camera views are your view of the scene, and can be repositioned in unlimited ways.

The default camera view is the Producer perspective, but there are other Producer camera views you can switch to at any time. You can also add your own custom cameras to view your scene.

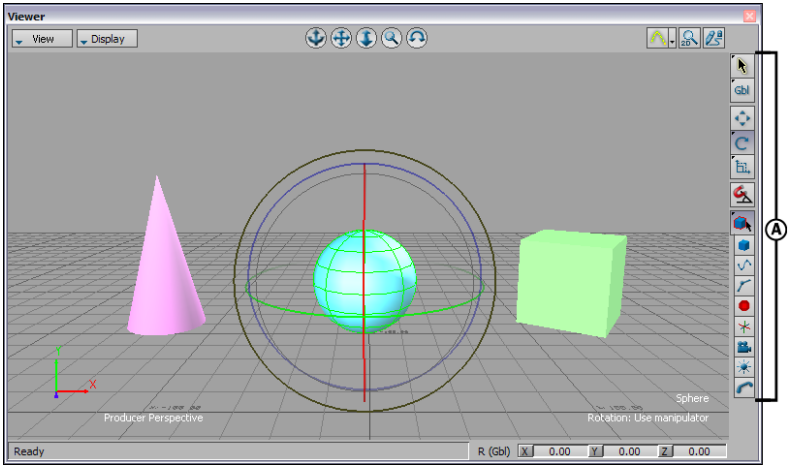
NOTE You can change the background and grid color you see in the Camera view. See Changing the background and grid colors on page 51.

Camera orientation

Each camera view indicates which way it is facing with an axis in the bottom left corner of the Viewer window. The active display mode also displays in the Camera Label.

Viewer toolbar

The Viewer toolbar, found along the side of the Viewer window in every layout, lets you choose how you want to select and manipulate objects in the Viewer window.



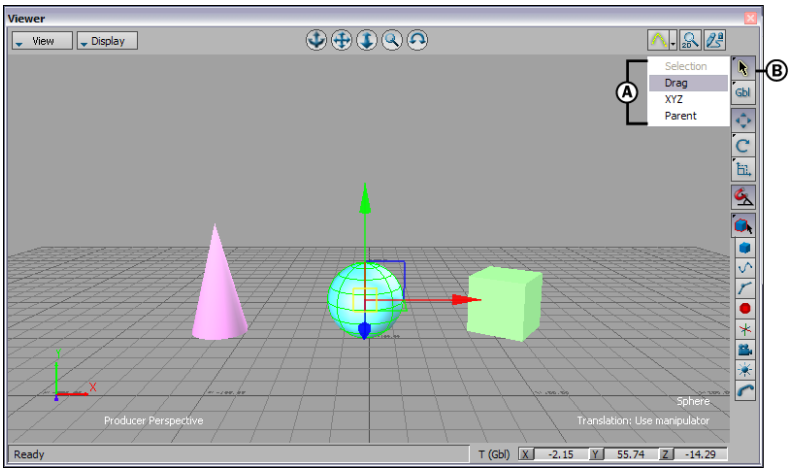
Viewer window *A.* **Viewer toolbar**

You can change which side of the Viewer window the Viewer toolbar displays on using the Viewer section of the Preferences window. See Preferences on page 129.

Selection Mode Menu

The Selection Mode menu lets you select how you want to transform selected objects. For example, you can choose to transform objects using their transform handles, by dragging in the Viewer window, or by entering specific XYZ coordinates into a field.

To access the Selection Mode menu, select an object (or objects) in the Viewer window, click the Selection Mode icon and pick one of the four methods from the menu.



Viewer window *A.* **Selection Mode menu** *B.* **Selection Mode icon**

You can choose from four Selection Modes:

Selection

Lets you transform an object with Translation arrows, Rotation rings, and Scaling handles. This is the default setting.

Drag

Lets you drag anywhere in the Viewer window to translate, rotate, and scale an object.

Drag mode moves or rotates a selected object along a single axis when you drag a Translation arrow or Rotation ring in the Viewer window.

XYZ

Lets you enter specific coordinates to translate, rotate, and scale an object in the Global/Local/Layer fields. XYZ mode is available when translating, rotating, or scaling an object.

XYZ mode translates, rotates, or scales the selected object in the Viewer window relative to the mouse button you use, and the direction in which you drag. For example:

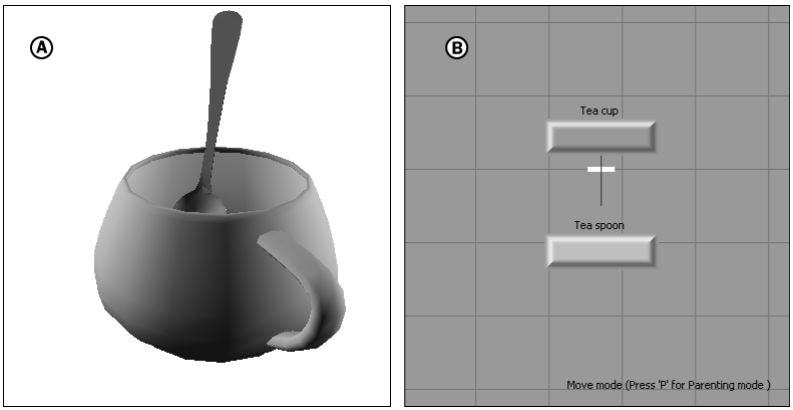
- To translate, rotate, or scale on the X-axis, click and drag.
- To translate, rotate, or scale on the Y-axis, middle-click and drag.

- To translate, rotate, or scale on the Z-axis, right-click and drag.
- To decrease the value, drag left.
- To increase the value, drag right.

Parent

Switches to Parenting mode, so you can create a parent/child relationship by dragging one object to another.

You can create parent to child relationships in either the Camera view or the Schematic view of the Viewer window. To view the parent/child hierarchy, switch to the Schematic view.



Viewer window *A.* **Camera view** *B.* **Schematic view**

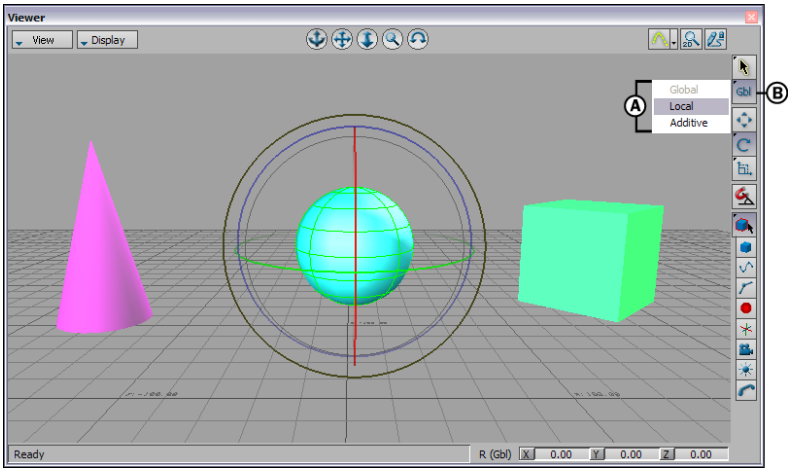
For more information on parenting, see Parenting and hierarchies on page 400.

Reference mode menu

The Reference mode menu lets you select between Global, Local, and Additive Reference modes. The Additive Reference mode is only available when you are in Rotation mode on page 689.

Reference modes affect how an object's translation, rotation, and scaling values are displayed. Refer to Reference modes on page 679 for detailed information on these modes.

To select a Reference mode, click the Reference mode icon, and select one of the three modes:



Viewer window *A.* **Reference mode menu** *B.* **Reference mode icon**

Global

Activates Global Reference mode, so the selected object's transformation values are displayed relative to the center of the scene (the global axis).

Local

Activates Local Reference mode, so that the selected object's transformation values are displayed relative to the center of the object, or from the center of its parent, if it is parented.

If the selected object does not have a parent, the values of Local mode are the same as Global mode.

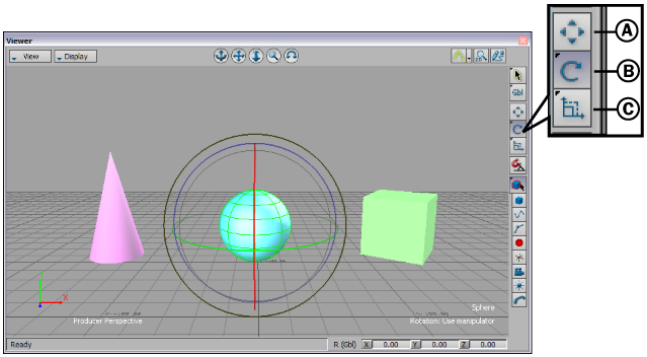
Additive

NOTE Additive Reference mode is available when you are in Rotation mode. In addition, it cannot be used when you have selected a Control rig effector while in Full Body or Body Part keying mode.

Activates Additive Reference mode so that the selected objects transformation values reflect its actual coordinates on the current layer only. This is useful when you are working with FCurve values.

Transformation buttons

The Transformation buttons let you activate the Translation, Rotation, or Scaling modes.



Transformation buttons *A.* **Translate** *B.* **Rotate** *C.* **Scale**

Translate

Select Translate to activate Translation mode on page 687 and move the selected object according to the Reference mode you have selected.

Translation mode lets you translate objects using the Translation arrows, and by entering values or dragging in the X, Y, and Z fields. For more information about translating objects in the Viewer window, see Translation on page 686.

Rotate

Select Rotate to activate Rotation mode on page 689 and revolve the selected object according to the Reference mode you have selected.

Rotation mode lets you rotate selected objects using the Rotation rings.

You can also select the Rotate Around option, which lets you designate a single object in a group of selected objects as the manipulation point. To select the Rotate Around option, click and hold the Rotate button to expand the Rotate menu. For more information about rotating objects in the Viewer window, see Rotation on page 689.

Scale

Select Scale to activate Scaling mode on page 696 and resize the selected object. Scaling mode lets you scale objects using the Scaling handles in the Viewer window, or by dragging or entering values in the X, Y, and Z value fields. For

more information about scaling objects in the Viewer window, Scaling on page 695.

Snap Rotation

Select Snap Rotation to snap the rotation of objects to an increment specified in the Preferences window, for example, 10 degrees.

The rotation angle increment is relative to the object's start angle. To snap to absolute values, switch to Additive Rotation mode.

This lets you set a standard rotation quickly for many objects.

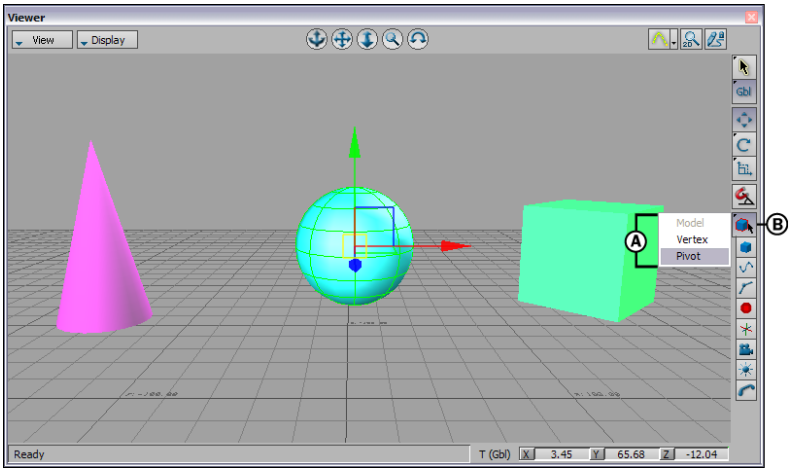
NOTE Snap Rotation can be used in all rotation modes: Rotate Around, Additive, Local, Global, and so on.

See Rotating an object on page 692 for more information.

Object Mode button

The Object Mode button lets you choose a mode for selecting objects in the Viewer window.

To change Object Modes, click the Object Mode button in the Viewer toolbar, and choose a mode from the Object Mode menu.



Object Modes *A.* **Object Mode menu** *B.* **Object Mode button**

Each of these modes lets you select different aspects of your scene, from objects to pivots. The default setting, if no modes are selected, is Models.

The three types of Object Modes are:

Model

Lets you select objects, models, curves, markers, Nulls, and bones.

Vertex

Lets you select vertices in the Skins window. This mode is like Object mode, but you must select objects first before selecting their components. This option is automatically activated and only available when the Skins window is open.

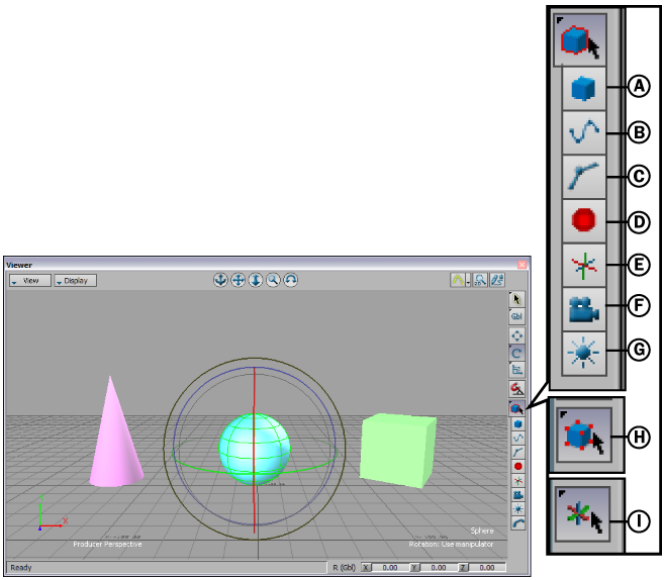
Pivot

Lets you select and manipulate pivots. When Pivot mode is activated, you can transform the pivot point of an object. You can use IK effector pivots to give you better control over hand and foot rotation or you can offset an object's pivot so that the object can rotate (or pivot) around it.

TIP Press Shift-D to deselect objects or properties.

Object Selection icons

The Object Selection icons let you choose which type of objects you can select in the Viewer window or Schematic view. This is useful in complex scenes where it is difficult to select a specific item without selecting everything near it.



Object Selection icons *A.* **Objects** *B.* **Curves** *C.* **Skeletons** *D.* **Markers** *E.* **Nulls** *F.* **Cameras** *G.* **Lights** *H.* **Vertex** *I.* **Pivot**

For example, when selecting a Null in a scene in the Viewer window, it is hard not to select the entire everything surrounding it. To select only the Null, disable all of the Object Selection buttons except the Null button.

NOTE The objects available for selection and manipulation vary depending on the Object Mode set. For example, you can only select Pivots in Pivot mode.

The following selection types are used in the different transformation modes:

Icon	Lets you select
	Models
	3D curves
	Skeletons. When in Skeleton mode, you cannot select the model or Control rig.

Icon	Lets you select
	Control rig effectors
	Nulls
	Vertices.Vertex selection is only available in Vertex mode.
	Auxiliary pivots. Pivot selection is only available in Pivot mode.
	Custom cameras
	Lights, excluding the Global light

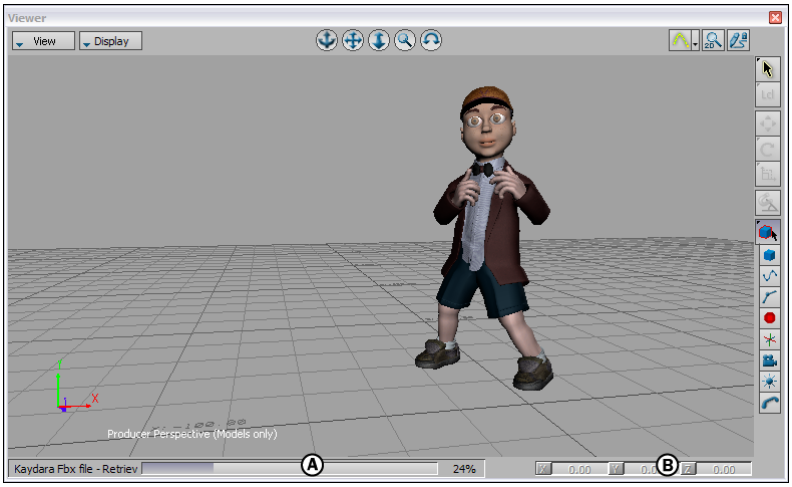
The current Transformation and Reference modes are displayed beside the Global/Local/Layer fields. If no Transformation mode is specified, you are able to select all objects in the Viewer window.You can activate multiple selection types at the same time or only have one mode active.

Status bar area

The Status Bar area is located at the bottom of the Viewer window and consists of the following:

Progress bar

The Viewer window Progress bar provides visual feedback on the progress of a currently processing operation.



Viewer window *A.* **Progress bar** *B.* **Global/Local/Layer fields**

For example, the progress bar shows the percentage of a scene still left to load, or the amount of animation still to be processed as the plotting is completed.

Global/Local/Layer fields

The Global/Local/Layer fields let you view the XYZ coordinates of the currently selected object's position. You can also use them to enter precise XYZ coordinates to transform selected objects.

You can change the values in the Global/Local/Layer fields in two ways:

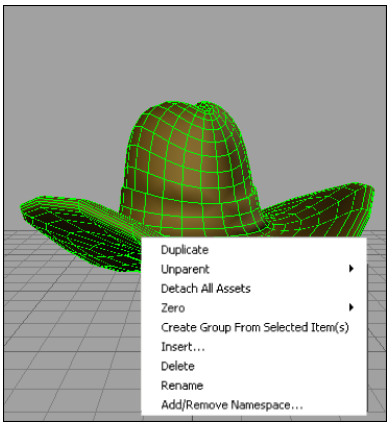
- Click and drag left or right in the field to decrease or increase the value. To drag through numbers more slowly, right-click and drag in the field.
- Double-click in the X, Y, or Z fields, type the new value, and click Enter.

The currently selected Transformation and Reference modes are displayed beside the Global/Local/Layer fields.

Viewer contextual menu

If you right-click in the Viewer window camera view, a contextual menu appears with options that pertain to what is currently selected.

Because you can have so many different objects in the Viewer window, the options in the contextual menu change depending on what you select.



Viewer contextual menu

For example, if you right-click a camera in the Viewer window, the Make Camera Current option is available to you, as well as the default Viewer window options that appear regardless of what you select.

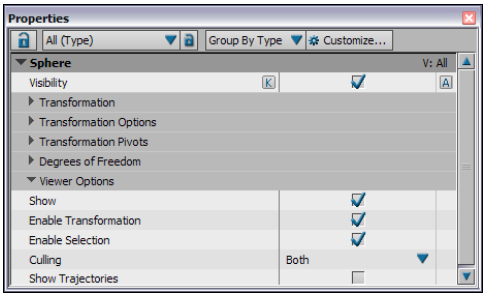
The following table lists the default options that occur when you right-click an object such as a camera in the Viewer window. If you right-click on an empty space, only the Insert option is available in the contextual menu.

Menu Item	Description
Duplicate	Creates a copy of the selected asset.
Detach All Assets	Removes any assets that have been applied to the object, for example, any shaders or texture settings.
Zero	Lets you set an object's X, Y, Z, Roll, or all transformation values to 0.00.
Make Camera Current	Switches the camera view to that of the selected camera. This option appears only when a camera is selected.
Select Interest	Opens the Camera settings for the current camera view in the Navigator window.
Create Group from Selected Item(s)	Lets you associate the selected objects into a group. See Groups on page 407.

Menu Item	Description
Create Set from Selected Item(s)	Lets you associated the selected objects into a set. See Sets on page 413.
Insert	Opens the Asset browser, where you can select assets to drag into the scene.
Delete	Deletes the selected object(s).
Rename	Opens a field where you can enter a new name for an object.
Add/Remove Namespace	Opens the Add/Remove Namespace dialog box.

Viewer window properties

For every object you load into the scene, you can define the Viewer Options in the Properties window to specify how you want the objects to display in the Viewer window.



Properties window, Viewer Options properties

Show

The Show option lets you display or hide selected objects in the Viewer window.

When the Show option is activated, the selected object displays in the Viewer window. When disabled, the object is hidden.

Enable Transformation

The Enable Transformation option lets you choose whether an object can be transformed in the Viewer window.

When the Enable Transformation option is activated, the object can always be transformed in the Viewer window. When disabled, the object cannot be transformed in the Viewer window, but it can still be transformed using the Properties window.

Enable Selection

The Enable Selection option lets you choose whether an object can be selected in the Viewer window.

When the Enable Selection option is activated, the object can always be selected in the Viewer window. When disabled, the object cannot be selected in the Viewer window, but it can still be selected in other areas, such as the Scene browser.

Culling

The Culling menu lets you select how you want the weighted polygons of a selected model to be rendered in the Viewer window. You can render only the polygons that compose the outside of your model, only the polygons that compose the inside of your model, or you can render both types of polygons. Choosing to render only set of polygons can reduce rendering times.

Option	Function
Both	Renders both the inner and outer polygons for the selected model.
Outer (Counter-Clockwise)	Renders only the polygons that compose the outside of the model.
Inner (Clockwise)	Renders only the polygons that compose the inside of the selected model.

Show Trajectories

The Show Trajectories option shows or hides the trajectory of the selected object.

NOTE Trajectories are only visible when Auto-Selection is activated in the Viewer window's Trajectories menu.

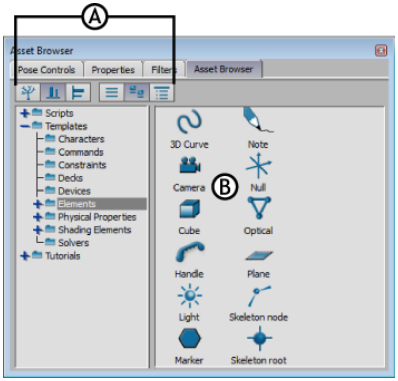
This option is the same as the Show on Selection and Clear on Selection options in the Trajectories menu.

Asset browser

3

The Asset browser window lets you choose assets you can use in your scenes. The assets are arranged in a hierarchical tree structure, and include Character assets, devices, elements, and shaders, as well as any shortcuts that you have added to your *.fbx* files.

The Asset browser consists of two main areas containing the View Options which let you choose how you view items, and the Browser pane, which lets you browse items.



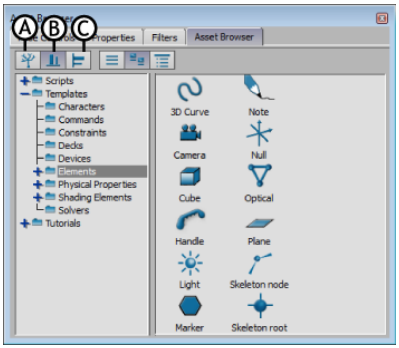
Asset browser *A.* **View options** *B.* **Browser pane**

View Options

The View Options are the two groups of buttons at the top of the Asset browser that let you choose how to view items. The View options are divided into Layout and Display options.

Layout options

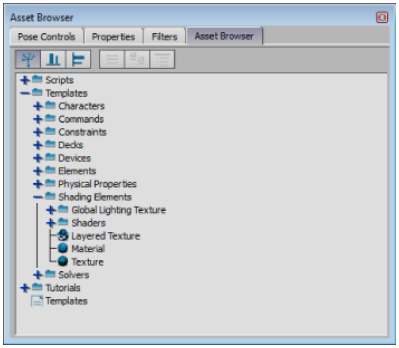
The Layout options determine how the folders and assets are arranged in the Asset browser window. The Layout options include Tree View (A), Vertical View (B), and Horizontal View (C).



Asset browser Layout options *A.* **Tree View button** *B.* **Vertical View button** *C.* **Horizontal View button**

Tree View layout

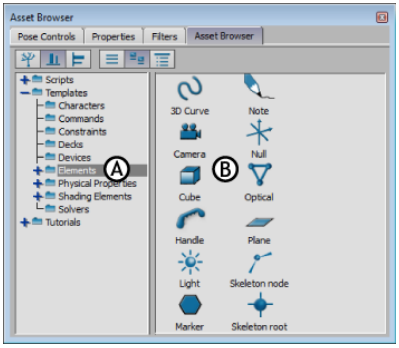
All folders and their contents display in a single browser pane. The contents of selected folders display directly below the folder name.



Tree View layout displays all items in one pane.

Vertical View layout

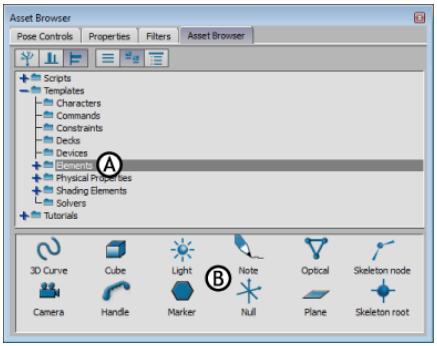
Splits the browser into two panes that appear side by side. When you select a folder in the left pane, the folder contents display in the pane on the right.



Vertical View layout in the Asset browser
A. **Selected folder** ***B.*** **Contents of selected folder**

Horizontal View layout

Splits the browser into an upper and lower pane. When you select a folder in the upper pane, its contents display in the lower pane.



Horizontal View layout in the Asset browser
A. **Selected folder** ***B.*** **Contents of selected folder**

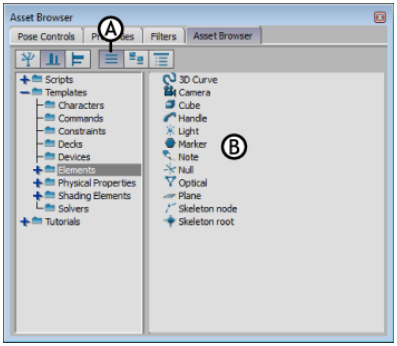
Display options

When the Horizontal or Vertical View layout options are selected, the Display buttons determine how the contents of a selected folder display in the second pane.

To select a Display mode, select a folder in either Horizontal or Vertical View layout, and select a display option.

List display

The contents of a selected folder display in a list when the Vertical or Horizontal View layout is active.



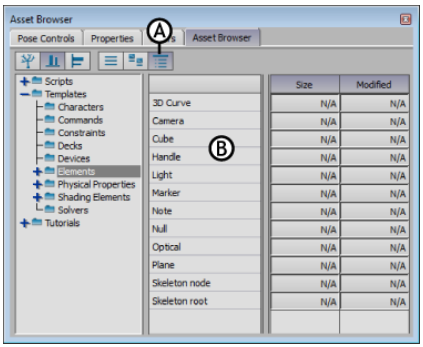
A. **List display option is selected.** *B.* **Contents of selected folder display as a list.**

Thumbnail display

The contents of a selected folder display with large icons. The Vertical or Horizontal View layout must be active. For example, the following figure shows the contents of a selected folder in a Horizontal View layout with the Thumbnails view.

Details display

The details about the contents of a selected folder with additional file information display, including the file size and modification date.



A. **Details display is selected.** *B.* **Detailed file information is shown.**

Browser pane

The Browser pane lets you add assets to your scene.

By default, the Browser pane displays the *Templates* folder and the *Tutorials* folder which contain default MotionBuilder assets for use in your scenes.

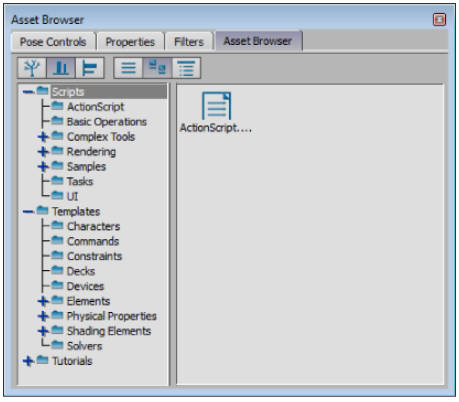
You can add your own folders to the Browser pane using the Create Favorite Path option in the Asset browser contextual menu.

- Browsing assets on page 381
- Creating custom icons on page 383
- Adding a favorite path on page 88
- Templates directory on page 84
- Types of assets on page 379

Scripts directory

The *Scripts* directory contains sub-directories. The *Scripts* directory contains Python scripts that enable you to automate workflows and customize the interface.

If you expand the *Scripts* folder, you will notice there are various sub-directories for the scripts. The name of the *Scripts* folders reflect the type of command.



There are over 100 scripts included in this release. Depending on the MotionBuilder version, these Python scripts are located in the following default directories on your system:

- *C:\Program Files (x86)\Autodesk\MotionBuilder 2011\bin\config\Scripts* for the 32-bit version of MotionBuilder
- *C:\Program Files\Autodesk\MotionBuilder 2011\bin\config\Scripts* for the 64-bit version of MotionBuilder

See also:

- Executing a script on page 202

NOTE You can access the *MotionBuilder Python Scripting Help* via the MotionBuilder Help menu.

Templates directory

The *Templates* directory contains many assets and tools that help you work on projects in MotionBuilder. For example, the Characters folder in the Templates folder contains the Character asset, which is a template that helps you connect character models to a source of motion data.

Characters folder

The Characters folder contains the Actor, Actor face, Character, and Character face templates used when working with character models and character head models. See Actor assets on page 1353, Actor Face asset on page 1611, Character assets on page 1271, and Character Face settings on page 1645 for more information on these topics.

Commands folder

The Commands folder contains Command assets. Drag any Command asset into the Story window to insert Command clips with which you can build animation in the Story window. See Creating command clips on page 1786 for more information.

Constraints folder

The Constraints folder contains Constraints that you can use to create relationships between objects. You can use constraints to make a character pick up an object, have a camera follow a character, manipulate other objects

in relation to each other or use the keyboard or mouse to trigger events. See Animating with Constraints on page 1023 for more information.

Decks folder

The Decks folder lets you assign a Deck asset to control, monitor, and synchronize the recording or playback of a VTR (Video Tape Recorders) from within MotionBuilder. See Decks on page 1220 for more information.

Devices folder

The Devices folder contains Device assets, which are either a special software component (such as the Voice and Sound devices) or a separate piece of hardware (joystick, mouse, or keyboard) that connects to your computer using a serial, ethernet, or other connection. See MotionBuilder devices on page 1219 for more information.

Elements folder

The Elements folder contains elements for working with MotionBuilder. See Types of assets on page 379 for a description of each Asset and what it does.

The Elements folder also contains the Primitives folder, which contains basic building blocks that you can use to build objects in MotionBuilder.

Physical Properties folder

The Physical Properties folder contains the Joint, Ragdoll, and Rigid body Physical solving assets, which let you control the collision behavior created by assets in the Solvers folder. You can use these assets to generate keyframe animation.

The Physical Properties folder also contains a PhysX folder. You can use the Cloth, Fluid, and Softbody assets if your computer has a graphics card that supports PhysX, but these cannot be used to generate keyframes.

See Animating with Physical Properties on page 1679 for more information.

Shading Elements folder

The material, texture, and shader assets are grouped in the Shading Elements folder. The Shading Elements folder contains the Material asset, as well as a Texture asset and a Layered Texture asset meant for use with materials.

The Global Lighting Texture folder in the Shading Elements folder contains various texture and Layered texture assets meant for use with shaders.

The Shaders folder in the Shading Elements folder contains all the shaders, including any custom shaders you may have on your system.

See Materials on page 531, Textures on page 549 and Surface effects on page 639 for more information.

Solvers folder

The Solvers folder contains Solver assets, which lets you create collision effects and apply the results to a linked model. See Solvers on page 1531 for more information.

NOTE You can also add "favorite paths" to create your own directories at the same level as the Templates directory, or create shortcut paths within the Templates directory. See Adding a favorite path on page 88.

Updating the Templates directory

You can use the Change Template Directory option to append shortcut paths to the Templates directory. The added paths appear the next time you launch MotionBuilder, and remain available for subsequent MotionBuilder sessions.

To change a template directory:

1. Right-click in the Asset browser Template directories area and select Change Template Directory.
2. An Open Directory dialog box appears where you can browse for a directory to add to the Templates directory.
3. Click Ok. The new directory is added to the Templates root directory.

To remove a directory added to the Templates directory:

1. Right-click in the Asset browser Template directories area and select Change Template Directory.
2. An Open Directory dialog box appears where you can browse for a directory to add to the Templates directory.
3. Browse to Program Files > Autodesk > MotionBuilder *x* (where *x* is the version you are running,) > Templates.
4. Click OK. The original default Template directory is restored.

To refresh the Template directory:

➤ Right-click in the Asset browser Template directories area and select Refresh Directory.

This option rereads the directory structure and icons from the file system, updating and redrawing the contents of the Scene browser and its folders.

Select this option if you notice that the file system has been changed but the change does not appear in the Scene browser. For example, a file may have been renamed but the file's new name does not appear in the Scene browser.

- Asset browser on page 79
- Removing a favorite path from the Asset browser on page 89

Adding shortcut paths to the Templates directory

You can append shortcut paths to the Templates directory. The added paths appear the next time you launch MotionBuilder, and remain available for subsequent MotionBuilder sessions.

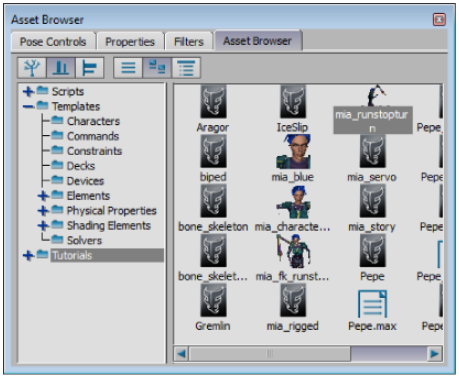
To add shortcut paths:

1. In the Asset browser, right-click in the Browser pane and select Change template directory from the contextual menu.
2. Navigate to choose the shortcut path you want to add in the dialog box that appears.

- Asset browser on page 79
- Adding a favorite path on page 88

Tutorials directory

The *Tutorials* directory contains all the assets required to do the tutorials included in this release of the MotionBuilder software product.



Asset browser: tutorial assets

See Adding tutorial assets on page 217.

Adding a favorite path

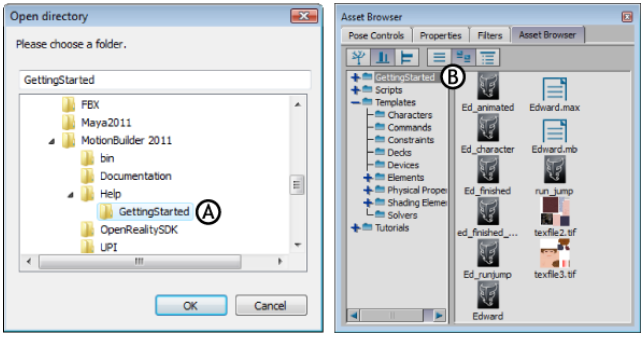
You can add a path in the Asset browser to a folder located on your computer or network. This lets you quickly access folders without having to remember their location.

You can also add a directory with the MotionBuilder templates directory. For more information, see Updating the Templates directory on page 86.

To add a favorite path:

1. Right-click in the browser, and select Add favorite path from the contextual menu.
2. In the dialog box that appears, select the folder you want to add.

   The selected folder displays at the bottom of the tree in the browser.



A. **Select the folder in the Open directory dialog box.** *B.* **The shortcut path appears in the Asset browser.**

Removing a favorite path from the Asset browser

To remove a favorite path:

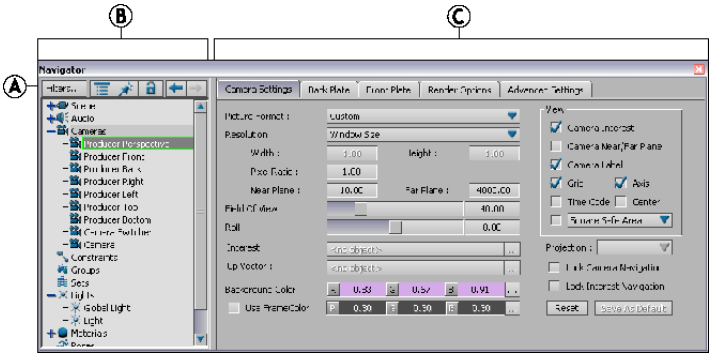
1. Right-click on the folder you want to remove.
2. Select Remove favorite path from the contextual menu.

■ Asset browser on page 79

Navigator window

4

The Navigator window lets you view the hierarchy of your scene, view relationships between assets, and edit an asset's settings. The Navigator window consists of the following areas:



Navigator window *A.* **View options** *B.* **Scene browser** *C.* **Asset Settings area**

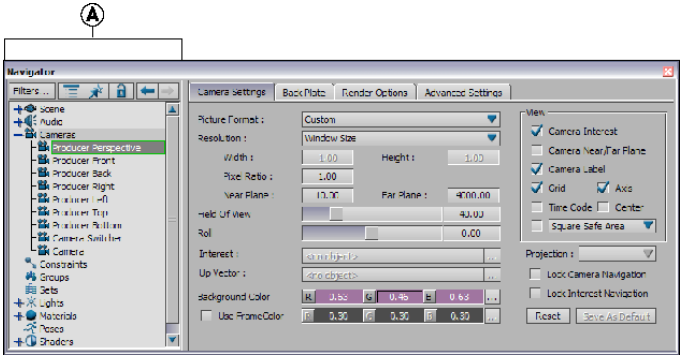
- Scene browser View options on page 97
- Scene browser on page 92
- Asset Settings on page 99

The Scene browser lists all the assets added to your scene, and the Asset Settings area displays the settings of the selected asset. You can add many Navigator windows to MotionBuilder. You can also add separate Scene browsers and Asset Settings windows from the Window menu in the MotionBuilder menu bar.

- Types of assets on page 379

Scene browser

The Scene browser is part of the Navigator window. It lists all of the assets in your scene, organized by type. Whenever you add an asset to the scene, it is also listed in the Scene browser. You can double-click any asset in the Scene browser to open the settings for that asset in the Navigator window.



Navigator window *A.* **Scene browser**

The Scene browser is composed of the following:

- Scene browser View options on page 97
- Asset list on page 96

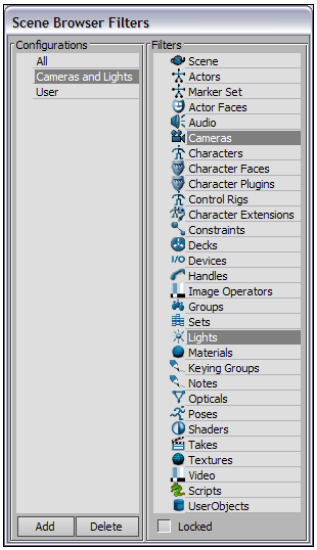
Creating Scene browser configurations

The Scene browser lists all of the assets in your scene, organized by type. Whenever you add an asset to the scene, it is also listed in the Scene browser. You can double-click any asset in the Scene browser to open the settings for that asset in the Navigator window.

To create Scene browser configurations:

1. In the Scene browser, click the Filters button.
2. In the Scene browser Filters dialog box that appears, click the Add button. The Scene browser configuration is automatically selected, rename it by typing a new name and pressing Enter.
3. Select any assets you want to include in this new configuration. By default, all assets are selected in the Filters list when you click Add.

Double-click an asset in the Filters area to select that asset and deselect the rest of the list, then Ctrl-click or Shift-click to select additional assets.

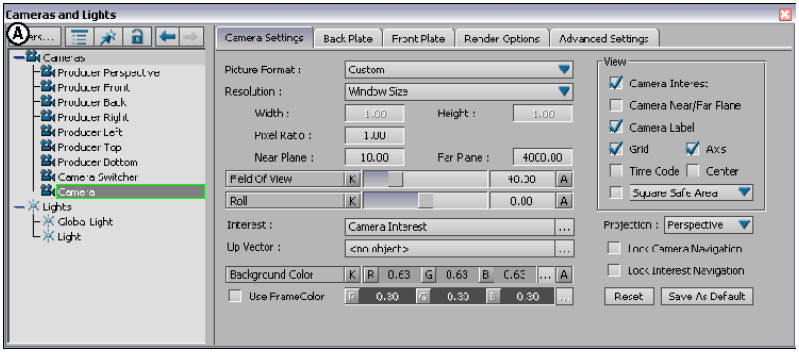


Scene browser Filter dialog box.

4 Activate the Locked option to lock the Scene browser configuration and prevent it from being changed accidentally.

5 Click Ok to filter the Navigator and show only the your chosen assets.

The name of the Scene browser configuration displays in the Navigator window's title bar. If the Navigator displays within a tabbed window, a tab displays the name of the Scene browser configuration. For example, the following figure shows the Navigator using a configuration named Cameras and Lights.



Cameras and Lights filtered Navigator window *A.* **Cameras and Lights appears in the title bar and in the Navigator tab.**

To rename Scene browser configurations:

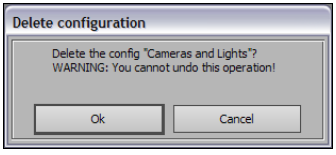
1. In the Scene browser, click the Filters button above the Asset list.

   The Scene browser Filters dialog box opens. See Scene browser Filters dialog box on page 95.

2. In the Configurations area, double-click the Scene browser configuration you want to rename, type a new name in the field, and press Enter.

To delete a Scene browser configuration:

1. In the Scene browser, click the Filters button to open the Scene browser Filters dialog box. See Scene browser Filters dialog box on page 95.
2. Select the configuration you want to delete in the Configurations area.
3. Click Delete.
4. In the Deleting configuration dialog box that appears , click Ok.



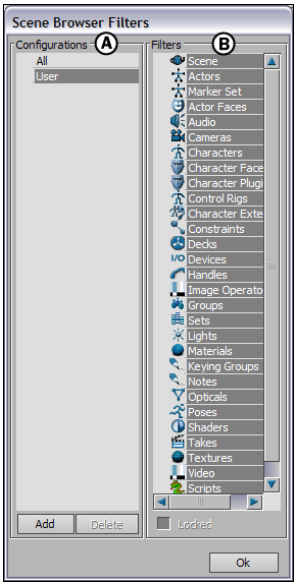
Deleting configuration dialog box

■ Scene browser on page 92

■ Scene browser Filters dialog box on page 95

Scene browser Filters dialog box

The Scene browser Filters dialog box is split into the Configurations area and the Filters area.



Scene Browser Filters dialog box *A.* **Configurations area (a custom configuration is selected)** *B.* **Filters area**

The Configurations area lists the items All and User by default. All displays the entire list of assets in the Scene browser and User lets you create temporary configurations.

■ Scene browser on page 92

■ Scene browser View options on page 97

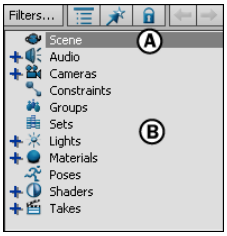
Asset list

The Asset list in the Scene browser lists all the assets added to your scene in a hierarchy with your scene as the root (Scene folder) and alphabetically by asset (Asset folders).

Scene folder and Asset folders

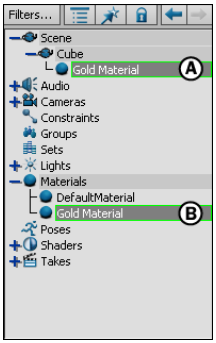
The Scene folder appears at the top of the Asset list, and contains a hierarchy of all assets in the scene.

Beneath the Scene folder, a separate Asset folder displays for every added asset. Asset folders are organized alphabetically in the list. For some assets, a folder is not listed if no assets of that type were added to the scene.



A. **Scene folder** *B.* **Asset folders**

When you select an asset in the Viewer or other windows, the Asset list shows the selected asset in both the Scene folder and its corresponding Asset folder. For example, the following figure shows the selected material named "Gold Material" in both the Scene and Materials folders.



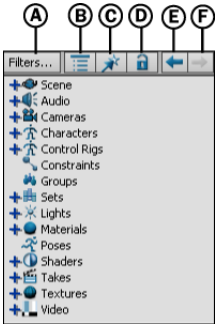
A. **Selected material displays in the Scene folder.** *B.* **Gold**

Material also displays in the Materials folder

- Navigator window on page 91
- Scene browser View options on page 97
- Scene browser on page 92

Scene browser View options

The View options appear at the top of the Scene browser within the Navigator window. They let you change the display in the Scene browser and Asset Settings area, lock the Asset Settings area, and step back and forth through recently viewed settings.



Scene browser View options *A.* **Filters** *B.* **Asset Details** *C.* **Single-Click Focus** *D.* **Lock Asset Type** *E.* **Back** *F.* **Forward**

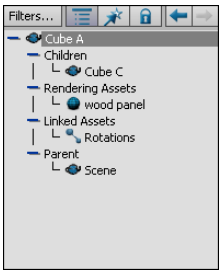
Filters

The Filters button opens the Scene browser Filters dialog box, which lets you change which assets are listed in the Scene browser.

Use this dialog box to create your own scene browser configurations, which you can select when changing the Asset list in other Scene browsers.

Asset Details

Select Asset Details to show a relational hierarchy of the selected asset and a categorized list of dependencies.



Asset Details option is active. Scene browser displays the selected asset (Cube A), and its children, parent, and other dependencies.

For example, the selected asset is Cube A, and the Scene browser shows that Cube A's dependencies include its child cube (Cube C), its texture (wood panel), and its constraint (Rotations).

Single-Click Focus

When the Single-Click Focus option is active, clicking once on any asset in the Scene browser selects the asset and changes the settings in the Asset Settings area.

When the Single-Click Focus option is disabled, you must double-click an asset in the Scene browser to show its settings in the Navigator window. This is the default behavior when selecting assets.

Lock Asset Type

Select the Lock Asset Type option to lock the current asset in the Asset Settings area. The settings do not change unless you disable Lock Asset Type, regardless of what asset you select in the Scene browser or Viewer window.

Back and Forward arrows

When you select assets and view their settings in the Asset Settings area, an internal list of previously viewed settings is created. The Back arrow and Forward arrow buttons let you move backward and forward through previous views in the Asset Settings area without changing your selection in the Scene browser.

For example, if you select a Cartoon shader and then select a light, the Asset Settings area changes to show the selected light. To view the Cartoon shader

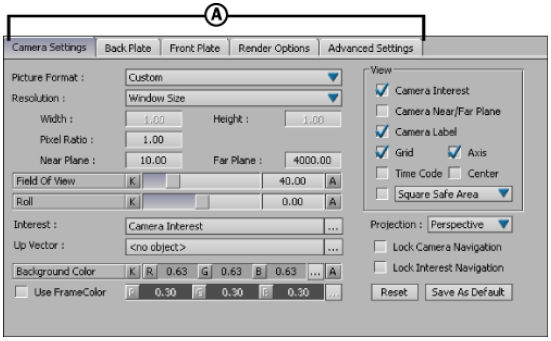
settings, click the Back arrow to go backward. To return to the light settings, click the Forward arrow to go forward.

■ Scene browser on page 92

Asset Settings

The Asset Settings, also referred to as the Settings area, display the settings for the asset selected in the Scene browser or in the Viewer window. The Asset Settings appear in the Navigator window or in a window of its own, depending on the current layout.

The settings for some assets can be divided further. For example, the Asset Settings area for the Cameras asset consists of five panes: Camera Settings, Front Plate, Back Plate, Render Options, and Advanced Settings.



Asset Settings area in the Navigator window for Camera assets. *A.* **Five camera panes**

In addition to assets, the Asset Settings area also displays settings for the selected track or clip when used with the Story window.

To view the Story window and Asset window together, select the Story layout from the Layout menu. A dedicated chapter describes the Asset Settings window when used in conjunction with the Story window.

■ Navigator window on page 91

■ Scene browser Filters dialog box on page 95

Python Editor

5

The Python Editor enables you to execute single and multi-line scripts, execute global scripts, configure MotionBuilder to receive scripts remotely, develop automation scripts, load and save script information as well as to create custom MotionBuilder tools.

Some of the functionalities supported by the Python Editor include single and multi-line entry, tabbed work areas, line numbering, color coding, history, keyboard shortcuts, script drag & drop, color coded error messages, and searching.

This release includes the *MotionBuilder Python Scripting Help* and the *MotionBuilder Open Reality SDK Help*.

To access the MotionBuilder SDK Help via the MotionBuilder software:

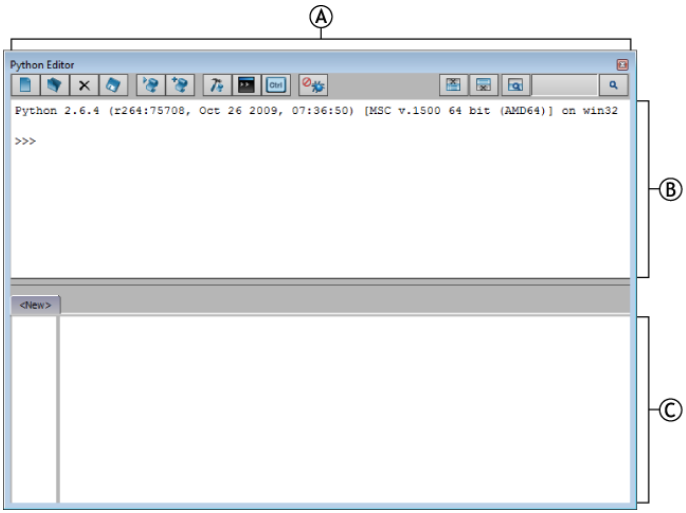
1. Launch MotionBuilder.
2. From the menu bar, select Help > MotionBuilder SDK Help.

   The *MotionBuilder SDK Help* launches.

   The *MotionBuilder SDK Help* encompasses the *MotionBuilder Open Reality SDK and Python Scripting Developer's Help*, the *MotionBuilder Open Reality SDK Reference Help*, the *MotionBuilder Python Scripting Reference Help*, and the *MotionBuilder SDK Samples*.

The goal for the Python Editor is to provide a robust environment for end users to create scripts and tools, and to interact with MotionBuilder through Python.

The Python Editor tool consists of the following areas: the toolbar, the interactive console, and the work area.



Python Editor: *A.* **Toolbar** *B.* **Interactive console** *C.* **Work area**

You can resize the Python Editor window by dragging any corner or border of the window.

This chapter includes the following topics:

- About the Python Editor on page 103
- Accessing Python Editor commands on page 105
- Python custom keyboard shortcuts on page 107
- Using the Python contextual Help on page 108
- Using the Python Editor interactive console on page 113
- Using the Python Editor work area on page 114
- About the Python Tool Manager on page 116
- Accessing Python tools on page 118
- About the Python Logger on page 118
- Using the Python Logger on page 119
- Setting the Python Editor preferences on page 120

See also:

- Python preferences on page 150

See also:

- *Python in MotionBuilder*
- *About MotionBuilder Open Reality SDK*

About the Python Editor

You can access most Python Editor commands from the Python Editor toolbar.

Python Editor toolbar

The Python Editor toolbar supports the following commands:

- create work area
- load script
- close (active) script
- save (active) script
- execute (active) script
- add (active) script to scene
- access Python Tool Manager
- launch Telnet Python Scripting Console
- trigger Python contextual Help
- launch Python Logger
- clear interactive console
- clear (active) work area
- search in interactive console
- search in (active) work area
- search in interactive console and in active work area

About the Python Editor interactive console

The Python Editor interactive console is similar to the Python IDLE. It provides feedback on the code in the Python Editor active work area. Errors, results from executed scripts and other feedback is also displayed in this console.

The Python Editor interactive console supports the following features.

- single or multi-line entry
- command history
- code auto-completion
- error feedback
- feedback on executed scripts
- code colorization
- Python contextual Help
- logging executed scripts

See Using the Python Editor interactive console on page 113.

About the Python Editor work area

The Python Editor work area provides a workspace area for writing scripts, dragging and dropping scripts, commenting and uncommenting scripts.

The Python Editor work area supports the following features.

- line numbers
- code auto-completion
- code colorization
- code comment and uncomment
- code indent and dedent
- drag and drop scripts
- add scripts to scenes
- multiple script work areas

See Using the Python Editor work area on page 114.

Accessing Python Editor commands

The following table lists the Python Editor commands accessible via the Python Editor toolbar, including the equivalent keyboard shortcuts.

Tool	Command	Description
	Create work area (*Ctrl+T*)	Creates a tab in the work area of the Python Editor for a new script.
	Load script (*Ctrl+O*)	Opens the Open Python Script browser window for you to locate a script to load in the new Python Editor work area. This action creates a tab for the loaded script.
	Close script (*Ctrl+-*)	Closes the active script in the Python Editor work area. Note that each script loaded in the work area has its work area (tab).
	Save script (*Ctrl+S*)	Saves the active script or opens the Save File browser where you specify the file name and location of the new script you want to save.
	Execute script (*F5*)	Executes code or a script, depending on whether a code is highlighted. If nothing is highlighted, it executes the active script in the Python Editor work area.
	Add script to scene (*Ctr+=*)	Adds the active script to the current scene. **NOTE** Make sure to save your script before adding it to the scene.
	Launch Python Tool Manager (*F10*)	Launches the Python Tool Manager that contains the tool scripts available in the *PythonStartup* folder in the *C:\Program Files\Autodesk\MotionBuilder 2010\bin\config* default directory.
	Launch Telnet console	Launches a local Telnet console that is automatically connected to MotionBuilder. The MotionBuilder modules are already imported.
	Trigger Python contextual Help (*F1*)	Displays in the interactive console the list of Python Editor keyboard shortcuts when the interact-

Tool	Command	Description
		ive console is empty. Displays in the interactive console contextual Help for: (a) a command in the interactive console, (b) highlighted text in the interactive console or work area.
	Launch Python Logger	Launches the script debugger tool.
	Clear interactive console	Clears the Python Editor interactive console.
	Clear active work area	Clears the Python Editor active work area.
	Search in interactive console (*Ctrl+F*)	Specifies the interactive console as the search area for the text entered in the text field. **NOTE** This is a toggle button.
	Search in active work area	Specifies the active work area as the search area for the text entered in the text field. **NOTE** This is a toggle button.
	Search in interactive console and in active work area	Specifies the interactive console and the active work area as the search area for the text entered in the text field. **NOTE** This is a toggle button.
	Search for text entered in Text field	Locates in the specified area the text entered in the text field.

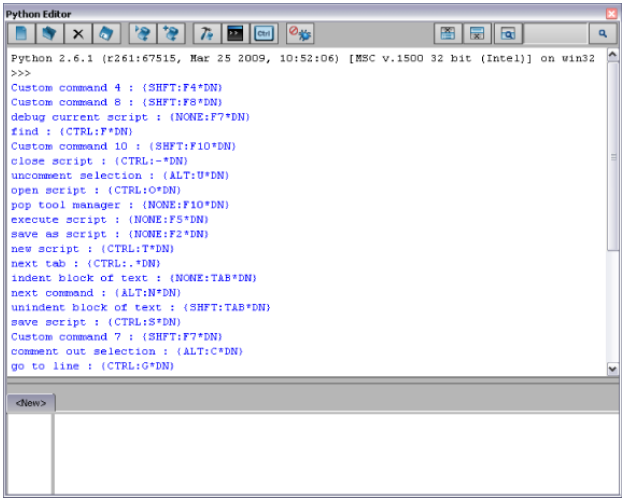
NOTE Keyboard shortcuts available via the Python Editor override the MotionBuilder keyboard shortcuts when the Python Editor is in active state.

To access the list of Python Editor keyboard shortcuts:

1 From the MotionBuilder menu bar, select Window > Python Editor. The Python Editor displays.

2 If there are lines of code in the interactive console, click the Clear interactive console button in the Python Editor toolbar. If there are no lines of code, proceed to the next step.

3 In the Python Editor toolbar, click the Python contextual Help button or press *F1*.



Python Editor commands keyboard shortcuts

The Python Editor interactive console displays a list of Python Editor keyboard shortcuts.

NOTE Additional Help information is available based on the context. Refer to the following section.

The Python Editor keyboard shortcut mappings are listed in the *C:\Program Files\Autodesk\MotionBuilder 2011\bin\config\Python\Python* default directory in the *Keyboard.txt* file.

Python custom keyboard shortcuts

MotionBuilder includes global keyboard shortcuts and Python Editor keyboard shortcuts. The global keyboard shortcuts are available anywhere from within MotionBuilder. You can bind a keyboard shortcut to the execution of a script by modifying configuration files.

IMPORTANT A script needs to be bound to a keyboard shortcut that is not used otherwise MotionBuilder will give a warning message and the keyboard shortcut will not work.

The Python Editor keyboard shortcuts are listed in the *C:\Program Files\Autodesk\MotionBuilder 2011\bin\config\Python\Python* default directory in the *PythonKeyboard.txt* file. You can customize 13 Python Editor keyboard shortcuts so they call the Python code.

See *Editor commands and keyboard shortcuts*.

See "Editor commands and shortcuts" in the *MotionBuilder Python Scripting Developer's Help*.

Using the Python contextual Help

You trigger the Python contextual Help by clicking the Contextual Help button

in the Python Editor toolbar. Since the Help is contextual, the information displayed depends on whether or not the interactive console is populated, on whether you selected text in the interactive console or in the active work area, or on whether or not the cursor is positioned at the end of a line of code in the interactive console.

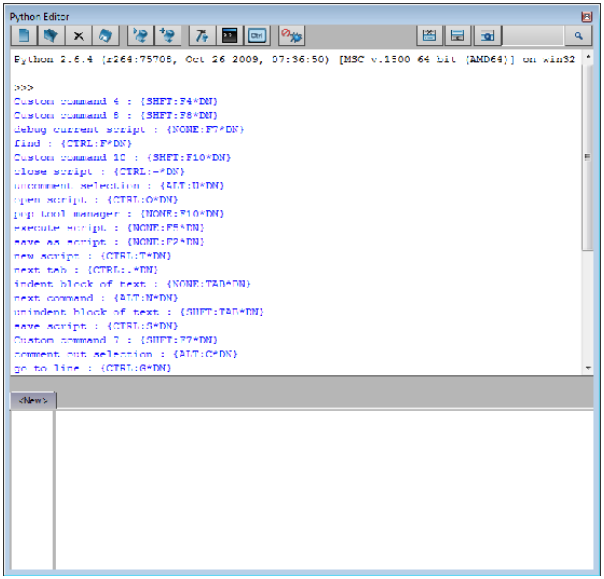
To display the Python Editor keyboard shortcuts contextual help:

1. If there are lines of code in the interactive console, click the Clear the Console button in the Python Editor toolbar. If there are no lines of code, proceed to the next step.

   All the lines of code in the interactive console are cleared.

2. In the Python Editor toolbar, click the Python contextual Help button

or press *F1*.



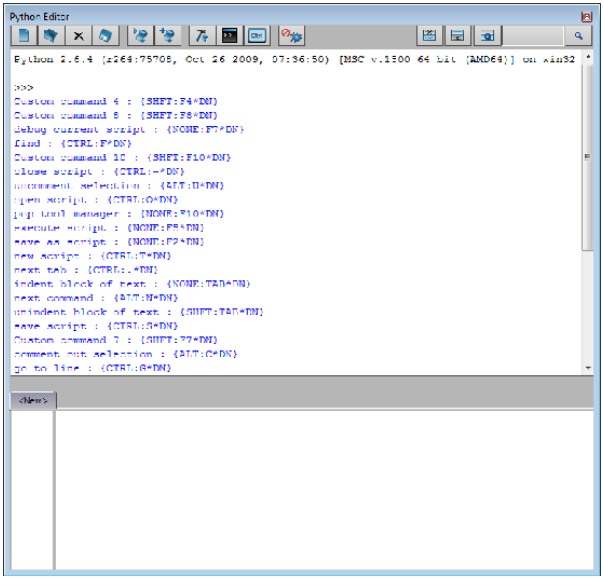
Python Editor commands keyboard shortcuts

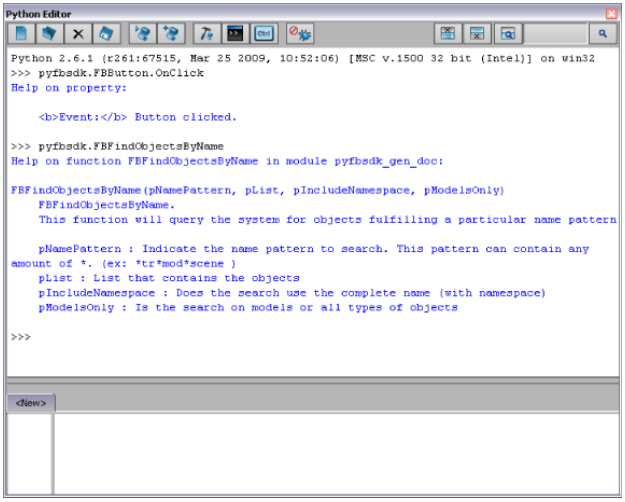
To display contextual help related to a command in the interactive console:

1 Make sure the interactive console is active.

2 In the Python Editor toolbar, click the Python contextual Help button or press *F1*.

The Python Editor interactive console displays Help related to the command entered in the interactive console.





Help about a command in the interactive console

To display contextual help related to selected content in the interactive console:

1 Select text in a line of code in the interactive console.

2 In the Python Editor toolbar, click the Python contextual Help button

or press *F1*.

Help related to the selected text is displayed in the interactive console.

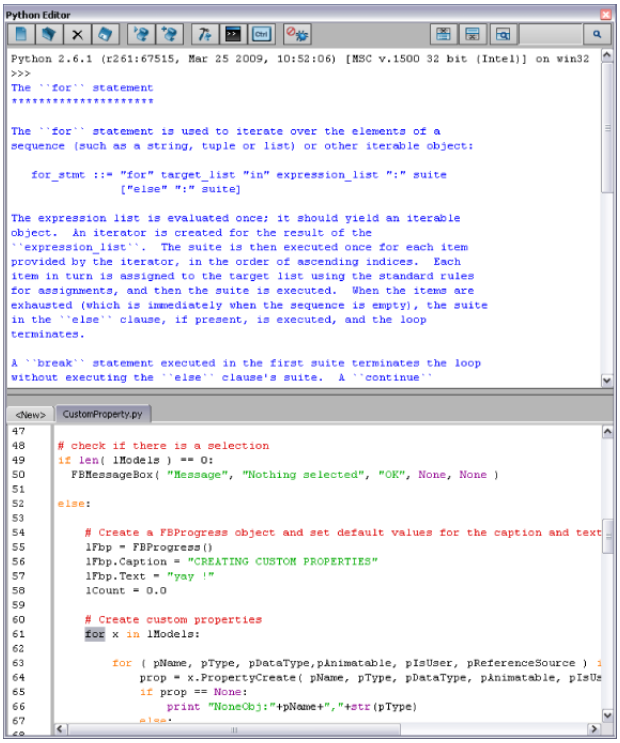
TIP To see all the content displayed in the interactive console, you can either resize the Python Editor window by dragging any corner or border of the window or adjust the height of the interactive console (without resizing the Python Editor window) by dragging the bottom border of the interactive console.

To display contextual help related to selected content in the work area:

1 Select text in a line of code in the work area.

2 In the Python Editor toolbar, click the Python contextual Help button

or press *F1*.



Python Editor interactive console displays contextual Help

Help related to the selected text in the Python Editor work area is displayed in the interactive console.

To display contextual help related to the content in the work area:

- In the Python Editor toolbar, click the Python contextual Help button or press *F1*.
  Help related to the text in the work area is displayed in the interactive console.

Using the Python Editor interactive console

The following assumes the default Python preferences settings are used. The code you enter is colorized based on Python syntax types:

- comments are red
- strings are green
- keywords are orange
- output is blue
- Python reserved words are purple

To populate the interactive console:

1. Click the interactive console.
   Entry lines start at the >>> prompt and feedback lines have no beginning.
2. Type a statement and then click *Enter*.

To copy, cut, paste, undo or redo:

- Right-click to choose an option from the contextual menu.

To traverse history, do either of the following:

- Click *Alt* + *N*.
- Click *Alt* + *P*.

To auto-complete an entry:

- Click *Ctrl* + *Space*.
  Relevant completion options become available in a window.

  NOTE You have to have the appropriate class instantiated before the auto-complete can take hold.

  For example,

To auto-complete an entry:

- Click *Ctrl* + *Space*

Relevant completion options become available in a window. For example:

```
x=FBModel
x. ...
```

This returns all available options for

```
x=FBModel
y=2
y. ...
```

This returns nothing.

To adjust the height of the interactive console without resizing the Python Editor:

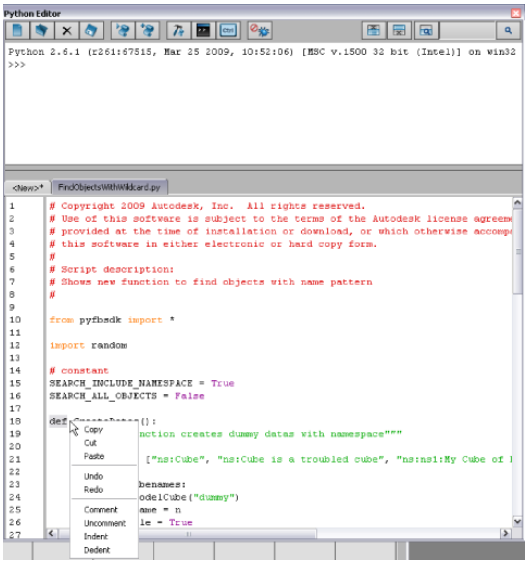
- Drag the bottom border of the interactive console.

Using the Python Editor work area

The following assumes the default Python preferences settings are used.

To copy, cut, paste, undo, redo, comment, uncomment, indent or dedent:

- Right-click to choose an option from the contextual menu.



Python Editor work area contextual menu displayed

When you comment a block of text, the text is commented with two leading ##.

When you uncomment a block of text, if there is at most 2 '#' in the first and second column of the line, the comment is removed.

When you indent a block of text, it is indented by X spaces (where X is specified in the configuration file). The default indent is set to four.

When you dedent a block of text, it is dedented by X spaces (where X is specified in the configuration file). The default dedent is set to four.

To auto-complete an entry:

- Click *Ctrl* + *Space*.
  Relevant completion options become available in a window.

  In the work area, only options that have been executed become available. Usually the information should be executed in the interactive console to see this in the work area.

To drop a script in the work area do any of the following:

- Drag and drop a script via a window in your OS.
- Drag and drop a script via the Asset Browser.

  NOTE The various Python scripts included in this release can be found in the Asset Browser's *Scripts* directory.

- Load a script via the Open Python Script dialog.

  NOTE To do so, activate the Python interactive console, click the Load Script button in the Python toolbar, select a script and click Open.

To drop multiple scripts in the work area:

- Select multiple scripts and drag/drop via a window in your OS, the Asset Browser's *Scripts* directory, or the Open Python Script dialog.

To add a work area, do either of the following:

- Right-click the top border of the work area and choose New.

- Activate the Python Editor interactive console and in the Python Editor toolbar, click the Create Work Area button.

To adjust the height of the work area without resizing the Python Editor window:

- Drag the bottom border of the interactive console.

About the Python Tool Manager

The Python Tool Manager stores a list of all custom MotionBuilder tools you created using Python. If you want to access a custom MotionBuilder tool that is not displayed in the UI, instead of running the script used to create the tool, you can access the tool via the Python Tool Manager.

NOTE Re-executing the script destroys the current execution of a script and re-initializes it. The Tool Manager allows you to call back the current state of a script even after closing the UI associated with it. This is provided as an example in the Python Startup folder. Users can rework this script to provide them more information or a more tailored form of working.

To access the Python Tool Manager:

1. From the MotionBuilder menu bar, select Window > Python Editor.

   The Python Editor displays.

2. In the Python Editor toolbar, click the Python Tool Manager button .

   The Tool Manager displays the tool scripts available in the *PythonStartup* folder. In the following figure, the Tool Manager displays the *CharacterSelect/Key Controls* tool script and the Batch Tool script.

Python Tool Manager

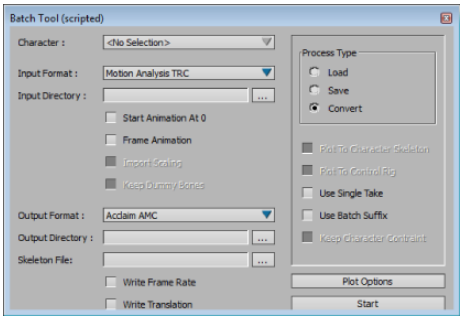
3 Click the *CharacterSelect/Key Controls* tool script.

The Character Selection/Key Controls tool displays.

Character Selection/Key Controls tool

The Character Selection/Key Controls tool script allows IK, FK, Effectors selection and keying, and allows keying FullBody, Body part and selection without changing the keying mode.

4 Click the *Batch Tool* script.



Batch Tool script

See “Tool Development” in the *MotionBuilder Python Scripting Developer’s Help*.

See *MotionBuilder SDK Help*.

Accessing Python tools

You can access the Python tools via the Python Tools menu or via the Python Tool Manager button in the Python Editor.

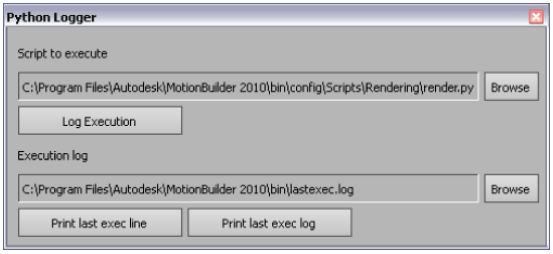
About the Python Logger

The Python Logger is a customizable script debugger you can use to locate a Python script that has created instability in MotionBuilder. The Python Logger outputs each line executed by MotionBuilder to a log file, and after you experience instability you can read the last Python line executed.

To access the Python Logger:

1. From the MotionBuilder menu bar, select Window > Python Editor.
   The Python Editor displays.

2. In the Python Editor toolbar, click the Python Logger button button .



Python Logger

The Python Logger shows the active script displayed in the Python Editor work area selected for debugging.

This table lists the Python Logger buttons:

Button	Description
Browse	Lets you select a new script to debug because clicking Debugger selects the current script automatically.
Log Execution	Executes the script using the debugger so that every line the script executes is logged in the log file.
Execution log	The path of the log file where all the logging is done. By default, this is <MotionBuilder Install Directory>\bin\lastexec.log.
Print Last Exec Line	Prints information about the last line executed by the debugged script in the console.
Print last exec log	Prints the whole log file in the console. This file contains information about the flow of a program; which lines are executed and which parameters were passed to function calls.

Using the Python Logger

The Python Logger sends information to a log file about each line in a script as it is executed. Even if a script creates instability in MotionBuilder, the last line of code executed before the crash is written to this log file. You can access this file through the Python Editor, or directly from the file system.

To create a log file for executed Python scripts:

1. Open the problematic script in the Python Editor.
2. On the Python Editor toolbar, click the Python Logger button .

   The Python Logger loads with the current script displayed.
3. If this is not the script you want to validate, click Browse and locate your file.
4. Click Log Execution to execute the script.

   By default, the Logger is off, and no log file is written.
5. To start the Logger silently, press *F7*.

   If MotionBuilder becomes unstable, restart it and open the Python Editor, then the Python Logger.
6. Do either of the following:
   - Click "Print last exec line" or "Print exec log". .
     The log file is written to [MotionBuilder]\bin*lastexec.log*.
   - Specify a custom file by clicking Browse and selecting it.
     The logger script is implemented as *mbdebugger.py*.

Setting the Python Editor preferences

The Python Editor has various settings you can define. These include the following:

- Python configuration settings
- Python server settings
- Python startup folder
- Python Editor color scheme
- Python Editor font type and size

To access the Python Editor preferences:

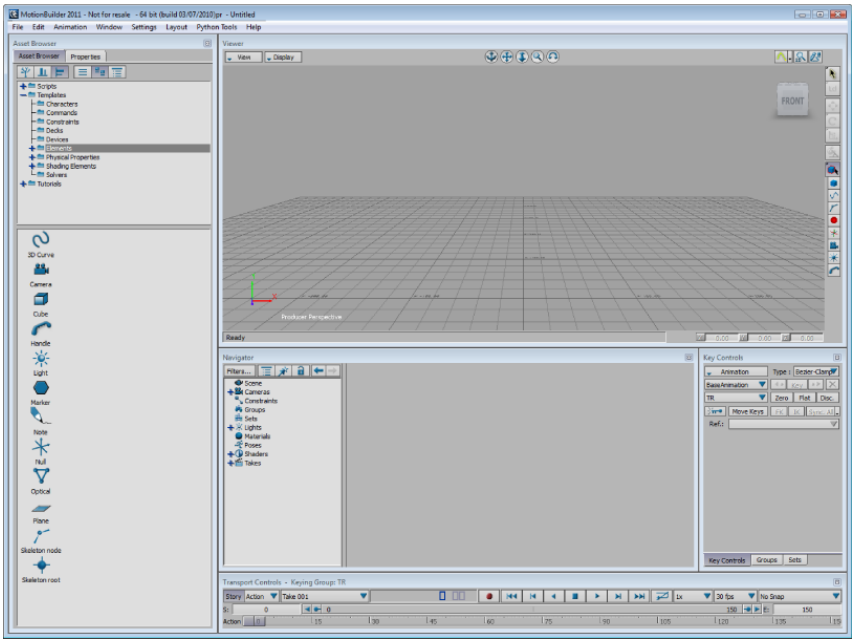
1. From the MotionBuilder menu, choose Settings | Preferences.
2. In the Preferences window, Choose Python.

For a description of the Python settings, see Python preferences on page 150.

Layouts

6

MotionBuilder includes the Creation, Animation, Editing, Preview, and Story layouts that are designed for specific tasks. For example, the Creation layout, with the large Asset browser, Navigator, and Viewer window, is an ideal layout for creating MotionBuilder scenes.



Creation Layout (1600 by 1200)

Similarly, Animation is the suggested layout for animating using the FCurves window and Animation Layer editor, while the Story layout, with a separate Asset Settings window, is convenient for animating within the Story window. The Editing menu gives easy access to the multiple windows you may need while editing the animation in your scene, while the Preview layout has a screen-wide Viewer window for displaying animation.

Each basic layout supports four screen resolutions. If your monitor settings do not match one of these four, MotionBuilder uses the layout version that is closest to your screen resolution. The four screen resolutions are:

- 1280 x 1024
- 1024 x 768
- 1600 x 1200
- 1920 x 1200

You can also create, rename, update, and delete custom layouts using the Layout menu. Each layout saves the size and position of currently opened windows.

You can use an external text editor to add tabs to the windows in your custom layouts so that more than one window can occupy the same screen space.

NOTE The windows in each pre-defined layout may change depending on your screen size. For example, the Creation Layout contains different windows when your display preferences are set to 1280 by 1024 compared to 1600 by 1200.

This chapter contians the following:

- Creating, updating, renaming, and deleting a layout on page 124
- Adding tabs to custom layouts on page 126

See also:

- Layout menu on page 36

Creating, updating, renaming, and deleting a layout

Layout creation lets you arrange the MotionBuilder interface by hiding, showing, or resizing specific windows and tools. This section contains information on creating, renaming, updating, and deleting custom layouts.

To create a layout:

1. Select Layout > Create Layout, enter a name in the dialog box.
2. Click OK.

The new layout displays in the list of custom layouts within the Layout menu.

To update the current layout:

1. Select the custom layout from the list of custom layouts in the Layout Menu.
2. Rearrange the MotionBuilder interface by hiding, showing, or resizing specific windows and tools.
3. Select Layout > Update Layout. A dialog box appears asking you to confirm.
4. Click Ok.

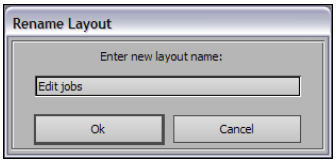
   The selected layout is updated to reflect the size, selection, and arrangement of MotionBuilder windows currently displayed.

NOTE You cannot update the four default layouts: Creation, Animation, Editing, Preview, and Story. If a default layout is selected, the Update Current Layout menu item is disabled.

To rename the current layout:

➤ Select Layout > Rename Layout.

The Rename Layout dialog box appears, letting you rename the current layout.



Rename Layout dialog box

NOTE You cannot rename the four default layouts: Creation, Animation, Editing, Preview, and Story. If one of these five default layouts is selected, the Rename Current Layout menu item is disabled.

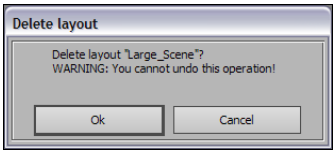
To delete a custom layout:

1. Select Layout > Delete Layout.

   A dialog box appears prompting you to select the custom layout you want to delete.

2 Select a custom layout and click Ok.

A second dialog box displays asking you to confirm deletion.



Delete Layout dialog box

3 Click Ok to delete the selected layout.

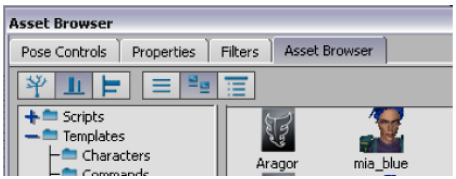
NOTE Be careful while deleting custom layouts. Deleting a layout cannot be undone.

If you delete the current layout, MotionBuilder switches to either the next custom layout or the first default layout. If there are no custom layouts, MotionBuilder switches to the first default layout.

■ Adding tabs to custom layouts on page 126

Adding tabs to custom layouts

Default layouts contain windows with tabs that combine two or more windows in the same window. For example, the following figure combines the Pose Controls window, Properties window, Filters window, and Asset browser in the same location. To switch between windows, click on the appropriate tab.



Window with tabs

To add tabs to a custom layout:

1 Go to `/bin/config/Layouts` directory in your MotionBuilder folder after performing a Show Package Contents.

2 Open and edit your custom layout using a text editor.

3 To create a window with two tabs, change the `NbTools` line to the number of tabs you want.

NOTE There is a limit of nine tabs per window.

4 For each tab, you must add a separate `ToolName_n = window_name`, where `n` is the number of the tab and `window_name` is the name of a MotionBuilder window.

The following is an example of a window declaration:

```
[Wnd_2]
NbTools = 3
ToolName_1 = Asset Browser
ToolName_2 = Groups
ToolName_3 = Properties
UsePix = true
TabPos = top
ToolX = 8
ToolY = 7
ToolW = 240
ToolH = 998
```

5 Change the position, width, and height of the window using the `ToolX`, `ToolY`, `ToolW`, and `ToolH` lines. Change the tab position by specifying either `Top` or `Bottom` beside `TabPos`.

NOTE Be careful when you edit custom layouts. Typographical errors, bad numbering, and multiple windows with identical tabs can cause problems.

■ Creating, updating, renaming, and deleting a layout on page 124

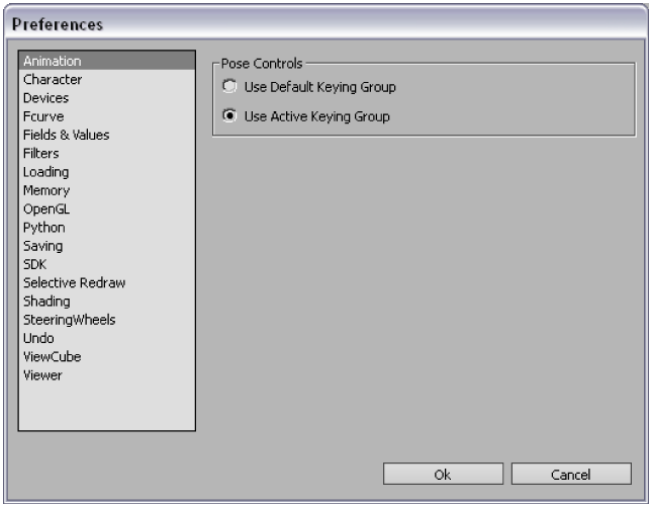
Preferences

7

The Preferences window lets you view and set MotionBuilder default and operational preferences.

To access the MotionBuilder preferences:

- From the MotionBuilder menu bar, select Settings > Preferences.



MotionBuilder Preferences

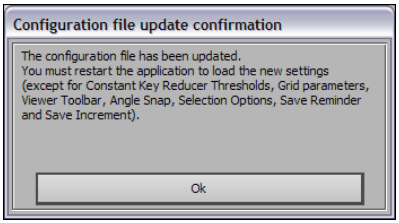
MotionBuilder includes the following preference settings:

- Animation preferences on page 131
- Character preferences on page 132
- Devices preferences on page 133

- FCurves preferences on page 137
- Fields and Values preferences on page 138
- Filters preferences on page 140
- Loading preferences on page 141
- Memory preferences on page 143
- OpenGL preferences on page 145
- Python preferences on page 150
- Saving preferences on page 153
- SDK preferences on page 157
- Selective Redraw preferences on page 158
- Shading preferences on page 159
- SteeringWheels preferences on page 161
- Undo preferences on page 164
- ViewCube preferences on page 165
- Viewer preferences on page 168

After modifying the options in any of the Preferences window's panes, click OK to activate the changes.

NOTE For some of the changes in preferences to take effect, a dialog box appears informing you that MotionBuilder must be restarted.



Configuration File Update confirmation dialog box

WARNING Be careful when you change preferences, as the Preferences window contains configurable options that refer to the operation of MotionBuilder on your computer.

See also:

- Serial Ports preferences on page 135
- OpenGL Viewer Info window on page 148

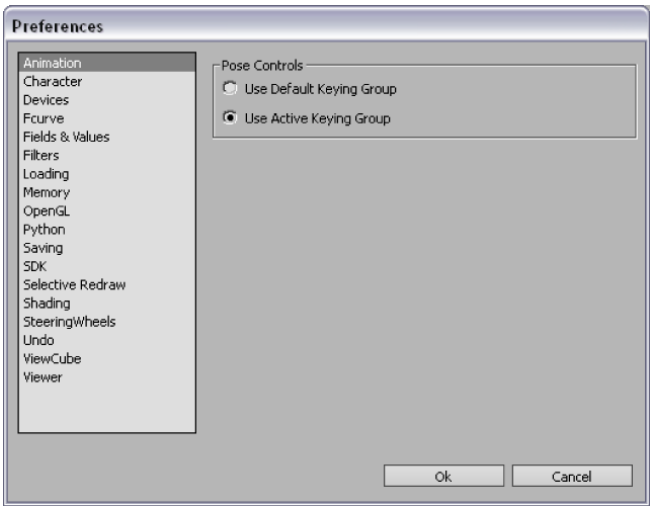
Animation preferences

In the Preferences window, you can choose whether the object poses you create use the default keying group or active keying group.

NOTE When you create character poses, the keying group will always default to "Full Body". But when you paste character poses, the keying group used will always be the active keying group. The choice between the "active" or "default" keying group setting applies to the creation of object poses.

To access the Animation preferences:

- From the MotionBuilder menu bar, select Settings > Preferences.
  The Animation preference settings display in the Preferences window.



Animation preferences

The following table describes the Object Animation preference settings.

Pose Controls settings	Description
Use Default Keying Group	This applies to object pose creation. The default keying group for object-pose creation is always, “TR” for translation and rotation channels.
Use Active Keying Group	This also applied to object pose creation—the keying group selected in the Key Controls window will always be considered the “active” keying group when creating an object pose.

See Creating a custom keying group on page 839 and keying group on page 2004.

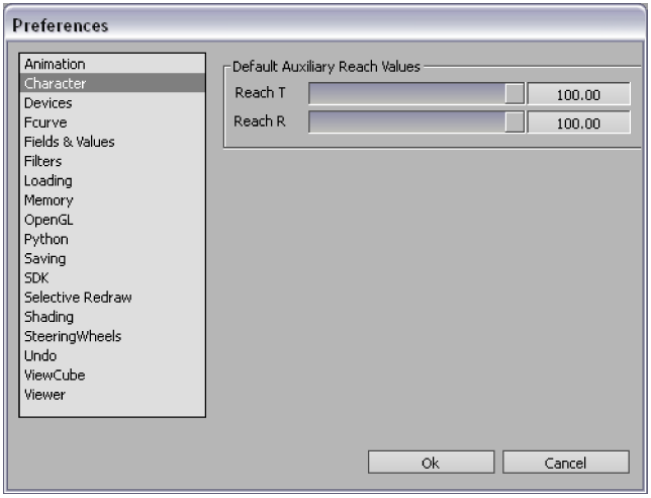
Character preferences

In the Preferences window, the Character preferences let you change the default Reach values.

To access the Character preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Character preference option.

   The Character preference settings display.



Character preferences

The following table describes the Character preference settings.

Default Auxiliary Reach Values settings	Description
Reach T	To set the default Reach translation.
Reach R	To set the default Reach rotation.

See Control rig effector properties on page 1455.

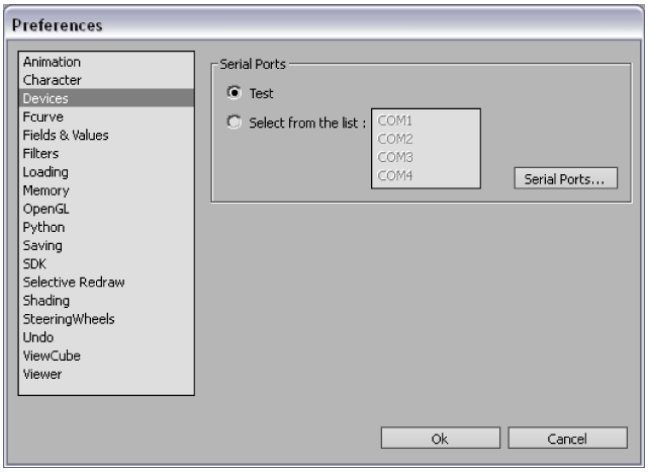
Devices preferences

In the Preferences window, the Devices preferences contain the Serial Ports preference settings, which lets you search for and assign serial ports.

To access the Devices preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Devices preference option.

   The Devices preference settings display.



Devices preferences

The following table describes the Devices preference settings.

NOTE MotionBuilder shows the current preferences of your computer system as the default. Use caution when changing them, as some preferences might not provide optimal results for your computer.

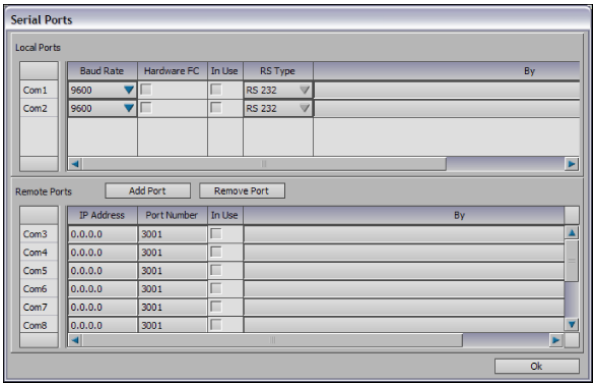
Serial Ports settings	Description
Test	To specify ports available to MotionBuilder. When activated, it enables you to search for valid ports from your default operating system setup.
Select from the list	When activated, it enables you to override the default ports setup and to choose a serial port from the list. Ctrl-click to select multiple ports.
Serial Ports	To view and configure the serial and remote ports that physically connect devices to MotionBuilder. Click the Serial Ports button to access the Serial Ports window.

Serial Ports preferences

Use the Serial Ports window to view and configure the serial and remote ports that physically connect devices to MotionBuilder.

To access the Devices Serial Ports preferences

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Devices preference option.
   The Devices preference settings display.
3. Click the Serial Ports option.
   The Serial Ports preference settings display.



Serial Ports preferences

The following tables describe the Serial Ports preference settings for the local and remote ports.

Use the Local Ports settings to change the preferences for ports directly connected to your computer, such as Com1, Com2, and Lpt1.

Local Ports settings	Description
Baud rate menu	To set the baud rate of the devices directly connected to your computer using the Com1 or Com2 port using the Baud Rate pull-down menu. The default baud rate is 9600.
Hardware FC option	To activate Hardware FC to enable Hardware Full Control on your computer. A basic serial port has ground, input, data in,

Local Ports settings	Description
	and data out (Receive Data and Translate Data, or RxD TxD GND) connections. When you attempt to transfer at a higher speed for more reliable communications, this device lets you use a special communication protocol to control the flow of data between the devices. This is a device-specific mode. Check the documentation shipped with your hardware device to make sure your device supports this mode before activating it.
In Use option	To activate the In Use option to make the local port active.
RS Type menu	To select which serial line standard you are using to connect serial ports. The default RS Type is RS-232.

Use the Remote Ports settings to connect a serial device that gives you additional ports where you can connect your input and output devices, such as the Lantronix Ethernet Terminal Server.

NOTE Each serial device connected to your computer has its own IP address, and each port has its own port number. This means that you can have many port numbers for the same IP address.

Remote Port settings	Description
IP Address	To enter the IP address of the remote terminal or terminal server connected to your computer. Double-click the IP Address field to enter the IP address of the appropriate terminal or terminal server.
Port Number	The port number for each remote port. The numbers in this column are set by default, and should only be changed if the specified port number is wrong or in use. For example, if the Port number is set to port 3001, and the device that you want to use is connected on port 4001, change the Port number field to 4001. Double-click the Port Number field to set a remote port number.
In Use	When a device is connected to a remote port and both the IP address and port number are correct, MotionBuilder activates the In Use column to indicate that the port is being used by a device. Activate the In Use option to indicate that the port

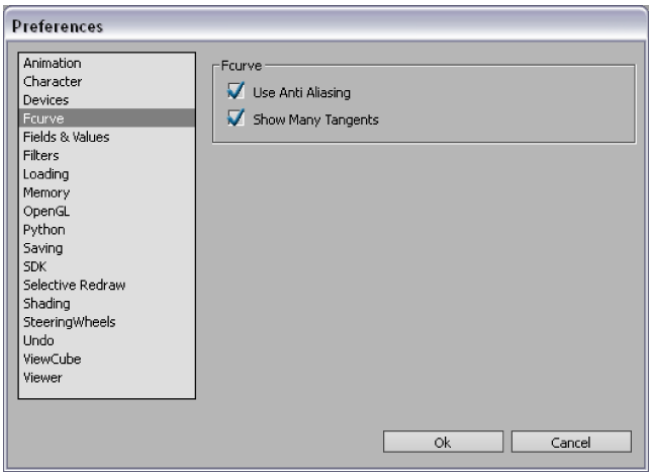
Remote Port settings	Description
	is in use. If In Use is not activated after you specify an IP address and port, the IP address or port number is incorrect.

FCurves preferences

In the Preferences window, the FCurves preferences let you modify options applicable to the FCurves window.

To access the FCurves preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the FCurves preference option.
   The FCurves preference settings display.



FCurves preferences

The following table describes the FCurves preference settings.

FCurves settings	Description
Use Anti-Aliasing	When enabled, creates a visual change only, no data is affected. The default option is active.

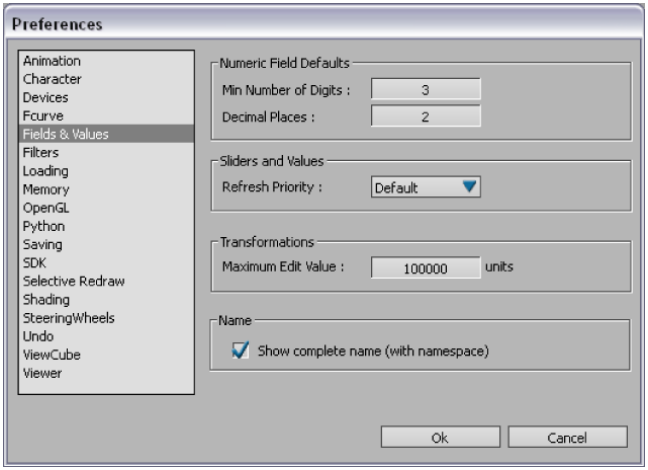
FCurves settings	Description
Show Many Tangents	When enabled, displays multiple tangents.

Fields and Values preferences

In the Preferences window, the Fields and Values preferences consist of numeric field default settings, sliders and values default refresh rate settings, the maximum number you can enter into a value field in the FCurves window, and the option to display names to include namespaces.

To access the Fields & Values preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Fields & Values preference option. The Fields & Values preference settings display.



Fields & Values preferences

The Numeric Field Defaults preference settings let you establish default preferences relating to the display of numeric values. The following table describes the Numeric Field Defaults preference settings.

Numeric Fields Defaults settings	Description
Min Number of Digits	The Min Number of Digits field lets you specify the length of values displayed in the MotionBuilder interface. The default setting is 3.
Decimal Places	The Decimal Places field lets you specify how many decimal place values display in numerical fields. The default setting is 2.

The Sliders and Values default preference setting lets you set a default rate for any sliders and values that appear in MotionBuilder.

The Refresh Priority menu options lets you choose the refresh rate of values set with sliders, for example, the Materials Opacity slider. The following tables describes the Sliders & Values refresh priority preference settings.

Sliders & Values Refresh Priority settings	Description
Low	To set a slow refresh rate.
Default	To set the default refresh rate. The Default is the recommended refresh rate setting for most systems.
High	To set a fast refresh rate. A high refresh rate creates a memory demand on the system.

The Transformations preference setting contains the Maximum Edit Value field, which lets you determine the maximum number you can enter into a value field in the FCurves window. The default number is 100000.

The Name preference setting enables you to either choose to display the names with the namespaces or choose to display the names without the namespaces. The default setting is set to display the names with the namespaces.

Filters preferences

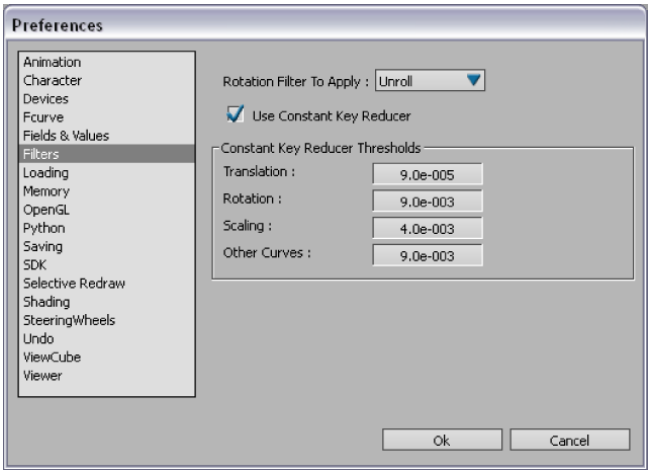
In the Preferences window, the Filters preferences let you set defaults for filters that MotionBuilder applies during the plotting process.

To access the Filters preferences:

1 From the MotionBuilder menu bar, select Settings > Preferences.

2 In the Preferences window, click the Filters preference option.

The Filters preference settings display.



Filters preferences

The Rotation Filter To Apply menu lets you choose between using the Unroll or Gimbal Killer filter during the plotting process. Modifying the Rotation Filter To Apply configuration options changes your data. The default option is Unroll.

The Use Constant Key Reducer option lets you minimize file sizes by eliminating unnecessary keys during the plotting process. Modifying this option changes your data. The default option is Active.

Constant keys occur when two keys are placed at the same value in the FCurves window, such as keys with Constant interpolation. When the difference between the values for two key's is greater than the specified threshold, the keys are kept. Any keys under the threshold are discarded. The default value is 5000e.012. This value is an exponent value.

NOTE Changes made to the Constant Key Reducer Thresholds are effective immediately.

The Translation, Rotation, Scaling, and Other Curves fields let you specify a value for translation, rotation, scaling keys, and any other curves, respectively.

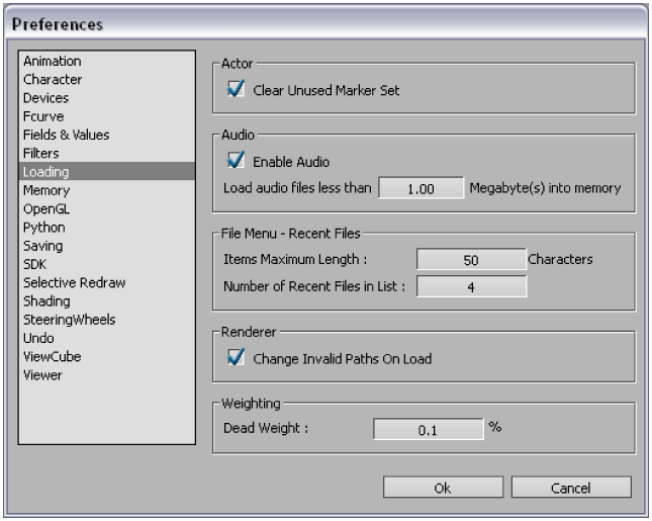
Loading preferences

In the Preferences window, the Loading preferences consist of the following:

- Actor preferences
- Audio preferences
- File preferences
- Renderer preferences
- Weighting preferences

To access the Loading preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Loading preference option.
   The Loading preference settings display.



Loading preferences

The Actor setting contains the Clear Unused Marker Set option, which clears any Marker sets not used by Actors after they are loaded in MotionBuilder. Activating this setting "cleans" old MotionBuilder files that might have been corrupted by large numbers of unused Marker sets.

NOTE Clear Unused Marker Set is disabled by default.

The Audio preference setting lets you activate or disable MotionBuilder audio. The following table describes the Audio preference settings.

Audio settings	Description
Enable Audio	To activate or disable audio capabilities. Activate Enable Audio to use audio in MotionBuilder. The default option is active.
Load Audio Files Less Than	To specify a size (in megabytes) threshold beyond which Audio files are not loaded into memory. For example, if the limit is 1.00, a file that is 5 megabytes is read directly from the disk. The default size is 1 Megabyte.

The File Menu - Recent Files preference settings let you set defaults relating to files recently loaded in MotionBuilder. The following table describes the File Menu preference settings.

File Menu Recent Files settings	Description
Items Maximum Length	To you set the number of characters used in menu items. The default setting is 50.
Number of Recent Files in List	To specify how many recently loaded files display in the File menu. The default setting is 4.

The Renderer preference setting lets you set defaults for output paths. The following table describes the Renderer preference setting.

Renderer setting	Description
Change Invalid Paths On Load	To choose whether or not invalid output paths are restored to default options when MotionBuilder loads. When activated, MotionBuilder looks for a path when the old path is not found. The default option is active.

The Weighting preference setting lets you specify thresholds for weighted models. The following table describes the Weighting preference setting.

Weighting setting	Description
Dead Weight	Double-click the Dead Weight field to set a threshold for weighted models, rounding off unassigned values applied to skins. This setting applies to models dropped into the Skin tool. For example, when a model is moved to 100 000 units and the skin stretches, you can correct the stretching if you modify the Dead Weight value. The default value is 0%. Weights under this value are ignored.

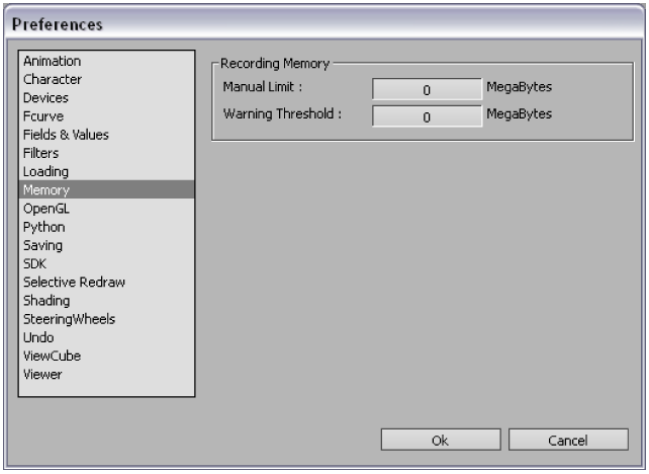
Memory preferences

In the Preferences window, the Memory preferences contain the Recording Memory preference settings which lets you activate or record memory values.

To access the Memory preferences:

1 From the MotionBuilder menu bar, select Settings > Preferences.

2 In the Preferences window, click the Memory preference option. The Memory preference settings display.



Memory preferences

The following table describes the recording memory preference settings.

Recording Memory settings	Description
Manual Limit	To specify the virtual limit of memory used for recording. Double-click the Manual Limit field to set a Manual Limit value, expressed in megabytes. The default value is 0.
Warning Threshold	To specify a memory warning value during recording. If the available memory for recording drops below the warning value, MotionBuilder displays a dialog box. To display the memory usage of your system, press Shift-M. Double-click the Warning Threshold field to enter a Warning Threshold value, expressed in megabytes. The default value is 0. Note: The Warning Threshold is not a limit, it only activates a warning message.

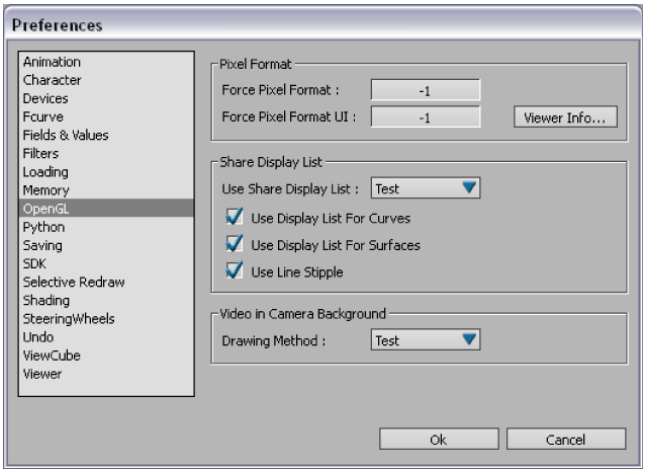
OpenGL preferences

In the Preferences window, the OpenGL® preference settings consist of the following:

- Pixel Format settings
- Share Display List settings
- Video in Camera Background settings
- OpenGL Viewer Info window on page 148

To access the OpenGL preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the OpenGL preference option.
   The OpenGL preference settings display.



OpenGL preferences

The Pixel Format preference settings let you set default values for the Viewer window display. The following table describes the Pixel Format preference settings.

Pixel Format settings	Description
Force Pixel Format	The Force Pixel Format value is an index of the Viewer window pixel format. For example, you can enter a value if you want to force your display to show Anti-Aliasing. Double-click the field to enter a value. This setting only affects the display of the Viewer window. The default value is -1.
Force Pixel Format UI	The Force Pixel Format UI value is an index of the pixel format for the interface, as seen in the PixelFormat pane of the Viewer Info window in MotionBuilder. Double-click the field to enter a value. This setting does not affect the Viewer window display, it affects only the interface. The default value is -1.
Viewer Info	Click the Viewer Info button to view the version and capabilities of the OpenGL implementation of your computer as well as the Pixel Format setup. See OpenGL Viewer Info window on page 148.

The Share Display List preference settings let you set default values for the Share Display List. The following table describes the Share Display List default preference settings.

Share Display List setting	Description
Use Share Display List	The Use Share Display List menu lets you choose options that concern the use of your display. If you choose Test, the static geometry is sent to the video driver or card only once for the whole session. Doing this speeds up the display of static geometry with no effect on skinned or shaped models. Select No from the menu only when using problematic or old video drivers or cards. The default option is Test.
Use Display List For Curves	Activate the Use Display List For Curves option to activate hardware acceleration for displaying curves in the FCurves window. The default option is active.

Share Display List setting	Description
Use Display List For Surfaces	The Use Display List For Surfaces option is like the Use Share Display List but applies to Patches and NURBS. If you select Test from the Use Share Display List menu, then activate Use Display List For Surfaces option, the non-deformed patches and NURBS uses the display list. Disable this option only when using problematic or old video drivers or cards. The default option is active.
Use Line Stipple	The Use Line Stipple option lets you use stipple or dotted lines in region selection and camera-safe areas. Disable this option only when using problematic video drivers or cards. In certain conditions, some newer video drivers or cards have had machine freeze problems when using line stipple. These problems usually occur when global anti-aliasing is used. The default option is active.

The Video in Camera Background preference settings contain the Drawing Method menu, which lets you choose what type of camera background display is used as the default. The following table describes the Video in Camera Background preference settings.

Video in Camera Background settings	Description
Test	Loads the camera background image in texture memory before displaying. This method is the best for displaying static images. This setting is the default selection
Texture	Loads the camera background image in texture memory before displaying. This method is the best for displaying static images.
Draw	Use the Draw option for video images, as it does not use texture memory. The Draw option transfers the background image from the main memory to the video memory. The texture video memory is then updated each time the video frames change. This method is the fastest in most “reflection on video” cases, or if your video is used for texturing geometry.

For additional information about camera backgrounds, see Back Plate pane on page 463.

OpenGL Viewer Info window

The OpenGL Viewer Info window lets you view the supported OpenGL features, versions and capabilities of your computer's OpenGL implementation as well as the Pixel Format setup.

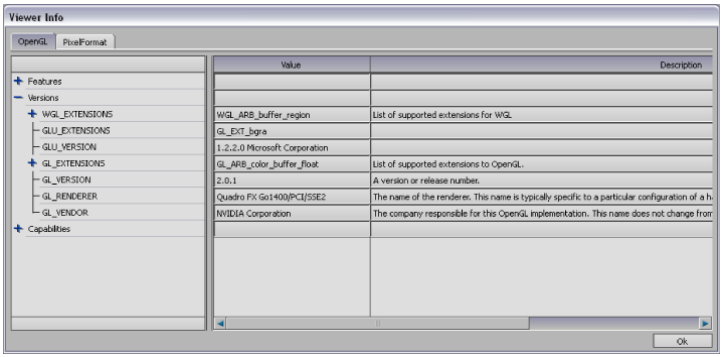
NOTE You cannot modify information in the OpenGL Viewer Info window, the information is for reference purposes only.

To access the OpenGL Viewer Info window:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the OpenGL preference option.

   The OpenGL preference settings display.
3. Click the Viewer Info option.

   The Viewer Info window appears, displaying the OpenGL pane preference settings.



OpenGL Viewer Info window displaying OpenGL pane

The OpenGL Viewer Info window consists of two panes:

- OpenGL pane
- PixelFormat pane

The OpenGL pane contains the following three menus:

- Features menu

- Versions menu
- menu

These menus contain information about Accumulation, Depth, Stencil, and Color buffers.

Expand the Features menu to view information about the Display List in the Value and Description fields.

Expand the Versions menu to view information about your OpenGL versions and extensions, as well as the name of the Renderer and the OpenGL vendor in the Value and Description fields. You can further expand the Versions menu to view the WGL and GL _Extensions.

Expand the Capabilities menu to view information about the maximum allowable limits in your OpenGL version for lights, texture sizes and stack depth, attribute stack depth, display list nesting, modelview, projectionview, supported name stack depth, application-defined clipping panes, minimum/maximum size for Anti-Aliased points, and the maximum supported height of the Viewer window.

The following tables provides a description of the OpenGL Capabilities menu. Expand the menu to view the menu's content.

Capabilities menu	Description
Accumulation buffer menu	Provides information about the number of bitplanes in the color and Alpha channels in the Accumulation buffer.
Depth buffer menu	Provides information about the number of bitplanes in the Depth buffer.
Stencil Buffer menu	Provides information about the number of bitplanes in the Stencil buffer.
Color buffer menu	Provides information about the number of bitplanes in the color and Alpha channels of the Color buffers. **NOTE** Some descriptions may not fit within the Viewer Info window. Resize the window or use the scroll bars to move across and down the rows of values.

To access the OpenGL Viewer Info Pixel Format information:

1 From the MotionBuilder menu bar, select Settings > Preferences.

2 In the Preferences window, click the OpenGL preference option.

The OpenGL preference settings display.

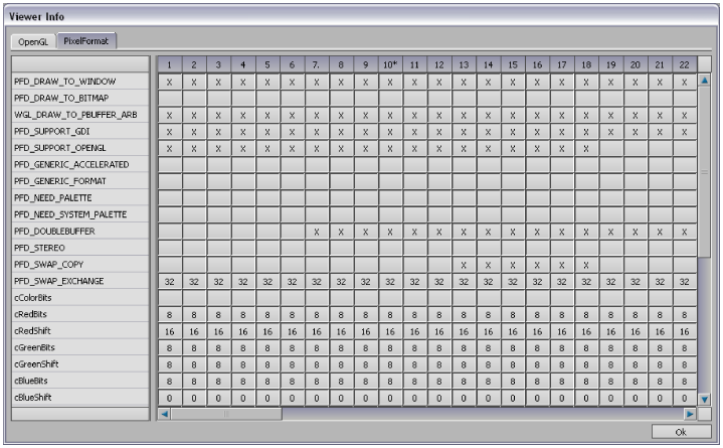
3 Click the Viewer Info option.

The Viewer Info window appears, displaying the OpenGL pane preference settings.

4 Click the PixelFormat pane.

The PixelFormat pane displays the setup of your OpenGL card. An X displays in any column that supports the specified value.

NOTE You cannot make changes in the PixelFormat pane. The information is included only as a reference.



OpenGL Viewer Info window displaying OpenGL PixelFormat pane

Some descriptions may not fit within the Viewer Info window. Resize the window or use the scroll bars to move across and down the rows of values.

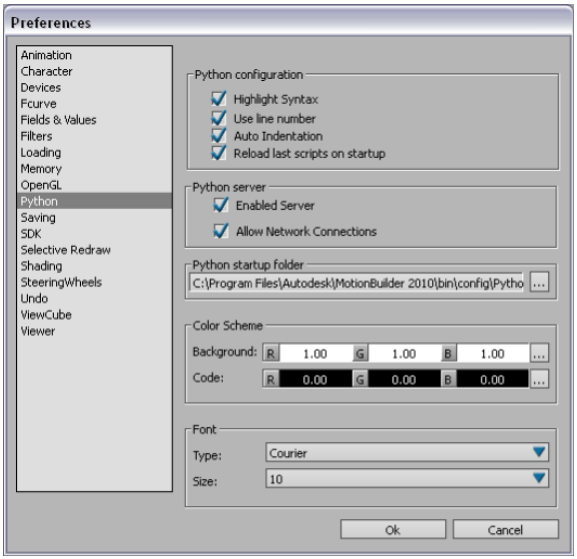
Python preferences

The Preferences window includes the Python preference settings.

To access the Python preferences:

1 From the MotionBuilder menu bar, select Settings > Preferences.

2 In the Preferences window, click the Python preference option.
The Python preference settings display.



Python preferences

The Python preference settings consist of the following:

- Python configuration settings
- Python server settings
- Python startup folder settings
- Color scheme settings
- Font type and size

The following table describes the Python configuration preference settings.

Python configuration settings	Purpose
Highlight Syntax	To show code colorized (as you type) based on Python syntax types.

Python configuration settings	Purpose
Use line number	To display line numbers in the Python editor Workspace pane.
Auto Indentation	To automatically indent a script where required.
Reload last scripts on startup	To load (in the Python Editor) the last scripts when launching application.

The following table describes the Python server preference settings.

Python server settings	Purpose
Enable Server	To start a server in order to execute Python commands remotely. Note: To be able to execute commands remotely, you must enable Allow Network Connections.
Allow Network Connections	To enable network connection. Note: To be able to execute commands remotely, you must Enable Server.

The following table describes the Python startup folder preference setting.

Python startup folder setting	Purpose
Python startup folder	To set Python path variables. This folder provides a location where you can place any and all scripts that you want to have executed on start-up. This allows you to get around using a .bat file or another form of start-up manipulation. You can provide several scripts to an artist to configure for example, UI, settings, load/save scenes etc.

The following table describes the Python Editor color scheme preference settings.

Python Editor Color Scheme settings	Purpose
Background	To set the color of the Python Editor console. You change the background of the Python color scheme using the Color window on page 2.

Python Editor Color Scheme settings	Purpose
Code	To set the color of the code. You change the color of the Python code using the Color window on page 2.

The following table describes the Python Editor font settings.

Python Editor Font settings	Purpose
Type	To set the default font type for the Python Editor interactive console and work area.
Size	To set the default font size for the Python Editor interactive console and work area.

See Python Editor on page 101.

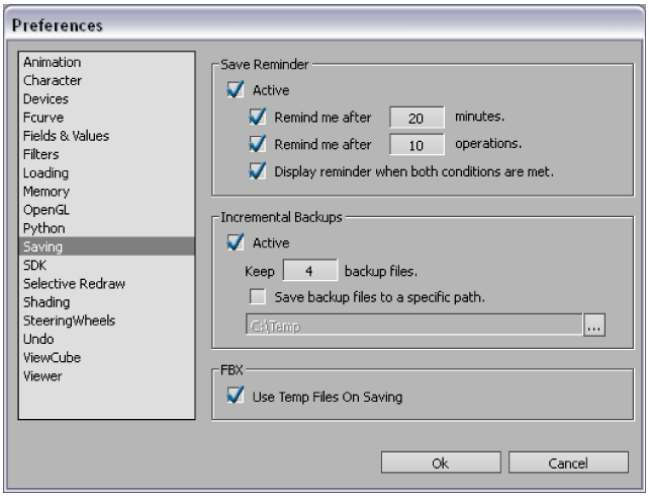
Saving preferences

In the Preferences window, the Saving preference settings consist of the following:

- Save Reminder settings
- Incremental Backups settings
- FBX setting

To access the Saving preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Saving preference option.
   The Saving preference settings display.

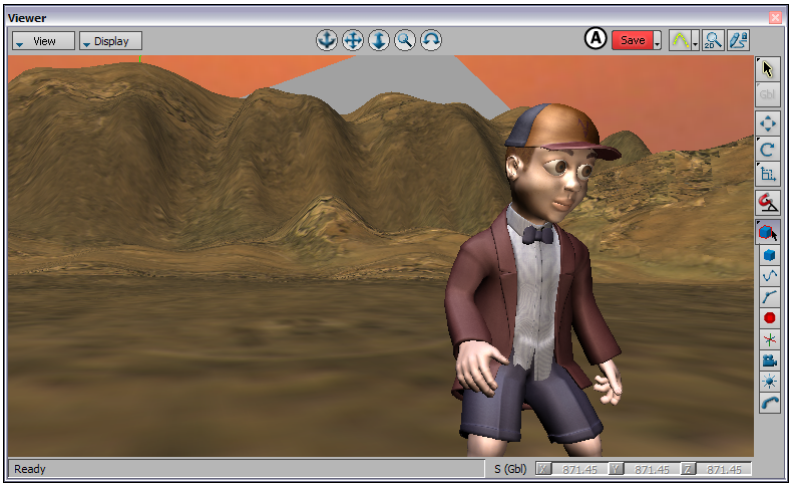


Saving preferences

The Save Reminder preference settings contain options which let you determine when MotionBuilder reminds you to save your scene.

NOTE The Save Reminder options are disabled by default.

To remind you to save, a red Save Reminder button appears in the top right corner of the Viewer window. You can click the Save Reminder button to save your file. See Save Reminder button on page 265 for more information.



Viewer window *A.* **Save Reminder button**

The following table describes the Save Reminder preference settings.

Save Reminder settings	Purpose
Active	When the Active option is enabled, the Save Reminder button displays in the Viewer window with a frequency determined by the following options:
Remind me after x minutes	The Remind me after x minutes field lets you specify the number of minutes after which you are reminded to save. (Where x is the number of minutes.)
Remind me after x operations	The Remind me after x operations field lets you specify the number of operations after which you are reminded to save. (Where x is the number of operations.)
Display reminder when both conditions are met	When the Display reminder when both conditions are met option is active, it prompts you to save once you have performed the specified number of operations as well as after the specified number of minutes since your last save. Otherwise you are prompted to save either after the specified number of operations or the number of minutes since your last save, whichever occurs first.

The Incremental Backups preference settings let you create multiple backups of your file every time you save it.

By default, a folder is created where you saved the original file. You can also select different location for this folder. The name of the folder is *n*.bck, where *n* is the original name of your FBX file. For example, if the name of the file was *running.fbx*, the name of the folder will be *running.bck*. See the following table.

The backup files are saved within this folder. The first backup file is named "*n*.001", where n is the name of the original file. Each file after that is named incrementally, as in "*n*.002", "*n*.003", "*n*.004", and so on.

The following table describes the Incremental Backups preference settings.

Incremental Backups settings	Purpose
Active	The Incremental Backup Active option lets you save backup files of the file on which you are working. This option is active by default.
Keep x backup files	The Keep x backup files field lets you choose the maximum number of backup files you want to keep. The default number of files is 4. For example, when you save the file for the fifth time, the first version of the file is deleted, so that only four versions remain in the folder.
Save backup files to a specific path	The Save backup files to a specific path option lets you select the location of your backup files. When the option is disabled, the folder containing your saved files is created in the same location as the file you saved originally. When the option is active, the folder is created in the location you specify. The default location is C:\TEMP.

The FBX preference setting contains the Use Temp Files On Saving option, which lets you affect the behavior of the Save operation for FBX files. The following table describes the FBX preference setting.

FBX setting	Purpose
Use Temp Files On Saving	The Use Temp Files On Saving option is useful if a problem occurs during the save process as activating this setting ensures that the original file is not corrupted. This way you can avoid overwriting an old version with another version, and losing data. Disable this option when you want to overwrite files with the same name. If the file in the specified

FBX setting	Purpose
	directory exists, the old version is replaced with the new one. This option is active by default.

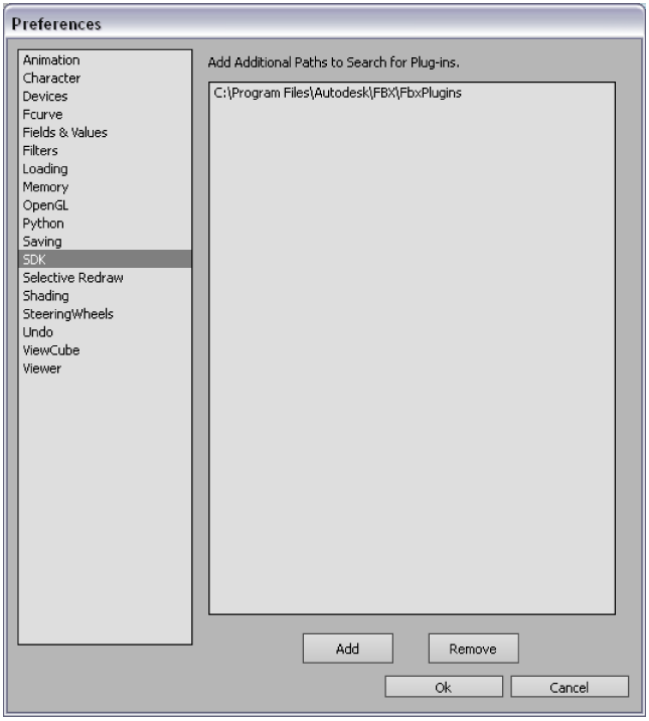
SDK preferences

In the Preferences window, the SDK preference settings let you assign a plug-in path so you can access plug-ins that reside in external directories.

To access the SDK preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the SDK preference option.

   The SDK preference setting displays.



SDK preferences

Setting a plug-in path

Use the SDK preference settings to assign additional paths for MotionBuilder to search so that you can access plug-ins that reside in external directories.

To set a plug-in path:

1. Select Settings > Preferences from the MotionBuilder menu bar.
2. From the Preferences window, select the SDK option.

   The SDK preference setting displays.
3. Click Add.

   The window Add Additional Paths to Search for Plug-ins appears.
4. Navigate to the plug-in folder.
5. Select the plug-in folder and click OK.

   Any plug-ins found in the specified location are now available to MotionBuilder.

To remove a plug-in path:

➤ Select the path and click Remove.

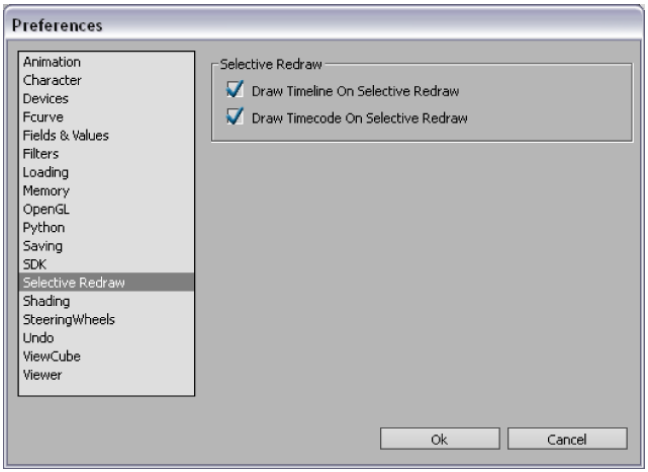
Selective Redraw preferences

The Selective Redraw preference settings let you set the defaults for timecode and timeline updating.

To access the Selective Redraw preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Selective Redraw preference option.

   The Selective Redraw preference settings display.



Selective Redraw preferences

The Draw Timeline On Selective Redraw option lets you specify whether the Timeline is updated. Activate this option to update the timeline. Disable it to achieve faster frame rates by skipping the automatic Timeline update. This option is active by default.

The Draw Timecode On Selective Redraw option lets you specify whether the time code is redrawn. Activate this option to update the Timecode, disable it to achieve faster frame rates by skipping the automatic Timecode update. This option is active by default.

Shading preferences

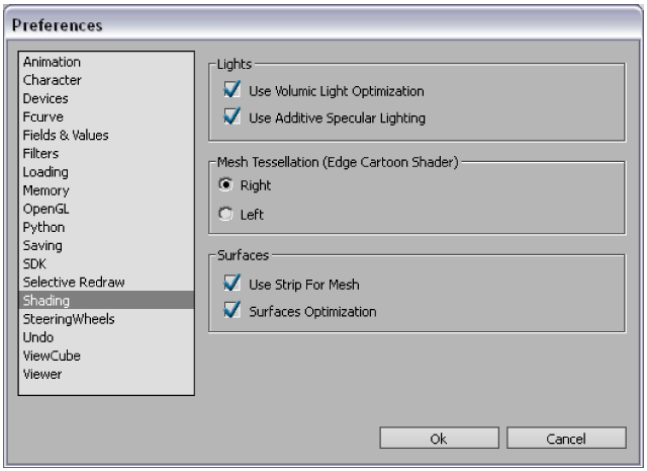
In the Preferences window, the default Shading preference settings consist of the following:

- Light settings
- Mesh Tessellation settings
- Surface settings

To access the Shading preferences:

1 From the MotionBuilder menu bar, select Settings > Preferences.

2 In the Preferences window, click the Shading preference option.
The Shading preference settings display.



Shading preferences

The Lights preference settings lets you set default preferences for Light assets. The following table describes the Lights preference settings.

Lights settings	Purpose
Use Volumic Light Optimization	The Use Volumic Light Optimization option lets you select a slower display method which is necessary for some OpenGL drivers. The default option is active.
Use Additive Specular Lighting	The Use Additive Specular Lighting option improves and saturates specular highlights if your video driver or card can support it. The majority of graphics cards support this setting. Disable this option only when using problematic video drivers or cards. When this option is disabled, the standard OpenGL lighting equation is used. The default option is active. See Specularity slider for more information.

The Mesh Tessellation preference settings lets you choose the way MotionBuilder tessellates quad to triangle strips: right or left (|/| or |\|). Most video drivers or cards support the conversion of quad to triangle strips. Activate these options only when using the Edge Cartoon shader when you need to match the edge of a quad perfectly.

TIP If seams between the geometry and shader appear when you use Patches or NURBS with Edge Cartoon shader, try setting this option to Left. The default option is Right.

See Edge Cartoon shader settings on page 612 for more information.

The Surfaces preference settings let you select default preferences for polygon geometry and NURBS or Patch tessellation. The following table describes the Surfaces preference settings.

Surface settings	Purpose
Use Strip For Mesh	Activate the Use Strip For Mesh option to convert polygon geometry to triangle strips to speed up display. Disable this option when using problematic or old video drivers, old video cards, or geometry with strip algorithms. The default option is active
Surfaces Optimization	The Surfaces Optimization option represents the tessellation of Patches and NURBS. This option maximizes Patch and NURBS processing speeds with no loss of quality. Activate this option to avoid having a deformed patch or NURBS evaluated at each frame. Disable this option only if activation causes problems. The default option is active.

SteeringWheels preferences

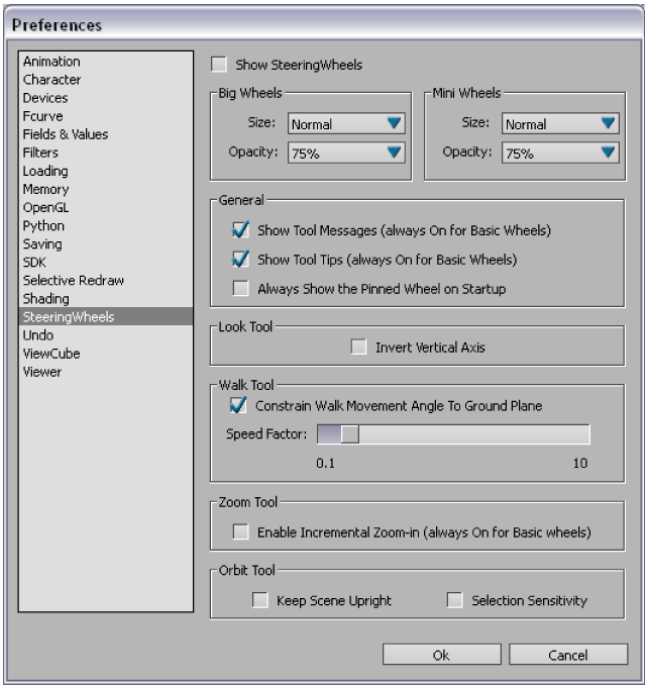
In the Preferences window, the SteeringWheels preference settings let you specify the display of the SteeringWheels.

NOTE The SteeringWheels do not display in the Viewer window by default. To display the SteeringWheels, you need to activate Show SteeringWheels in the SteeringWheels preferences.

To access the SteeringWheels preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the SteeringWheels preference option. The SteeringWheels preference settings display.

   NOTE If you make changes to the SteeringWheels preference settings, you need to restart MotionBuilder for the changes to take effect.



SteeringWheels preferences

The following table describes the Show SteeringWheels preference settings.

Show SteeringWheels settings	Function
Show SteeringWheels	Activate this option to display the SteeringWheels in the Viewer window.
Big/Mini Wheels Size	Use the Size menu to specify the size of the Steering-Wheels.
Big/Mini Wheels Opacity	Use the Opacity menu to specify the opacity of the SteeringWheels. When the cursor is near the Steering-Wheels, it becomes opaque. When the cursor is not near it, it is transparent.

The following table describes the General SteeringWheels preference settings.

General settings	Function
Show Tool Messages	Activate this option to show tool messages that display over the Viewer window and give you instructions about using the SteeringWheels tools. Disable this option to tool messages off. Note: Disabling tool messages only affects the messages displayed when the Full Navigation Wheel is in use.
Show Tool Tips	Activate this option to display Tool tips, which appear for each wedge and button on a wheel when you hover the mouse over them. The tooltips identify what action is performed if you click the wedge or button.
Always Show the Pinned Wheel on Startup	This option lets you control the startup placement of the SteeringWheels. Activate this option if you want the wheel to be pinned when it displays; disable this option if you want the wheel to follow the position of the cursor.

The following table describes the Look Tool preference setting.

Look Tool setting	Function
Invert Vertical Axis	Activate this option to swap the up-down mouse motion of the Look Tool.

The following table describes the Walk Tool preference settings.

Walk Tool settings	Function
Constrain Walk Movement Angle to Ground Plane	When active, you can look up and down while walking on the floor; if you disable this option, you will fly in the direction you are looking.
Speed Factor	Use the slider to sets the speed for the Walk Tool

The following table describes the Zoom Tool preference setting.

Zoom Tool setting	Function
Enable Incremental Zoom-In	When activated, you can increases the magnification of the model by clicking over the Zoom wedge. If disabled,

Zoom Tool setting	Function
	nothing happens if you single click over the Zoom wedge.

The following table describes the Orbit Tool preference settings.

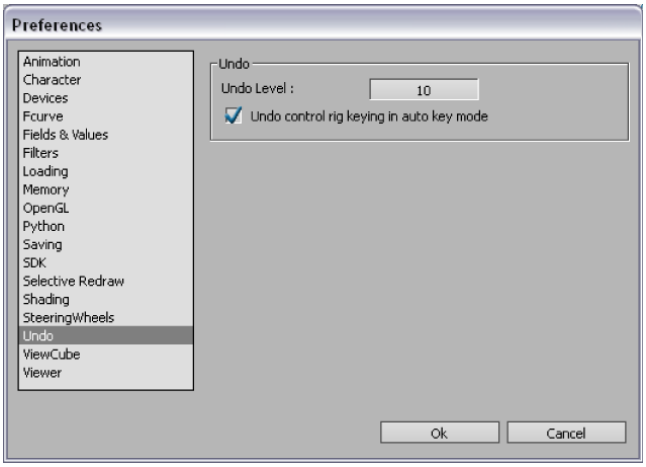
Orbit Tool settings	Function
Keep Scene Upright	When activated, avoids orienting the scene upside-down when you use the SteeringWheels.
Selection sensitivity	When activated, the objects selected before the Orbit tool are used to calculate the pivot point to use for orbiting. The pivot point is calculated based on the center of the selected objects.

Undo preferences

In the Preferences window, the Undo preference settings let you specify the number of "undos" used by MotionBuilder.

To access the Undo preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Undo preference option.
   The Undo preference settings display.



Undo preferences

The Undo Level value lets you set the maximum number of “undos”. You may want to reduce the number of undo levels to save memory and speed up MotionBuilder. The default Undo value is 10.

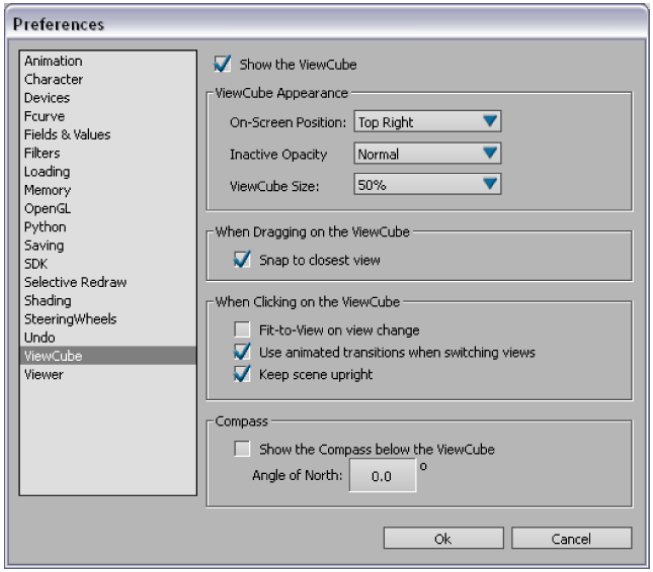
When activated, the Undo Control Rig in Auto Key Mode option lets you undo (*Ctrl* + *Z*) Character keys set with the Auto Key option in the Key Controls window. This setting is disabled by default as it can affect system performance.

ViewCube preferences

In the Preferences window, the ViewCube preference settings let you specify the default display of the ViewCube.

To access the ViewCube preferences, do either of the following:

- Right-click the ViewCube and choose Properties from the contextual menu.
- From the MotionBuilder menu bar, select Settings > Preferences, and then click the ViewCube preference option.
  The ViewCube preference settings display.



ViewCube preferences

The ViewCube preference settings enable you to either show or hide the ViewCube in the Viewer window. The ViewCube is displayed by default.

The ViewCube Appearance preference settings lets you set how the ViewCube displays in the Viewer window. The following table describes the ViewCube appearance preference settings.

ViewCube Appearance settings	Function
On Screen Position	Use this menu to choose which corner you can display the ViewCube: Top Right, Bottom Right, Top Left, or Bottom Left.
Inactive Opacity	When the cursor is near the ViewCube, the cube is opaque. When the cursor is not near the ViewCube, additional controls (except the Home button) do not display. Use this menu to specify the opacity of the ViewCube when the ViewCube is not in use. There are four options you can choose from the drop-down list: 0%, 25%, 50%, 75%, or 100%. The default inactive opacity is set to 50%.

ViewCube Appearance settings	Function
ViewCube Size	Use this menu to specify the size of the ViewCube. There are three options you can choose from the drop-down list: Small, Normal, Large. The default size is set to Normal.

The ViewCube dragging and clicking preference settings let you set behaviors for how the scene displays when you use the ViewCube.

The following table describes the ViewCube dragging preference setting.

When Dragging on the ViewCube setting	Function
Snap to closest view	When active, the Viewer window snaps to one of the fixed views when it is close to one of the fixed views.

The following table describes the ViewCube clicking preference settings.

When Clicking on the ViewCube setting	Function
Fit to view on view change	When active, clicking the ViewCube rotates around the center of the scene and zooms out to fit the scene into the Viewer window. When you drag the ViewCube, before the drag, the view changes to look at the scene center (but does not zoom) and continues to use that as the pivot point while dragging. When disabled, clicking or dragging the ViewCube rotates around the current pivot point and does not zoom in or out.
Use animated transitions when switching views	When active, an animated transition displays when you click on a section of the ViewCube so you can visualize the spatial relationship between the current view and the selected view. Note: When navigating scenes containing vast amounts of geometry, the application frame rate may drop significantly and make it difficult for the system to smoothly animate a viewpoint transition.

When Clicking on the ViewCube setting	Function
Keep scene upright	When activated, avoids orienting the scene upside-down when you click edges, corners, or faces of the ViewCube.

The Compass preference settings lets you indicate which direction is defined as North for the scene. The ViewCube compass North direction is based on the North and Up directions defined by the scene or set in the Angle of North field. The following table describes the Compass preference settings.

Compass settings	Function
Show the compass below the ViewCube	Activate this option show or hide the compass.
Angle of North	Enter a value (in degrees) in the field to set the angle between the ViewCube FRONT face and the Compass directionNorth.

Viewer preferences

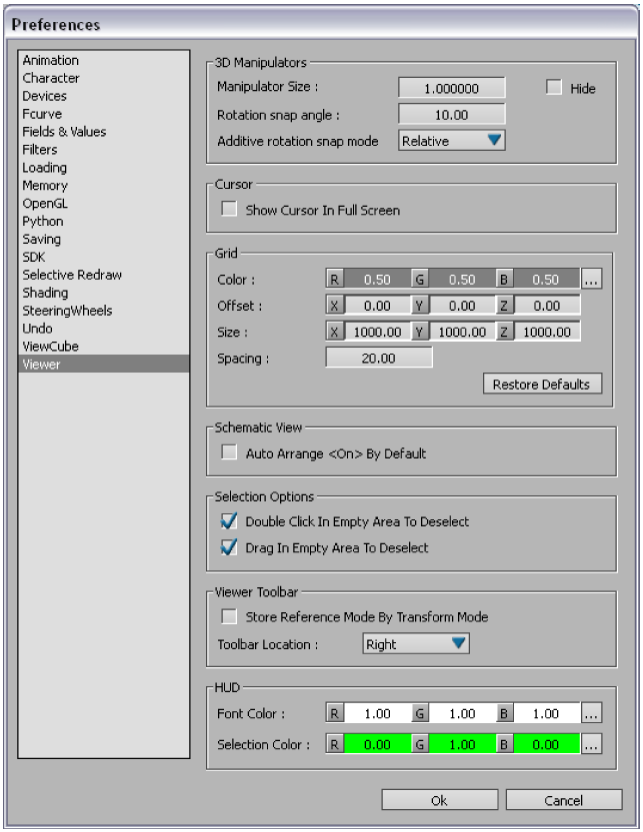
In the Preferences window, the Viewer preference settings contain the following:

- 3D Manipulators settings
- Cursor settings
- Grid settings
- Schematic View setting
- Selection Options settings
- Viewer Toolbar settings
- HUD settings

To access the Viewer preferences:

1. From the MotionBuilder menu bar, select Settings > Preferences.
2. In the Preferences window, click the Viewer preference option.

The Viewer preference settings display.



Viewer preferences

The 3D Manipulators preference settings let you activate, disable, and change the appearance of the 3D Manipulators shown when objects are selected in the Viewer window. The following table describes the 3D Manipulator preference settings.

3D Manipulators settings	Purpose
Manipulator Size	Enter a value in this field to make the 3D manipulator handles/arrow appear larger or smaller in the Viewer window.

3D Manipulators settings	Purpose
Hide	The Hide option lets you disable the display of the 3D manipulators. The default option is disabled so that the 3D manipulators are shown.
Rotation Snap Angle	The Rotation Snap Angle Field lets you specify an increment for the Snap Angle button to use when activated. To set a rotation increment, double-click the Rotation Snap Angle field and enter a value. See Setting a rotation increment on page 172. For information on using the Angle Snap button, see Snap Rotation on page 70.
Additive Rotation Snap Mode	Select Absolute from the menu to snap the rotation angle snap at exact increments, so, if you had set 10 in the Rotation Snap Angle field, the rotation would proceed incrementally 20, 30, 40, 50 degrees and so on. Select Relative to have the increments start relative to the position of the object. So, for example, if your object was at 12 degrees to begin with, and you specified a 10 degree angle, the rotation would be 22, 32, 42, 52, and so on.

The Cursor preference setting enables you to set the default options for cursor actions in the MotionBuilder interface. The Show Cursor In Full Screen setting enables you to have the mouse pointer appear in full screen mode when activated and hide disabled.

The Grid preference settings lets you customize the grid displayed in the Viewer window. With the Grid options, you can set the color of grid lines, reposition the grid center, and alter the grid's size and spacing. The following table describes the Grid preference settings.

Grid settings	Purpose
Color	The Color values let you set the color of the grid lines. The main grid lines display a shade lighter to act as a guide.
Offset	The Offset values let you move the grid center from its default position. Only two components of this offset are used for each grid, for example, you can offset an "XZ" grid along the X and the Z axes, but not along the Y axis.

Grid settings	Purpose
Size	The Size values let you set the size of the grids. For example, an XZ grid uses the X and Z coordinates of "Size" as its width and height.
Spacing	The Spacing value lets you set the distance between the grid lines. There is only one value necessary as the spacing is consistent for all dimensions.
Restore Defaults	Click the Restore Defaults button to return to the original grid options.

The Schematic View preference setting contains the Auto Arrange On by Default option, which enables nodes to be automatically arranged in the Viewer (in the Schematic View). The setting is disabled by default.

The Selection Options preference settings let you configure the method used to deselect objects in the Viewer window. The following table describes the Selection Options preference settings.

Selection Options settings	Purpose
Double Click in Empty Area to Deselect	Activate the Double Click in Empty Area to Deselect option if you want to deselect all selected objects by double-clicking in an empty area of the Viewer window.
Drag in Empty Area to Deselect	Activate the Drag in Empty Area to Deselect option if you want to deselect all selected objects by dragging in an empty area of the Viewer window.

The Viewer Toolbar preference settings let you modify the toolbar position and set Transform reference modes. The following table describes the Viewer Toolbar preference settings.

Viewer Toolbar settings	Purpose
Store Reference Mode By Transform Mode	Activate the Store Reference Mode By Transform Mode option if you want to set a Reference Mode (Local/Global/Additive) specific to each Transformation type. For example, you can set your Translations to be in Local mode, where your Rotations are set to Global. This way,

Viewer Toolbar settings	Purpose
	when you switch back to Translating an object, the mode returns to Local automatically.
Toolbar Location	Select either Left or Right from the Toolbar Location menu to choose which side of the Viewer window the Viewer toolbar appears.

The HUD (head-up display) preference settings let you change the color of commonly used visual feedback in the MotionBuilder user interface. The following table describes the HUD preference settings.

HUD settings	Description
Font Color	Lets you change the color of the software operational statistics in the top-left corner of the Viewer window. See Display Rate on page 57.
Selection Color	Lets you change the color of the selected item visual feedback.

See also:

- Keyboard Shortcuts on page 1929

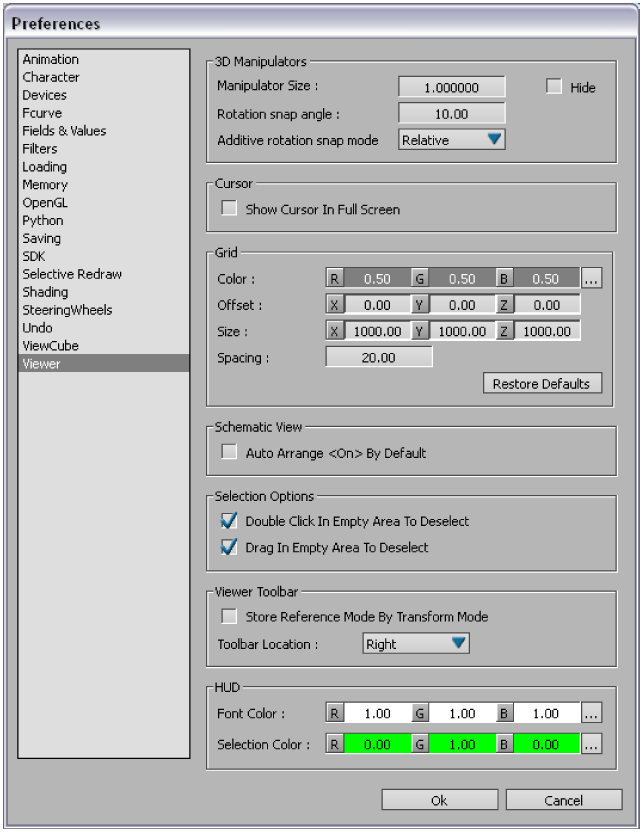
Setting a rotation increment

You can set rotation snap angle increments to show in the Viewer.

To set a rotation increment:

1. Select Settings > Preferences from the MotionBuilder menu bar.
2. From the Preferences window, select Viewer.

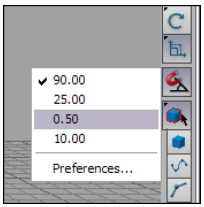
   The Viewer default preference settings appear.



Viewer preferences

3 In the 3D Manipulator settings, double-click the Rotation Snap Angle field and enter a value.

4 If you have set a Snap Angle previously, right-click the Snap Rotation button in the Viewer window to see a list of the last five angles set.

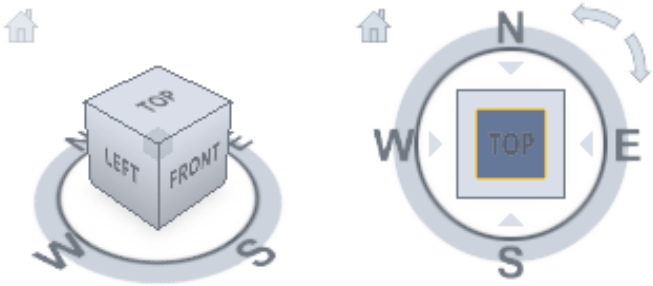


5 Click one of the angles listed, or click Preferences to open the Preferences window, where you can set an angle.

Part 2: Viewing Assets and Navigating in 3D Space

The ViewCube lets you change the orientation and view objects in the Viewer window. It tools let you adjust the detail of objects and create views that define an area of a model as well as use preset views to restore a known view or orientation.

The ViewCube is a 3D navigation tool that appears in the top-right corner of the Viewer window. While the ViewCube is inactive, it displays the current view of the model based on the current UCS and the North direction defined by the WCS of the model.



ViewCube

Position your mouse over the ViewCube to activate it. When the ViewCube is active, you can switch to one of the preset views, roll the current view, or change to the Home view of the model. While the ViewCube is inactive, it gives you visual feedback about the current view of objects in the Viewer window as view changes occur.

See ViewCube on page 187.

SteeringWheels are tracking menus that let you access different 3D navigation tools from a single tool.

SteeringWheels save you time by combining many common navigation tools into a single interface. They are contextual to the scene that you are viewing.

SteeringWheels

NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default.

SteeringWheels are divided into different sections known as wedges. Each wedge on a wheel represents a single navigation tool that lets you pan, zoom, or manipulate the current view of a model in different ways.

See SteeringWheels on page 177.

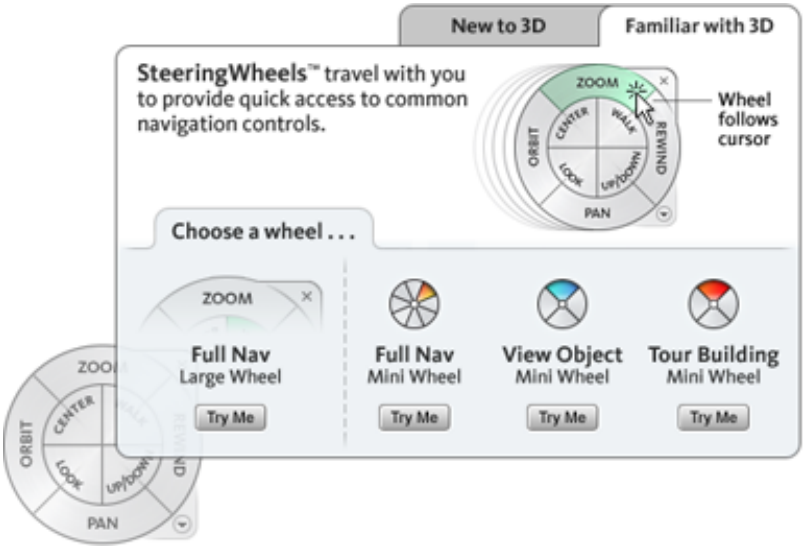
SteeringWheels

8

SteeringWheels are tracking menus that allow you to access different 3D navigation tools from a single tool.

NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default. To activate the SteeringWheels, see SteeringWheels preferences on page 161.

SteeringWheels First Contact balloon



The first time you open MotionBuilder after installation, the First Contact balloon on page 1998 appears. The First Contact balloon introduces you to the wheels and explains how you can use them.

Using the SteeringWheels

You can display a wheel by pressing *Ctrl-Shift-N* on the keyboard or activate the Show SteeringWheels option from the SteeringWheels preferences on page 161.

NOTE You must activate the SteeringWheels to make them appear in the Viewer window. The SteeringWheels do not display in the Viewer window by default.

Once you set the SteeringWheels to display, use the available navigation tools by either clicking over one of the wedges on the wheel or clicking and holding down the mouse button. Once the button is held down, drag over the Viewer window to reorient the current view. Releasing the button returns you to the SteeringWheel.

NOTE Pressing and dragging on the wheel sectors is the main way to use the SteeringWheel.

Showing/hiding the SteeringWheels

To show or hide the SteeringWheels in the Viewer window:

1. Right-click the SteeringWheels and select Properties from the contextual menu that appears.
2. Deactivate the Show the SteeringWheels option.
3. Click OK.

For more on SteeringWheels preferences see SteeringWheels preferences on page 161

Controlling the appearance of the SteeringWheels

You can control the appearance of the wheels by changing the current mode, or by adjusting the size and opacity.

The SteeringWheels are available in two different modes: big and mini. To change the current mode of a SteeringWheel, right-click the wheel and select a different mode.

You can also adjust the opacity and size for the wheels. The size of a wheel controls how large or small the wedges and labels appear on the wheel; the opacity level controls the visibility of the objects in the model behind the wheel. Change the settings in the SteeringWheels preferences on page 161.

Control Tooltips and messages for SteeringWheels

Tooltips are displayed for each wedge and button on a wheel as the you hover the cursor over them. Tooltips appear below the wheel and identify what action the wedge or button performs if you click it.

NOTE You can activate or disable Tooltips in the SteeringWheels preferences on page 161.

Similar to tooltips, tool messages are displayed when you use one of the navigation tools from a wheel. Tool messages are displayed over the Viewer window to provide instruction for using the active navigation tool. Like tooltips, you can turn tool messages on or off in the SteeringWheels preferences on page 161.

Disabling tool messages only affects the messages that are displayed when using the Full Navigation wheel.

SteeringWheels contextual menu

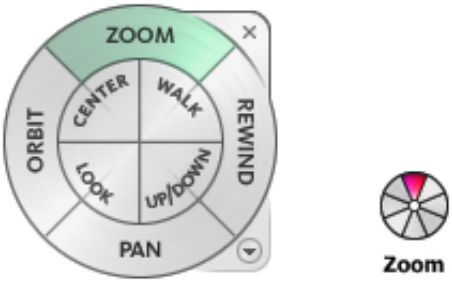
Right-click the SteeringWheel to open the SteeringWheels contextual menu.

Option	Function
Mini view object	Displays the mini version of the View Object wheel. See View Object wheels on page 182 for more information.
Mini tour building	Displays the mini version of the Tour Building wheel. See Tour Building wheels on page 184 for more.
Mini navigator	Displays the mini version of the Full Navigation wheel. See Navigation wheels on page 181 for more information.
Full view object	Displays the View Object wheel. See View Object wheels on page 182 for more information.
Full tour building	Displays the Tour Building wheel. See Tour Building wheels on page 184 for more information.

Option	Function
Full navigator	Displays the Full Navigator wheel. See Navigation wheels on page 181 for more information.
Increase walk speed	Increases the walk speed used for the Walk tool by two times.
Decrease walk speed	Decreases the walk speed used for the Walk tool by one half.
Close	Closes the SteeringWheels. (Press *Ctrl-Shift-N* to reopen it.)

Navigation wheels

The Full Navigation wheels combine the 3D navigation tools found on the View Object and Tour Building wheels.



The Full and Mini Navigator SteeringWheels

The Full Navigation wheel is divided into the following wedges:

Wedge	Function
Zoom	Adjusts the magnification of the current view.
Rewind	Restores the most recent view. You can move backward or forward through previous views.
Pan	Repositions the current view by panning.
Orbit	Rotates the current view around a fixed pivot point.

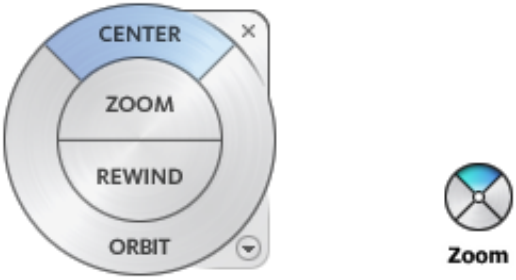
Wedge	Function
Center	Specifies a point on a model to adjust the center of the current view or change the target point used for some of the navigation tools.
Walk	Simulates walking through a model.
Look	Swivels the current view.
Up/Down	Slides the current view of a model along the Y axis of the screen

The Mini Navigation wheel is divided into the following wedges:

Wedge	Function
Zoom (Top wedge)	Adjusts the magnification of the current view.
Walk (Upper right wedge)	Simulates walking through a model.
Rewind (Right wedge)	Restores the most recent view. You can move backward or forward through previous views.
Up/Down (Lower right wedge)	Slides the current view of a model along the Y axis of the screen.
Pan (Bottom wedge)	Repositions the current view by panning.
Look (Lower left wedge)	Swivels the current view.
Orbit (Left wedge)	Rotates the current view around a fixed pivot point.
Center (Upper left wedge)	Specifies a point on a model to adjust the center of the current view or change the target point used for some of the navigation tools.

View Object wheels

The View Object wheel is for 3D navigation; it includes the orbit 3D navigation tool. Use the View Object wheel to examine 3D objects from the outside.



The Full and Mini View Object SteeringWheels

Center

Specifies a point on a model to adjust the center of the current view or change the target point used for some of the navigation tools.

Zoom

Adjusts the magnification of the current view.

Rewind

Restores the most recent view orientation. You can move backward or forward through previous views.

Orbit

Rotates the current view around a fixed pivot point.

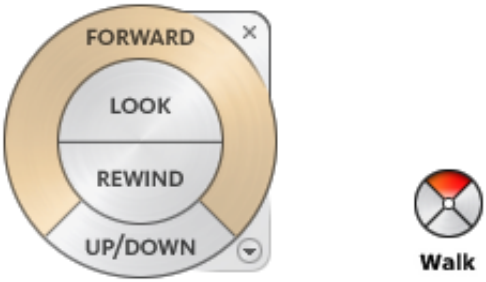
The mini View Object wheel is divided into the following wedges.

Wedge	Function
Zoom (Top wedge)	Adjusts the magnification of the current view.
Rewind (Right wedge)	Restores the most recent view. You can move backward or forward through previous views.
Pan (Bottom wedge)	Repositions the current view by panning.
Orbit (Left wedge)	Rotates the current view around a fixed pivot point.

To switch back to the Full View Objects wheel, right-click the wheel and click Full View Object Wheel.

Tour Building wheels

The Tour Building wheels are designed for 3D navigation of scenes where the viewer moves through the scene, such as a building.



The Full and Mini Tour Building SteeringWheels

The Full Tour Building wheel is divided into the following wedges.

Wedge	Function
Forward	Adjusts the distance between the current point of view and the defined pivot point of the model. Clicking once moves forward as far as the object you clicked.
Look	Swivels the current view.
Rewind	Restores the most recent view. You can move backward or forward through previous views.
Up/Down	Slides the current view of a model along the Y axis of the screen.

The Mini Tour Building wheel is divided into the following wedges.

Wedge	Function
Walk (Top wedge)	Simulates walking through a scene.
Rewind (Right wedge)	Restores the most recent view. You can move backward or forward through previous views.
Up/Down (Bottom wedge)	Slides the current view of a model along the Y axis of the screen.

Wedge	Function
Look (Left wedge)	Swivels the current view.

ViewCube

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The ViewCube is a 3D navigation tool that appears in the top-right corner of the Viewer window. While the ViewCube is inactive, it displays the current view of the scene based on the current North direction defined by the scene.

Controlling the appearance of the ViewCube

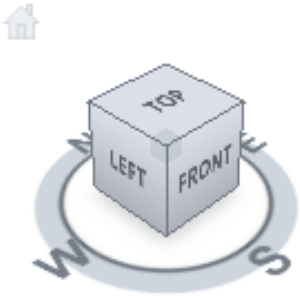
The ViewCube is displayed in one of two states: inactive and active.

When the ViewCube is inactive, it is transparent over the Viewer window When the ViewCube is active, it is opaque and hides some objects in the Viewer window.

In addition to controlling the inactive opacity level of the ViewCube, you can also control its size, on-screen position, and the default ViewCube orientation. The settings used to control the appearance of the ViewCube are located in the Preferences window. You can also access the ViewCube Preferences if you right-click the ViewCube and select Properties from the contextual menu. See ViewCube preferences on page 165.

Using the Compass

The ViewCube compass shows which direction North is defined for the scene. The North indicated by the compass is based on the North settings in the ViewCube properties.

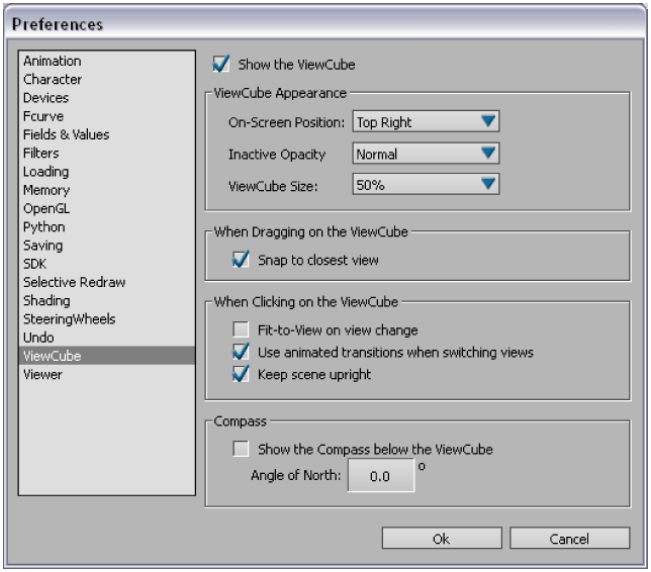


You can specify the Compass North Angle settings in the Preferences window. See ViewCube preferences on page 165.

To display the ViewCube compass:

1 Right click the ViewCube and select Properties.

The ViewCube preferences display.



ViewCube preferences

2 Activate “Show compass below the ViewCube” in the Compass area.

For more information on the ViewCube preference settings, see ViewCube preferences on page 165.

Changing the view of a scene with the ViewCube

The ViewCube provides twenty-six defined areas you can click to change the current view of a model. These areas are categorized into three groups: corner, edge, and face. Six of the twenty-six defined areas represent standard orthogonal views of a model: top, bottom, front, back, left, and right. Orthogonal views are set by clicking one of the faces on the ViewCube.

You use the other twenty defined areas to access angled views of a model. Clicking one of the corners on the ViewCube reorients the current view of the scene to a three-quarter view.

Rolling a face view

When you view a model from one of the face views, two additional icons are displayed near the ViewCube. These are the roll arrows. You can use the roll arrows to roll or rotate the current view 90 degrees in the positive or negative directions around the center of the view.

ViewCube contextual menu

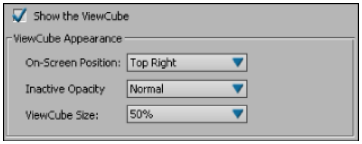
Right-click the ViewCube to display the ViewCube contextual menu, which gives you access to ViewCube settings.

Option	Function
Home	The default Home position is the existing orientation of the default view (southeast corner of the scene. You can also define a view of the model as the Home view so you can easily return to the familiar view by clicking the Home icon or by clicking Set Current View as Home in the contextual menu.
Set Current View as Home	Defines the Home view of the model based on the current Viewer window position.
Properties	Opens the Preferences window where you can configure the ViewCube default settings in theViewCube preferences on page 165.
Help	Provides information on the ViewCube.

Showing/hiding the ViewCube

To show or hide the ViewCube in the Viewer window:

1. Right-click the ViewCube and select Properties from the contextual menu that appears.
2. Deactivate the Show the ViewCube option.



ViewCube preferences

3. Click OK.

Part 3: Managing Files

An *.fbx* file is a collection of assets, animation, and MotionBuilder settings. Assets may include a model created in another 3D software package and exported using an FBX plug-in, animation data saved using MotionBuilder, or any other assets created and saved using MotionBuilder including lights, cameras, control rigs, and so on.

This chapter describes the more common file operations within MotionBuilder that deal with adding, loading, merging, and saving assets from *.fbx* files, as well as loading and merging keying group data. The chapter also also discusses importing and exporting full scenes and importing and exporting animation or motion capture using other data file formats. Preferences specific to saving or backing-up *.fbx* files are also discussed, as well as topics on batch processing, audio, and version control.

To find out what is supported when exporting from MotionBuilder and then imported into Autodesk 3ds Max or Autodesk Maya, see the MotionBuilder FBX Map FBX Interoperability Chart at: *http://www.autodesk.com/fbx*, on the FBX Documentation page.

NOTE The default system units in MotionBuilder are centimeters.

The following are topics included in this chapter.

- Opening and loading on page 195
- Merging on page 233
- Saving on page 249
- Importing on page 267
- Exporting on page 281
- Converting on page 295
- Batch processing on page 297
- Rendering on page 307
- Audio on page 329
- Video settings on page 347

- Version control on page 353

Opening and loading

10

NOTE For an overview of the changes to the file I/O, see File I/O Support.

MotionBuilder provides the following methods of adding and loading scenes and assets:

- Select File > Open, File > FBX Plug-in Import, or File > Import from the MotionBuilder menu bar to select a file using the file browser
- Select a previously saved file from the list of recently opened files in the File menu.
- Drag an asset or *.fbx* file from the Asset browser into the Viewer window or Scene browser.
- Merge a file with a scene using the Merge functions. See Merging on page 233.

Opening an .fbx file

This topic describes how to open (or load) *.fbx* files created or modified in MotionBuilder and other software.

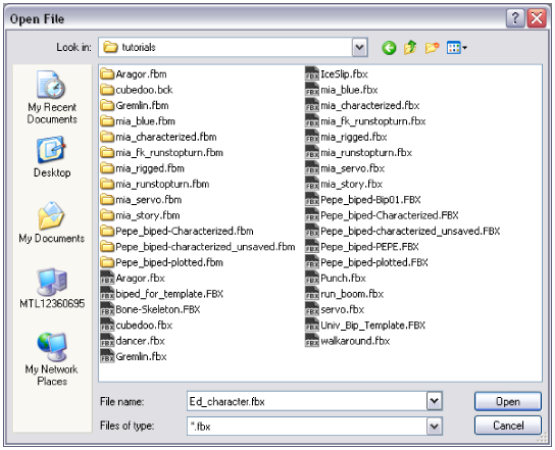
There are three ways to open files:

Method	Description
File > Open	Use this method to opening **.fbx* files saved in MotionBuilder.
File > FBX Plug-in Import	Use this method to open **.3ds*, **.dae*, **.obj* files, and **.fbx* files saved with the FBX Plug-in inside another software application, for example, 3ds Max or Maya. See Installing the latest FBX Plug-ins.

Method	Description
File > Import	Use this method to import motion files, such as **.bvh*, **.htr*, **.trc*, **.amc*, and **.c3d* files. You can also import **.fbx* files to bring in animation.

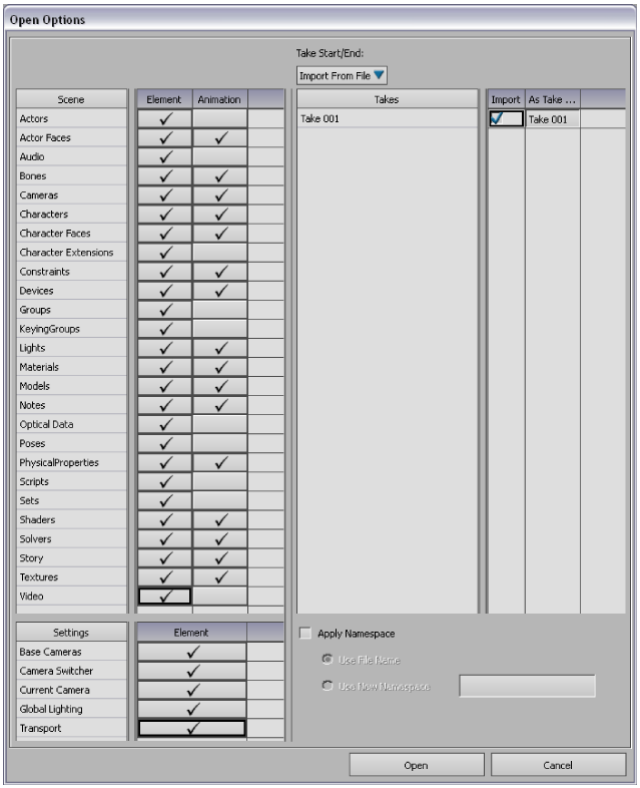
To open an *.fbx* file in MotionBuilder:

1 Select File > Open from the MotionBuilder menu bar.
The Open File dialog box appears.



Open File dialog box

2 Using the Open File browser, select a file and click Open.
The Open Options dialog box appears.



Open Options dialog box

3 Disable any elements of the file you do not want to load with the file.

4 Activate Apply Namespace if you want to prepend a namespace to objects included in the incoming file.

5 Click Open.

The file loads in MotionBuilder.

See Open Options dialog box on page 225.

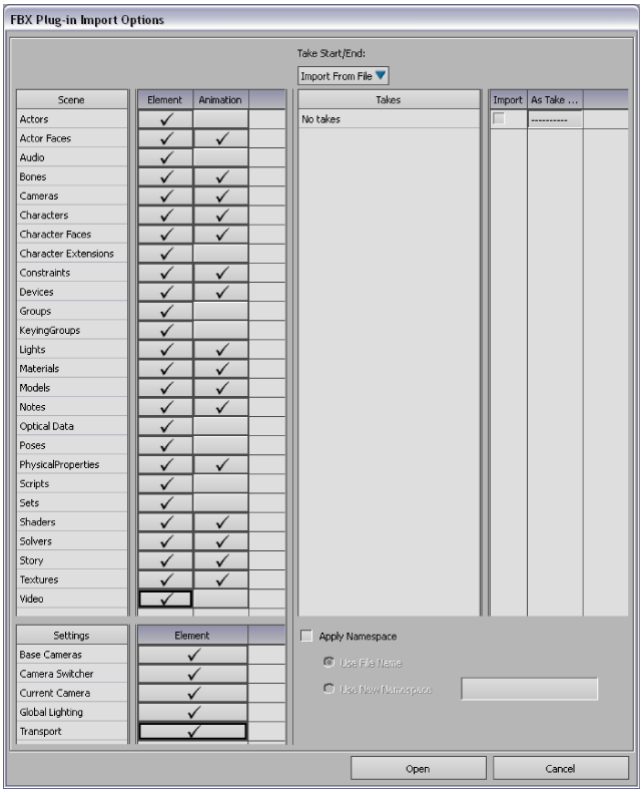
To open a file into a scene, see Merging on page 233.

Opening a file from another 3D package

You can open *.FBX*, *.3ds*, *.dae*, and *.obj* files with the FBX Plug-in Import method. For all other formats, save your file in the originating software (such as Maya) as an FBX file using the FBX Plug-in. See Installing the latest FBX Plug-ins.

To open a file from another 3D package:

1. Select File > FBX Plug-in Import from the MotionBuilder menu bar.
   The Open File dialog box appears.
2. Using the Open File browser, select a file and click Open.
3. Select a file and click Open.
   The FBX Plug-in Import Options dialog box appears.



FBX Plug-in Import Options dialog box

4 Disable any elements of the file you do not want to load with the file.

5 Activate Apply Namespace if you want to prepend a namespace to objects included in the incoming file.

6 Click Open.

The file loads in MotionBuilder.

See FBX Plug-in Import Options dialog box on page 274.

To open a file into a scene, see Merging on page 233.

Opening a motion (MoCap) file

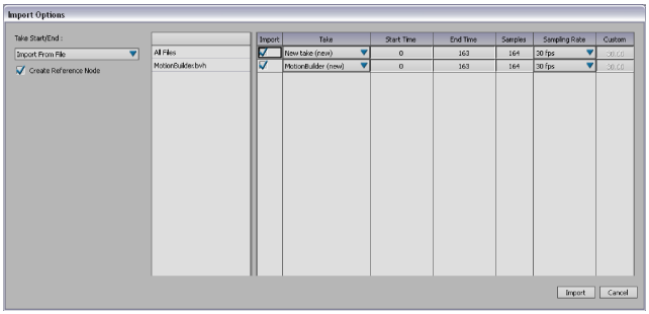
You can open *.fbx*, *.bvh*, *.htr*, *.trc*, and *.c3d* files with the FBX Import method.

To open a motion file:

1 Select File > FBX Import from the MotionBuilder menu bar.

2 Navigate via the Import Files dialog, and select a file.

3 Click Open.
The Import Options dialog box appears.



Import Options dialog box

4 Disable any elements of the file you do not want to load with the file.

5 Click Import.
The file loads in MotionBuilder.

Adding assets to a scene

You can load any asset in your scene by dragging it from the Asset browser or Scene browser into the Viewer window.

To add an asset to the scene, do either of the following:

- Drag an asset into the Viewer window
- Drag an *.fbx* file into the Viewer window

NOTE The Note and Skeleton Root asset both require a few more steps than is usual for you to add them correctly. Refer to the section on each asset for instructions.

When you drag an asset into the Viewer window, depending on the selected asset, the asset's settings appear in the Navigator window, letting you set the asset's properties. For example, if you drag a light asset from the Asset browser into the Viewer window, a light is added to the scene and its settings display in the Navigator window. The light is placed where you release the mouse button in the Viewer window. See Dragging and dropping assets and files on page 224.

You can drag *.fbx* files into the Viewer window to add their assets to your scene if you create a path to their directories in Asset browser. See Adding a favorite path on page 88.

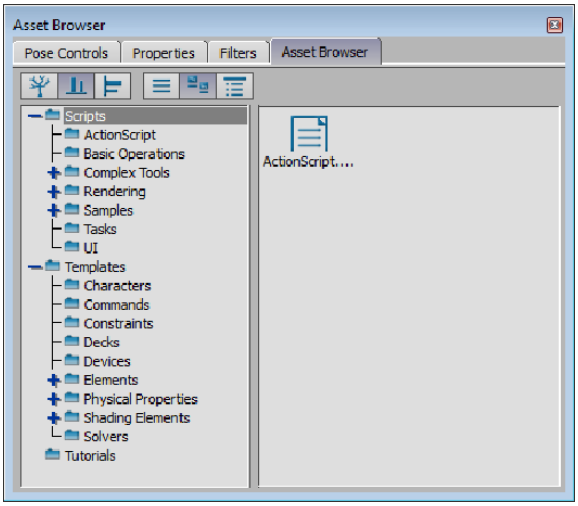
When you drag *.fbx* files into the Viewer window, a contextual menu displays letting you choose whether to Open or Merge the *.fbx* file. See Dragging and dropping assets and files on page 224.

See also:

- Types of assets on page 379
- Merging files dragged into the Viewer window on page 236

Adding Script assets

You can drag scripts to the Viewer window to either execute a task, add to the scene, or both —add to the scene and execute a task. Scripts can speed up processes that can be quite time consuming when executed manually.



Asset browser: Script assets

Executing a script

MotionBuilder provides various methods for executing scripts. You can choose any of the following methods to execute a script:

- Drag and drop a script from the Asset browser
- Execute a script via the Python Editor
- Place a Python tool in the *PythonStartup* folder
- Run a script using a keyboard shortcut
- Use the Function FBApplication::ExecuteScript
- Launch a script from the Command Line startup

To launch a script from the Command Line startup:

- Enter `motionbuilder.exe [flags] [Python script or filename]`. This represents a generic syntax. The flags are optional.

If you start MotionBuilder from the command line *motionbuilder.exe*, there are various startup options you can specify. Running MotionBuilder by command

line can be a very effective way to assist you in optimizing your pipeline and helping you automate certain tasks.

See also:

- Python Editor on page 101

MotionBuilder Startup Flags

The following table lists the MotionBuilder startup flags.

NOTE A command line cannot consist of a user specifying a Python script and a filename for startup because for efficiency your Python script can open the file you want on startup using FBApplication if you need both.

Command line argument	Description
`-console`	Opens an output window used by FBTrace in the OR SDK, where the appropriate stdout/err stream goes. If you choose to use this console output window for Python output, you also need to specify the `-verbosePython`flag.
`-g [width] [height]`	Sets the window size of MotionBuilder to the values you specified. The default value is as large as the screen size.
`-S`	Starts MotionBuilder in Full Screen Mode. This is the same as choosing Display > Full Screen inside the Viewer. To exit out of Full Screen Mode, press *Alt-Enter*.
`-setAsFrontMostApp`	Sets MotionBuilder to the foreground and makes it the active application.
`-suspendMessages`	Disables all the warnings and dialogs. This flag is useful for automation purposes when you do not want the script to be interrupted by dialogs. By default, all warnings and dialogs are shown.
`-T[UI Name]`	Finds a tool with the matching name among the tools that MotionBuilder has registered, and if it is found, it activates it. This flag parameter is case sensitive. Note that unlike the other flags, there is no space between the flag name and the UI Name parameters.

Command line argument	Description
`-verbosePython`	Outputs all Python messages to the appropriate stdout/err stream.This puts the Python print messages to the window that you activate as well as to the Python Editor using the console flag. This is the same location that FBTrace outputs to when using the OR SDK. By default, we do not output python output to stdout/err, only to the Python Editor.

If you know every single time you run MotionBuilder you always want a flag to be executed, instead of using the command line which can be inefficient, you can edit your Windows shortcut for the MotionBuilder application to include the flag parameter you want so that when you double click the application icon the flag is executed. A good use of this is for the `-console` flag. Following are some examples.

Command line argument	Description
`motionbuilder.exe mia_blue.fbx`	Opens the file *mia_blue.fbx* on MotionBuilder startup.
`motionbuilder.exe -S mia_blue.fbx`	Starts MotionBuilder in Full Screen opening the scene *mia_blue.fbx*.
`motionbuilder.exe -suspendMessages testScript.py`	Launches the script *testScript.py* on startup and suppresses all messages boxes that the script might generate.
`motionbuilder.exe -console -verbosePython Script.py`	Launches the script *Script.py* and sends the output to the console output window.
`motionbuilder.exe -g 500 500 -S mia_blue.fbx`	Specifies the full screen mode to be 500 by 500 with the scene *mia_blue.fbx* open.
`motionbuilder.exe -TAudio`	Launches the tool Audio from the *toolaudio* folder in the *Samples\tools* directory on start up. (You need to compile it first.)

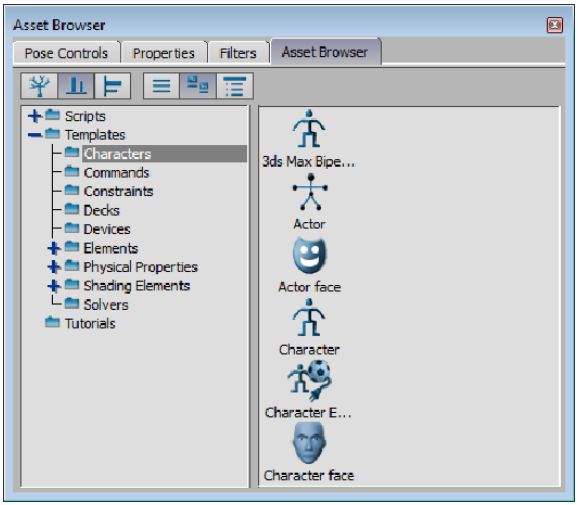
Command line argument	Description
`motionbuilder.exe -console "-TPython Editor" mia_blue.fbx`	Launches the tool Python Editor and console opening the scene *mia_blue.fbx*.

See also:

- *MotionBuilder Open Reality SDK Developer's Help -Startup flags*

Adding Character assets

The Character assets help you create a complete map of your character model's structure and link it to a motion source for animation.



Asset browser: Character assets

There are six types of assets in the Asset browser Character folder: 3ds Max Biped Template, Actor, Actor face, Character, Character Extension, and Character face.

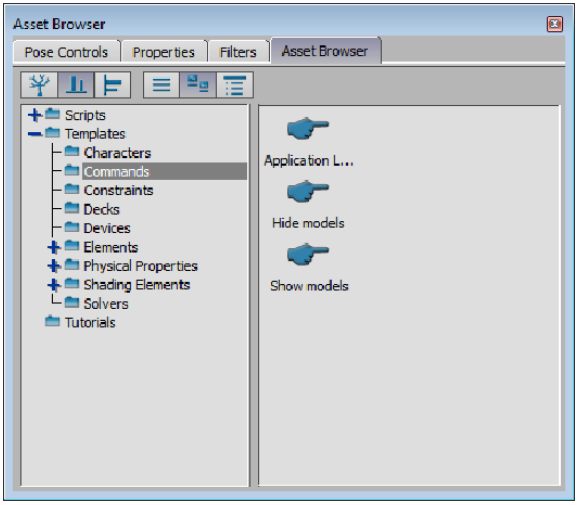
See also:

- Adding a Character asset on page 1271
- Creating an Actor on page 1354

- Attaching an Actor Face to a head model on page 1612
- Creating a Character Extension on page 1344
- Adding a Character Face on page 1640
- Characterizing a 3ds Max biped on page 1276

Adding Command assets

The Asset browser Commands folder contains assets you can use in the Story window to insert Command clips that let you build animation. There are three types of Command assets: Application Launch, Hide Models, and Show Models.

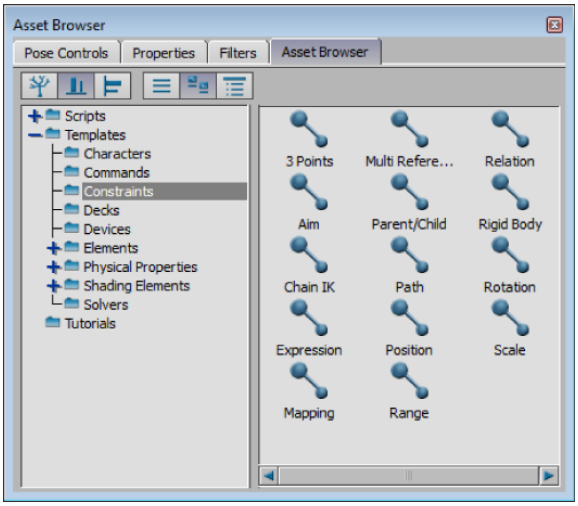


Asset browser: Command assets

See Creating command clips on page 1786 for information on how to add these three assets to your scene.

Adding Constraint assets

The Asset browser's Constraints folder contains constraints that you can use to create relationships between objects in your scene.

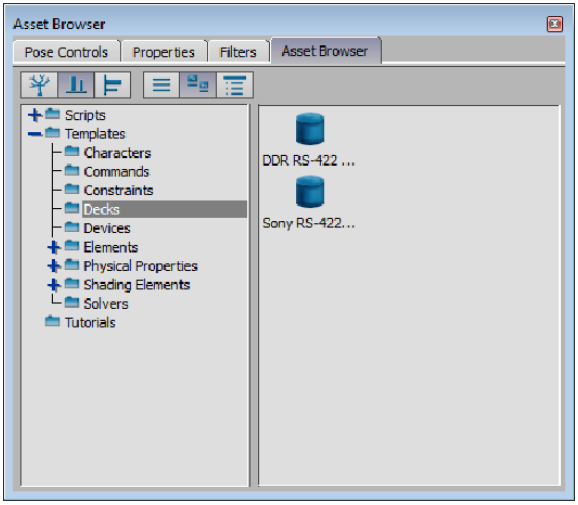


Asset browser: Constraint assets

See Adding a constraint asset on page 1028.

Adding Deck assets

Decks let you control, monitor, and synchronize the recording or playback of a VTR (Video Tape Recorders) from within MotionBuilder.



Asset browser: Deck assets

MotionBuilder supports two decks:

- DDR RS-422 Compatible
- Sony RS-422 Compatible

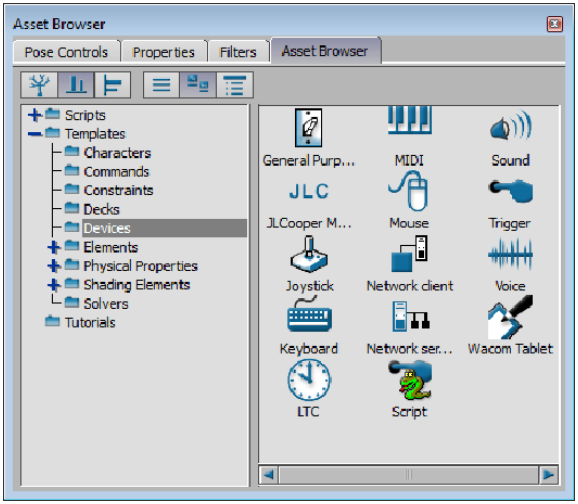
To add a deck:

1. Select either of the supported decks.
2. Drag a deck into the Viewer window from the Asset browser Decks folder. The Decks settings pane appear in the Navigator window.

Adding Device assets

A device is either a special software component or a separate piece of hardware that connects to your computer.

NOTE The Devices shown in the Asset Browser *Devices* folder are the devices supported by MotionBuilder.

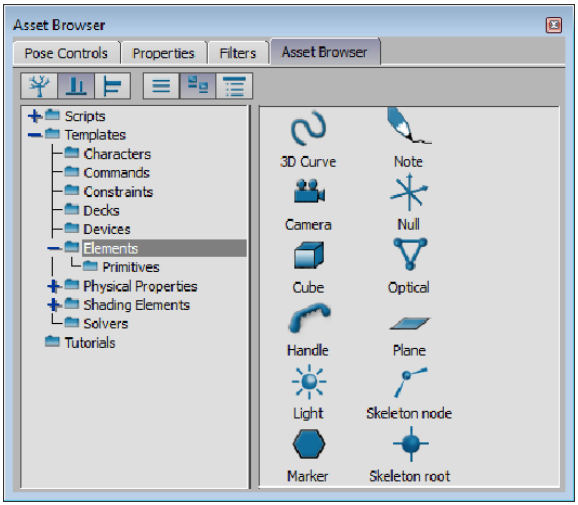


Asset browser: Device assets

For information on how to use a device in your scene, see Adding a device on page 1212.

Adding Element assets

There are 12 elements in the Elements folder. These elements can be added to a scene in a similar way as other assets.



Asset browser: Element assets

To add an Element asset to a scene:

1. Drag an Elements folder asset from the Asset browser's Elements folder into the Viewer window.
2. The asset appears in the Viewer window. The Navigator window updates to display settings for the asset.

To add multiple assets to your scene:

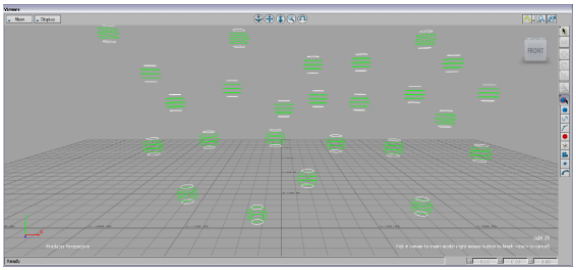
1. Double-click the asset in the Asset browser.

   The cursor becomes a cross hair.

   NOTE This procedure applies only to the 3D Curve, Camera, Cube, Light, Marker, Null, Optical, Plane, Skeleton node, and Skeleton root assets.

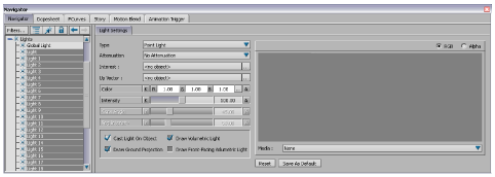
2. Click anywhere in the Viewer window to place assets at that point.

   The Viewer window updates displaying assets being added to the scene. In the following figure, multiple lights are added.



Viewer window displays multiple lights

The Navigator window updates to display settings for those assets.



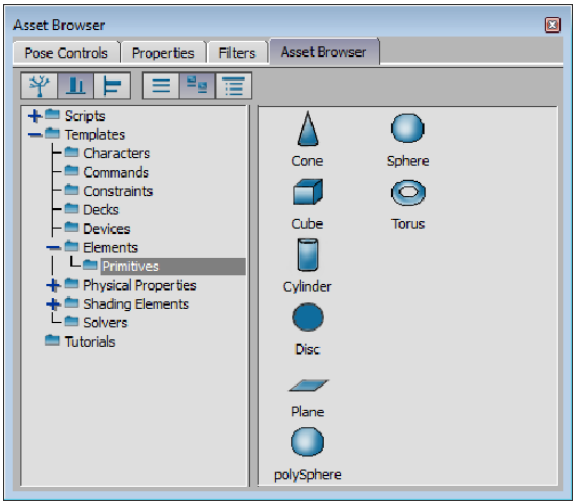
Navigator displays asset settings

3 If you are creating a 3D Curve, you must press Enter to accept the operation or press Escape to cancel it. For more information, see Creating a 3D curve on page 1119.

There is more specific information on adding Element assets in their respective sections.

Adding Primitive Element assets

The Primitives folder within the Elements folder contains basic shapes (or Primitives) you can use as basic models for testing. You can animate, transform, and apply materials and effects to Primitives.

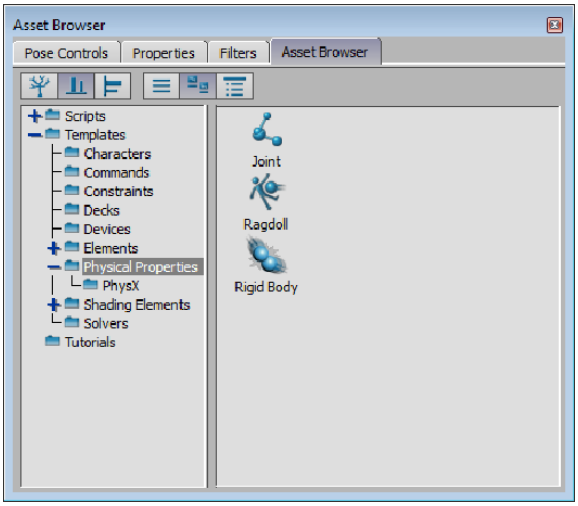


Asset browser: Primitive Element assets

NOTE Use the polySphere element in the Asset browser when you require a sphere model for Physics solves (such as Rigid body, Joint, or Ragdoll). The Elements Sphere element has geometry that may produce unpredictable results.

Adding Physical Property assets

The Rigid Body Physical property enables you to create real-time collisions you can use to prevent interpenetration of characters, objects, and other scene elements. The Ragdoll Physical property enables you to simulate and record collisions and collapses on characters with Control rigs. The Joint Physical Property enables you to create physical links between two objects that are solved by the Physics Solver. These physical links then let you reproduce behaviors such as hinges, a ball and socket joint, and so on.



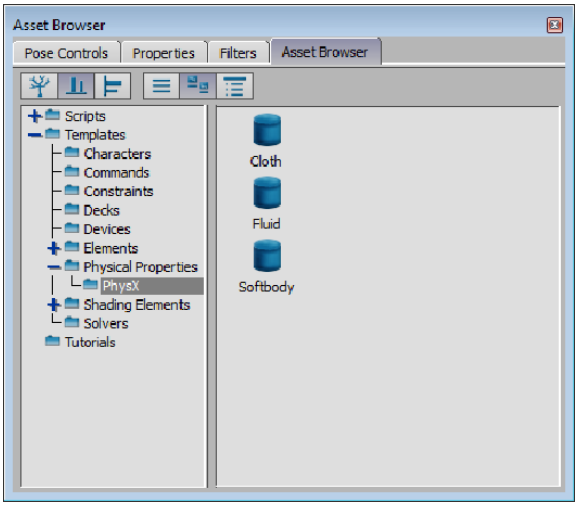
Asset browser: Physical Properties assets

See also:

- Rigid Body Physical property on page 1721
- Ragdoll Physical property on page 1696
- Joint Physical property on page 1679

Adding PhysX Physical Property assets

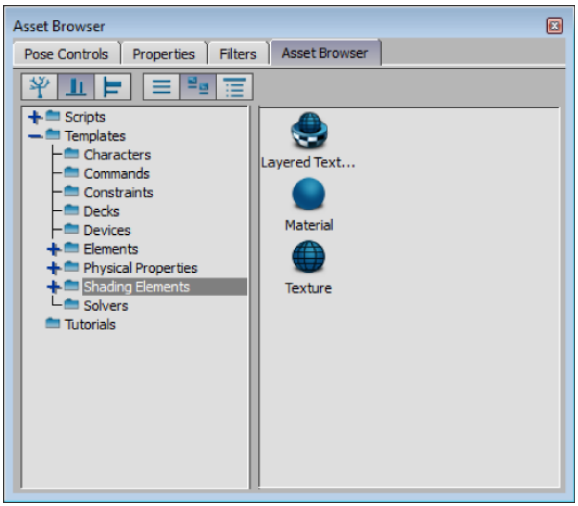
The PhysX assets include the Cloth, the Fluid and the SoftBody assets. When you have PhysX-compatible graphics card, you can uses these assets to simulate the movement of cloth, fluid, and soft bodies. However, you cannot use these three assets to generate visual keyframes.



Asset browser: PhysX assets

Adding Shading Element assets

The Shading Elements assets include assets for materials, textures, layered textures, and shaders.



Asset browser: Shading Element assets

Adding Material assets

You can assign materials to the surface or faces of an object to simulate different substances, such as wood, metal, cloth, or skin. Used alone, materials affect the color and glossiness of objects. Used with textures and shaders, materials let you simulate surface detail, transparency, reflectivity, and displacement. See Applying a material to a model on page 537, and Applying a material to a region on page 537.

Adding Texture assets

Textures let you add surface detail using an image or video. The Texture asset in the Shading Elements folder is meant to be attached to a material or Layered texture. See Adding a texture to the scene on page 559 and Adding a texture to a material on page 561.

For other types of textures, see Adding Global Lighting Texture assets on page 214 and Choosing texture types on page 557.

Adding Layered Texture assets

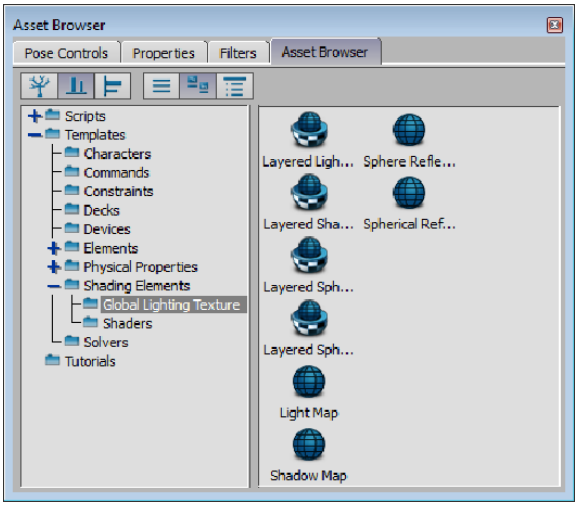
A Layered Texture asset lets you blend multiple images and videos, then add them to a material as if they were a single media. The Layered Texture asset in the Shading Elements folder is meant to be attached to a material. See Blending multiple textures on page 563.

For other types of Layered textures, see Adding Global Lighting Texture assets on page 214 and Choosing texture types on page 557.

- Materials on page 531
- Textures on page 549
- Shaders on page 585

Adding Global Lighting Texture assets

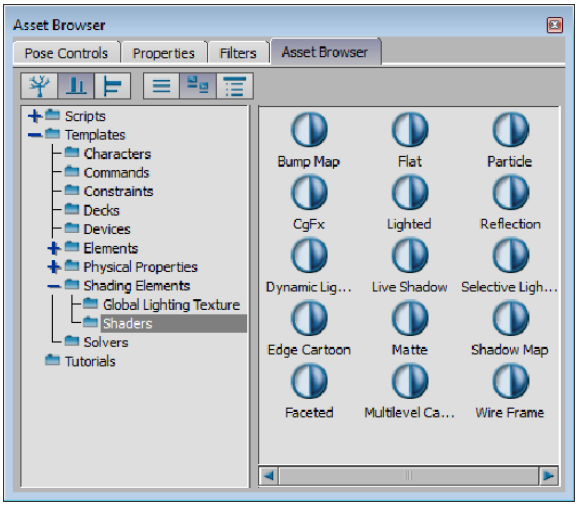
Apply Global Lighting textures directly to the model and use them with shaders. You have the option of creating layered or standard single-layered Global Lighting textures. See Choosing texture types on page 557.



Asset browser: Global Lighting Texture

Adding Shader assets

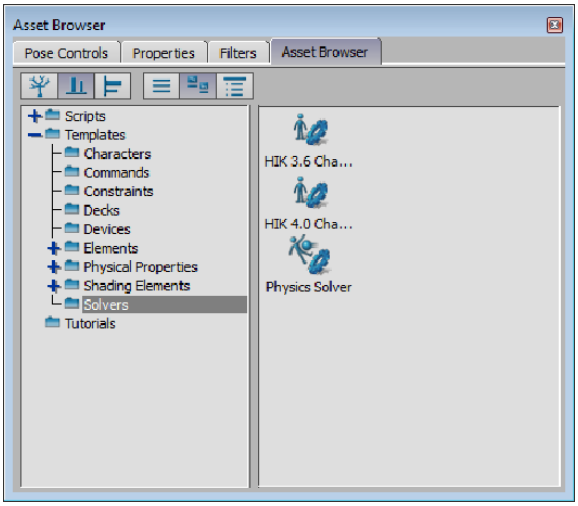
Shaders control the way the surface interacts with the lighting in the scene, creating color, specularity, reflection, transparency, shadowing, and refraction effects. You can use them with materials and textures to create various surface effects. See Applying a shader to a model on page 594.



Asset browser: Shader assets

Adding Solver assets

You can add solvers to perform Character solving. HumanIK solvers provide full-body inverse kinematics (IK) and retargeting. On the other hand, the Physics solver world is a reflection of dynamic elements from a scene, that is any object with a property attached to it.



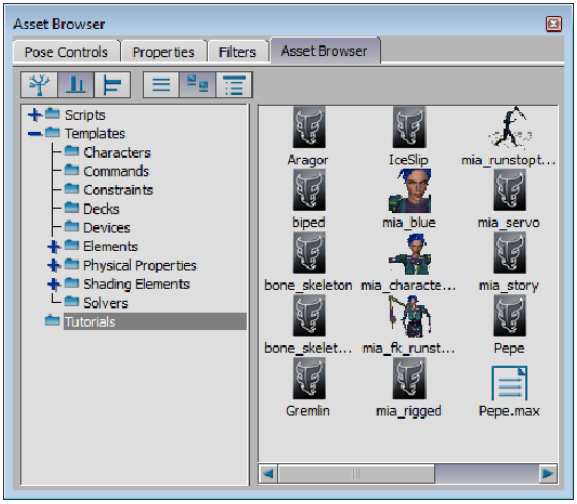
Asset browser: Solver assets

See also:

- HumanIK (HIK) character solving on page 1541
- Physics solver on page 1536

Adding tutorial assets

The *tutorials* asset folder contains various assets required to do the MotionBuilder tutorials. Some of these assets were created using the 3ds Max software or the Maya software. See Opening a file from another 3D package on page 198.



Asset browser: tutorial assets

To add an *.fbx* asset to the scene:

1 In the Asset browser, click-drag an asset in the Viewer window.

2 From the contextual menu that appears, select FBX Merge or FBX Open and select an option.

NOTE The contextual menus differ depending whether the asset is a native *.fbx* file (created using MotionBuilder) or an *.fbx* file originating from another 3D software such as 3ds Max or Maya.

See also:

- Opening an .fbx file on page 195
- Opening a motion (MoCap) file on page 200
- Importing on page 267
- Merging on page 233

Loading motion data

There are two ways to add motion data to your scene, using the menu bar and dragging a motion file from the Asset browser.

To load motion data via the menu bar:

1. Select File > Open from the MotionBuilder menu bar.
2. Browse for your motion file using the Open File dialog box. When you have located a file, select it and click Open.
3. The Open Options window appears. Choose which aspects of the motion file you want to import and click Open.

   The motion file loads in your scene.

   To connect Motion data to an Actor or character, see Loading poses on page 220.

To load motion data via the Asset browser:

1. Drag a motion file from the Asset browser's Elements folder into the Viewer window.
2. A contextual menu appears where you have dragged the file, asking you if you want to open or merge the file, if there is already something in the scene.
3. Select the take you want to use in the scene.

Loading custom local keying group data

Instead of defining a local keying group for each character in your scene, you can define a single custom local keying group and apply it to all the characters in your scene, using the namespace merge feature.

To apply custom local keying group data to many characters in a scene:

1. Create a scene with a single character:
   - create a custom local keying group for selected effector(s)
   - remove the character namespace value from the effector(s) to make them generic
2. Save the scene with a name that reflects the keying group you've created.

NOTE When you merge a scene with keying group data from another scene, the keying group will rely on the specific object names (and namespaces) in the scene to identify what it will connect with.

3. Create your other scenes, with a single character in each, making sure that the characters' effectors are named the same way as in the keying group you saved in the previous step
4. Load the scene into which you want to merge your characters
5. Merge each of your characters, applying a namespace on each load with the name of the character.
6. Merge the keying group you saved in step 2 above with these conditions:
   - discard all elements and animation from the file except the keying group information
   - apply namespace on the merge using the name of a character in the scene
   - repeat this keying group merge for each character in the scene, applying a namespace with each character's name

Loading poses

To add a pose to a scene:

1. Select File > Open in the menu bar.
2. Navigate to select the *.fbx* file containing your poses from the Open File dialog box.

TIP You can also drag an *.fbx* file containing poses into the Pose Controls window from the Asset browser. When dragging, make sure you release the *.fbx* file over a folder or pose.

- Creating a pose on page 1486
- Saving a pose on page 257
- Pose Controls window on page 1492

For information about creating, updating, deleting, and copying poses, see Poses on page 1485.

Loading audio files

There are two ways to load audio files in MotionBuilder, using the menu bar and the Transport Controls:

Menu bar

To add a audio file to a scene using the menu bar:

- Select File > Import Audio from the menu bar and navigate to select an audio clip.

Transport Controls

To add a audio file to a scene using the Transport Controls:

1. Right-click the Action Timeline in the Transport Controls and select Audio > Open Audio Clip from the contextual menu.
2. Browse for a *.wav* or *.mp3* file.

   The Navigator window displays the Audio settings with either the Audio Settings pane.

   TIP If audio files are already in the Asset or Scene browsers, you can drag them into the Viewer window.

Loading video files

There are two ways to load video files in MotionBuilder, using the menu bar and the Scene browser.

NOTE MotionBuilder supports *.avi*, *.qt*, and *.mov* video formats.

To load video files, do one of the following:

- Select File > Import Video from the menu bar and navigate to select a video file.

- Right-click the Scene browser in the Navigator window and select Insert Video from the contextual menu, then browse for a video clip.

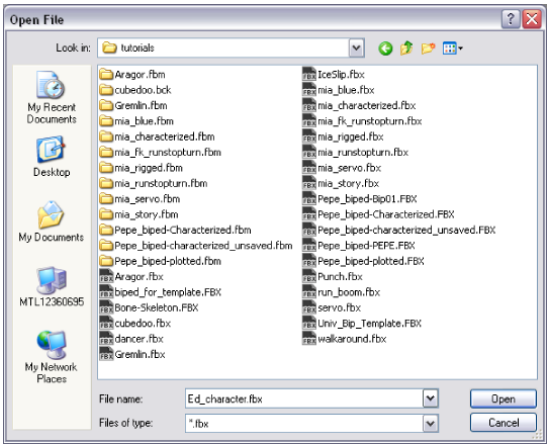
TIP If video files are already in the Asset or Scene browsers, you can drag them into the Viewer window.

Loading assets from .fbx files

You can load only certain elements from an *.fbx* file, instead of opening the whole file.

To load assets from an *.fbx* file:

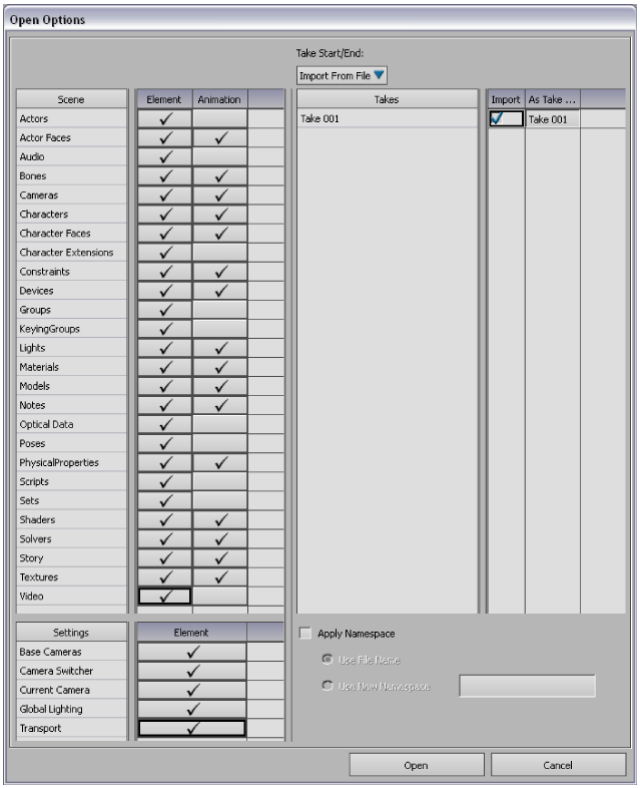
1 Select File > Open from the MotionBuilder menu bar. The Open File browser appears.



Open File browser

2 Using the File browser, select the file containing the assets you want to load and click Open.

The Open Options dialog appears.



Open Options dialog box

NOTE You can resize the Open Options dialog box.

The Open Options dialog box consists of the following areas:

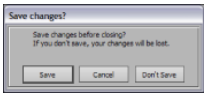
- Assets area on page 226
- Takes area on page 228
- Settings area on page 229
- Namespace area on page 229

3 Disable any elements of the file you do not want to load with the file.

4 Activate Apply Namespace if you want to prepend a namespace to objects included in the incoming file.

5 Click Open to open the selected *.fbx* file and load the selected assets, settings, and takes.

6 If there are objects, models, or other elements already in your scene, the Save Changes dialog box appears confirming that you want to replace your scene with the file you are loading.



Save Changes dialog box

See Open Options dialog box on page 225.

Dragging and dropping assets and files

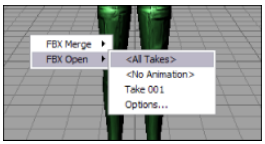
You can drag *.fbx* files and assets into the Viewer window to open them.

To drag and drop assets or files:

1 Drag an *.fbx* file into the Viewer window from the Asset browser.

The FBX Open contextual menu appears where you dropped the file.

2 Expand this menu to see the open options.



FBX Open options

If there is anything already in the scene, there is a second option: FBX Merge.

3 Select from the following options:

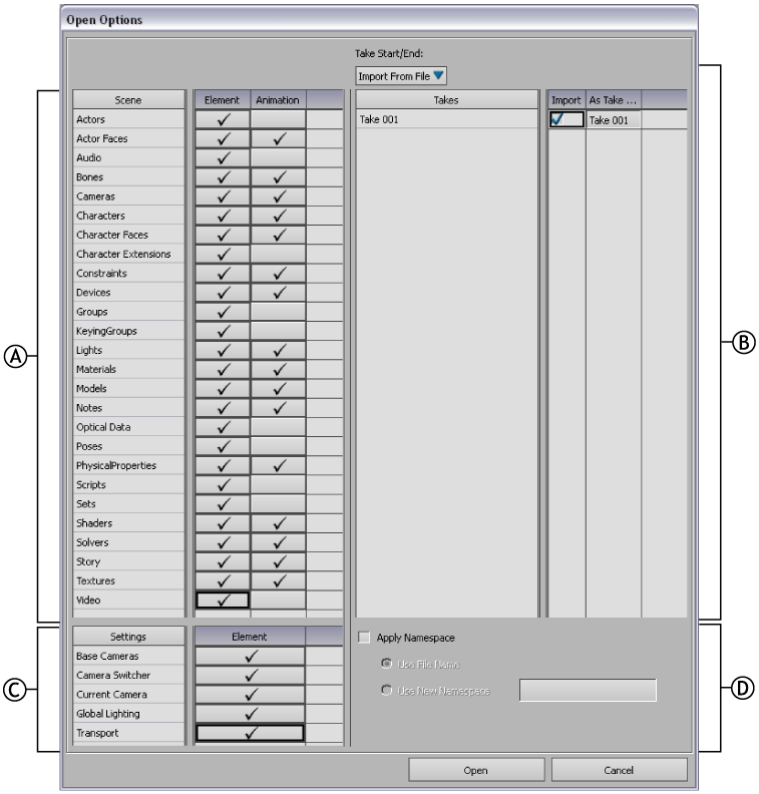
Option	Description
All Takes	Replaces the current scene with the assets, settings, and takes from the *.fbx* file. All assets and models are loaded with their

Option	Description
	animation. If something is already in your scene, a save dialog box appears for you to save it before the new scene is opened.
No Animation	Replaces the current scene with the assets and settings from the *.fbx* file. All keyframe animation on assets and models are not loaded. Takes are also not loaded.
Take 001	This part of the contextual menu lists the takes in the *.fbx* file. Selecting the take name replaces the current scene with the keyframe animation on assets and models associated with the selected take.
Options	Opens the Open Options dialog box, letting you select the assets, settings, and takes to load. For more information on the Open Options dialog box, see Loading assets from .fbx files on page 222.

If you select Options, the Open Options dialog box appears to let you select assets, settings, and takes to load from the new scene.

Open Options dialog box

The Open Options dialog box appears after you select a file in the Open File file browser. The Open Options dialog box lets you select assets, settings, and takes to load from the new scene, and prepend a namespace to all objects included in the incoming file.



Open Options dialog: *A.* **Assets area** *B.* **Takes area** *C.* **Settings area** *D.* **Namespace area**

NOTE You can resize the Open Options dialog box.

The Open Options dialog box is split into four areas:

- Assets area on page 226
- Takes area on page 228
- Settings area on page 229
- Namespace area on page 229

Assets area

The Open Options Assets area provides a list of every MotionBuilder asset that you can load from the *.fbx* file being opened.

Although each asset is listed in the Open Options Assets area, it does not indicate that the *.fbx* file being loaded contains these assets. For example, if the *.fbx* file you are loading does not contain Light assets, the Lights element is still listed.

In the Open Options Assets area, the following symbols (under the Element column) indicate whether the assets are loaded or ignored:

Symbol	Description
✓	Loads the asset from the *.fbx* file.
⊘	Does not load the asset.

For each asset's animation, the following symbols (under the Animation column) indicate whether the animation is loaded or ignored:

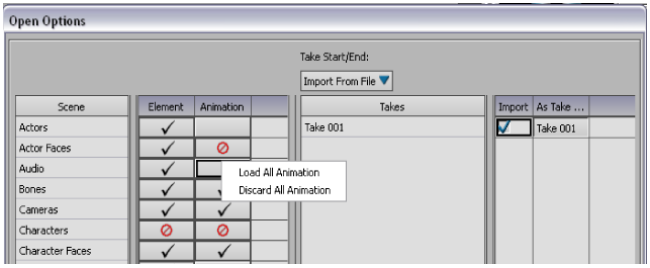
Symbol	Description
✓	Loads the asset's animation.
⊘	Does not load the asset's animation.

For each scene and settings element, you can choose to either load all elements, animation, and settings or discard all elements, animation, and settings.

For example, in the following figure, the Open options shows all the assets with the exception of the Characters asset are loaded, and the Bones', Cameras', and Character Faces' animations are loaded from the *.fbx* file. The Open options also shows that the Actors asset is loaded without their animation.

To change loading options:

1 Right-click a scene element or animation and choose Load All Elements or All Animation or Discard All Elements or All Animation from the contextual menu as shown in the following figure.



Open Options contextual menu

2 Right-click a settings element and choose Load All Settings or Discard All Settings from the contextual menu.

Takes area

The Open Options Takes area shows all the takes stored in the *.fbx* file that you are opening. You can also set how the start and end of each take is determined as well as the name given to each take.

Use the Take Start/End field to select how the start and end of each take is determined. Take Start/End gives you the following options:

Take Start/End Options	Description
Leave As Is	Leaves the take start and end times unchanged. If you are creating a take, the take start and end times are imported from the file.
Import From File	Uses the start and end timecodes specified by the *.fbx* file being loaded.
Frame Animation	Frames the start and end of the animation for each take.

Use the Take list to select which takes to load from the *.fbx* file. The Take list is split into the following columns:

Take list Option	Function
Take name	Shows the name of the take as it was saved in the *.fbx* file. You cannot change this column.
Import	Marks the take for loading. When disabled, the take is not loaded.

Take list Option	Function
As Take	Changes the name of the take when loaded.

Settings area

The Open Options Settings area lets you choose MotionBuilder settings that you can load from the *.fbx* file being opened.

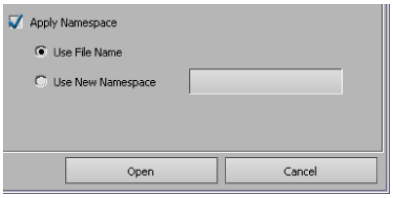
Each setting affects everything from the timing options in the Transport Controls, to the position of Producer cameras. The Open Options Settings area consists of the following:

Setting	Description
Base cameras	Activate to load the Producer cameras from the *.fbx* file. See Producer cameras on page 425.
Camera switcher	Activate to load the Camera Switcher from the *.fbx* file. To load camera switches, you must also load the take where the camera switches were set. See Camera switcher on page 483.
Current camera	Activate to switch the current camera to the current camera specified in the *.fbx* file. For example, if the *.fbx* file was saved with the Producer Front camera as the current camera, the scene switches to the Producer Front camera when the *.fbx* file is loaded. See Making a camera current on page 420.
Global lighting	Activate to load the default Global lighting from the *.fbx* file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser. See Global lights on page 521.
Transport	Activate to load the timing options that include the frame rate and playback speed. Timing options are shown in the Transport Controls window. See Timing Controls on page 804.

Namespace area

The Open Options Namespace area lets you prepend a namespace for all objects included in the incoming file. When you merge an object into a scene that contains another object with the same name, a namespace is added to the second object to resolve the naming conflict.

Activate the Apply Namespace option to enable the Namespace options.

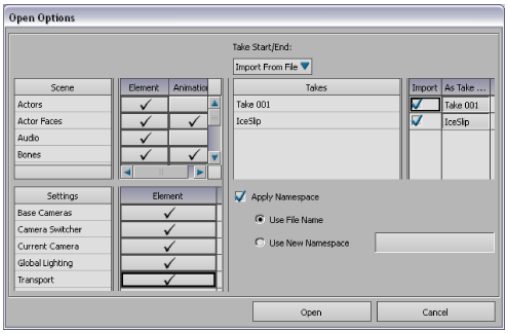


Open Options Apply Namespace option

The following table provides a description of the Namespace options.

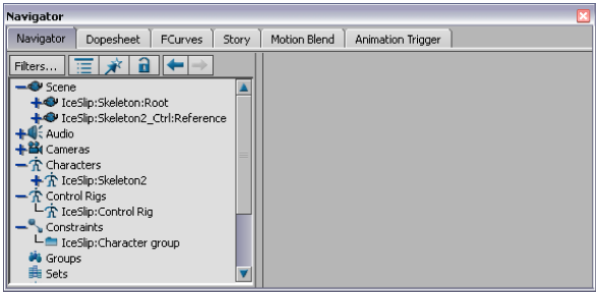
Option	Description
Use File Name	Uses the name of the file as the namespace for all objects contained within the file.
Use New Namespace	Lets you specify a namespace for all objects contained in the file. You need to enter the namespace in the Use New Namespace field. This lets you keep multiple objects with the same name in one scene. See Namespace on page 359.

The following figure shows the Open Options dialog displaying the *IceSlip* file to load and prepend the file name namespace.



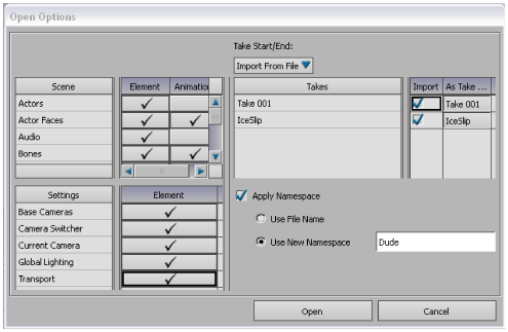
Namespace activated and set to default option

When you open an *.fbx* file with the Apply Namespace activated and set to Use File Name, all the objects within the file use the file name as the namespace, as shown in the following figure.



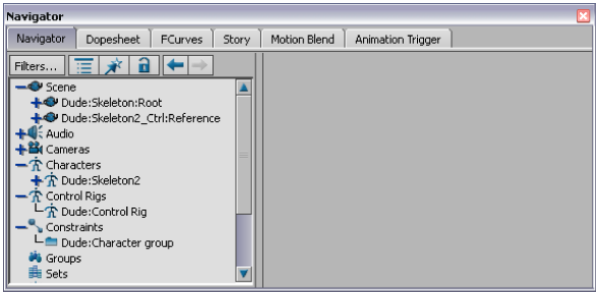
Objects' names prepended with the file name as the namespace

When you open an *.fbx* file, activate Apply Namespace and enter a namespace in the Namespace field as shown in the following figure, all the objects within the file use the namespace specified in the Namespace field.



Namespace activated to use specified namespace

The following figure shows the objects' names display the prepended namespace specified in the Namespace field.



Objects' names prepended with the specified namespace

To change the default namespace setting, see Fields and Values preferences on page 138.

Merging

11

NOTE For an overview of the changes to the file I/O, see File I/O Support.

MotionBuilder provides the following methods of merging an *.fbx* file with the current scene:

- Select File > Merge from the MotionBuilder menu bar. See Merging assets from .fbx files on page 233.
- Drag an *.fbx* file from the Asset browser into the Viewer window and select Merge from the contextual menu that appears. See Merging files dragged into the Viewer window on page 236.

Both methods let you select the assets, setttings, and takes that are merged, appended, and replaced.

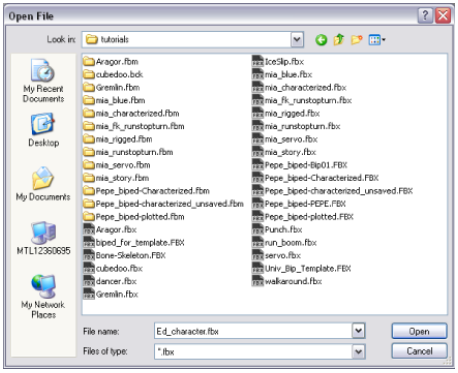
NOTE When you merge scenes with animation set on multiple layers, keyframes set on the BaseAnimation layer are merged (but not plotted) to the BaseAnimation layer. However, other layers are added to the scene as additional layers and these layers are not merged. The result is the same whether you merge-append or merge-replace the scenes.

Merging assets from .fbx files

To merge assets from an *.fbx* file with the current scene:

1. Select File > Merge from the MotionBuilder menu bar.

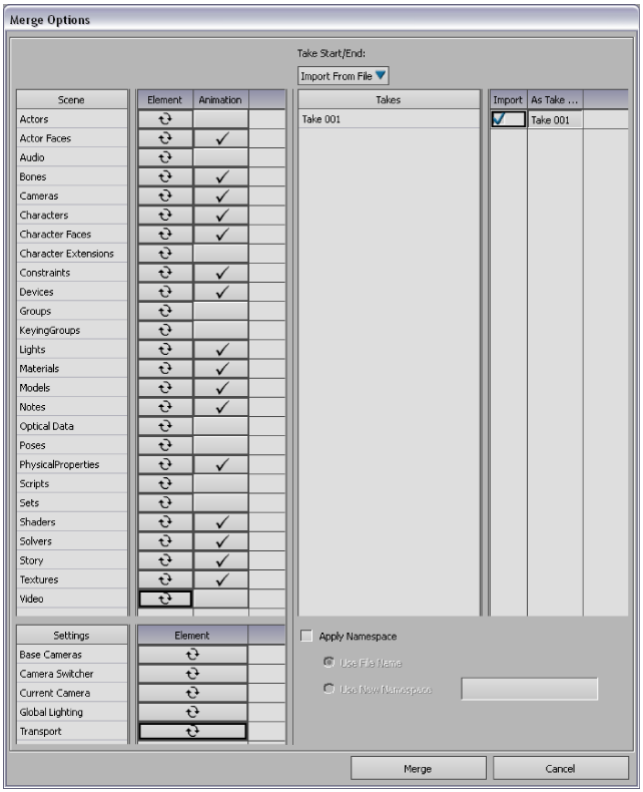
   The Open File dialog box appears.



Open File dialog box

2 Using the Open File browser, select the file containing the assets you want to merge, append, or replace and click Open.

The Merge Options dialog box appears.



Merge Options dialog box

NOTE You can resize the Merge Options dialog box.

The Merge Options dialog box consists of the following areas:

- Assets area on page 238
- Takes area on page 239
- Settings area on page 240
- Namespace area on page 241

3 Disable any elements of the file you do not want to merge with the current scene.

4 Activate Apply Namespace if you want to prepend a namespace to objects included in the incoming file.

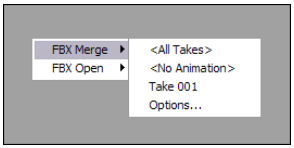
5 Click Merge.

The selected assets, settings, and takes are merged into the current scene.

See Merge Options dialog box on page 237

Merging files dragged into the Viewer window

You can merge *.fbx* files by dragging them from the Asset browser into the Viewer window where a contextual menu appears with merging options.



FBX Merge options

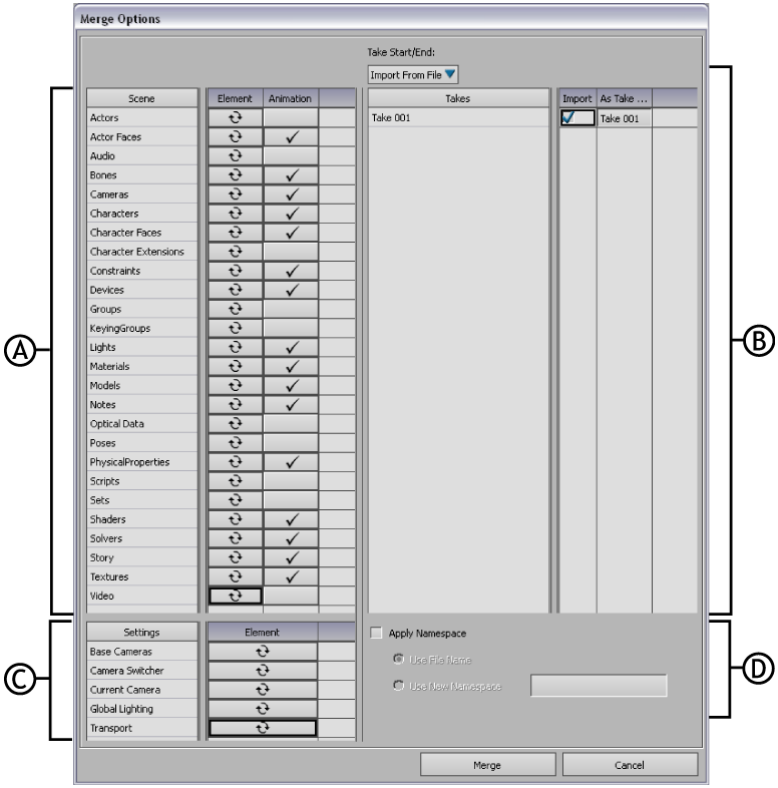
The following table provides a description of the merge options.

Merge option	Description
All Takes	Merges the current scene with the assets, settings, and takes from the *.fbx* file. All assets and models are loaded with their animation.
No Animation	Merges the current scene with the assets and settings from the *.fbx* file. All keyframe animation on assets and models are not loaded. Takes are also not loaded.
Take 001	This part of the contextual menu lists the takes in the *.fbx* file. Selecting the take name merges only keyframe animation on assets and models associated with the selected take.
Options	Opens the Merge Options dialog box, letting you select the assets, settings, and takes to merge. See Merging assets from .fbx files on page 233

NOTE MotionBuilder lets you merge-append any asset in your scene to the same object in your scene. However assets with a link, such as a Character constraint, do not merge-append properly to characters with existing character constraints. Use a namespace to differentiate the similar objects.

Merge Options dialog box

The Merge Options dialog box appears after you select to open a file in the Open File file browser. The Merge Options dialog box lets you select assets, settings, and takes to merge with or append to the current scene, and to prepend a namespace to all objects included in the incoming file.



Merge Options dialog box: *A.* **Assets area** *B.* **Takes area** *C.* **Settings area** *D.* **Namespace area**

NOTE You can resize the Merge Options dialog box.

The Merge Options dialog box is split into four areas:

- Assets area on page 238
- Takes area on page 239
- Settings area on page 240

■ Namespace area on page 241

Assets area

The Merge Assets area provides a list of all MotionBuilder assets that you can merge, replace, or append to your current scene.

Although each asset is listed in the Merge Assets area, it does not indicate that the *.fbx* file being merged contains assets of the same type. For example, if the *.fbx* file you have selected does not contain Character Extensions, the Character Extensions option is still listed.

In the Merge Options Assets area, the following symbols (under the Element column) indicate whether the assets are appended, merged, or discarded:

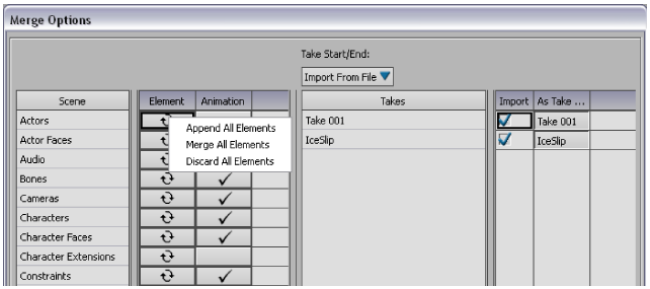
Symbol	Description
	Appends the asset from the *.fbx* file. Assets with the same name are not replaced.
	Merges the asset from the *.fbx* file, replacing any assets with the same name.
	Does not merge the asset.

For each asset's animation, the following symbols (under the Animation column) indicate whether the animation is loaded or discarded:

Symbol	Description
	Loads the asset's animation. This symbol is linked to the append setting in the asset column.
	Does not load the asset's animation.

To append or merge assets with the current scene:

■ Right-click a scene element and choose Append All Elements, Merge All Elements, or Discard All Elements from the contextual menu as shown in the following figure.



Merge Options contextual menu

To merge or discard settings:

- Right-click a settings element and choose Merge All Settings or Discard All Settings from the contextual menu.

Takes area

The Merge Options Takes area shows all the takes stored in the *.fbx* file you are merging with the current scene.

Use the Take Start/End field to select how the start and end of takes are set when they are merged. Take Start/End gives you the following options:

Take Start/End Option	Description
Leave As Is	Leaves the take start and end times unchanged. If you are creating a take, the take start and end times are merged from the file.
Import From File	Uses the start and end time codes specified by the *.fbx* file being merged.
Frame Animation	Frames the start and end of the animation for each take.

Use the Take list to select which takes to load from the *.fbx* file. The Take list is split into the following columns:

Take list Option	Function
Take name	Shows the name of the take as it was saved in the *.fbx* file. You cannot change this column.

Take list Option	Function
Import	Marks the take for merging. When active, the corresponding take replaces takes with the same name. When disabled, the take is not merged.
As Take	Changes the name of the take when merged. This is useful if your scene has a take with the same name and you don't want to replace it with the take being merged.

Settings area

The Merge Options Settings area lets you choose MotionBuilder settings to merge with your current scene.

Each setting affects everything from the timing options in the Transport Controls, to the position of Producer cameras. The Merge Options Settings area consists of the following:

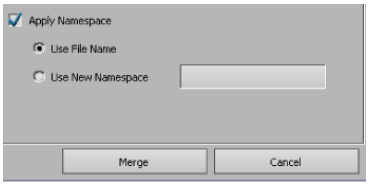
Setting	Description
Base cameras	Activate to merge the Producer cameras from the *.fbx* file into the current scene. See Producer cameras on page 425.
Camera switcher	Activate to merge the Camera Switcher from the *.fbx* file into the current scene. To merge camera switches, you must also merge the take where the camera switches were set. See Camera switcher on page 483.
Current camera	Activate to switch the current camera to the current camera specified in the *.fbx* file. For example, if the *.fbx* file was saved with the Producer Front camera as the current camera, the scene switches to the Producer Front camera when the *.fbx* file is merged. See Making a camera current on page 420.
Global lighting	Activate to merge the default Global lighting from the *.fbx* file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser. See Global lights on page 521.
Transport	Activate to merge the timing options that include the frame rate and playback speed. Timing options are shown in the Transport Controls window. See Timing Controls on page 804.

For each setting, the following symbols indicate whether the setting is merged or discarded:

Symbol	Description
	Merges the *.fbx* file settings with the current scene.
	Does not merge the setting from the *.fbx* file, leaving the setting in the current scene unchanged.

Namespace area

The Merge Options Namespace area enables you to prepend a namespace for all objects included in the incoming file. Activate the Apply Namespace option to enable the Namespace options.

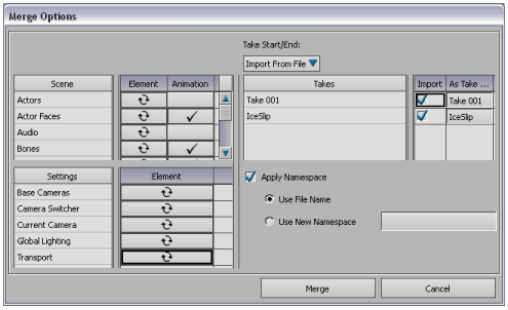


Merge Options Apply Namespace option

The following table provides a description of the Namespace options.

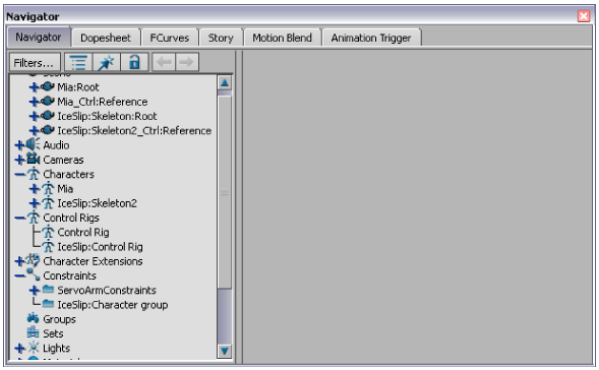
Option	Description
Use File Name	Uses the name of the file as the namespace for all objects contained within the file.
Use New Namespace	Lets you specify a namespace for all objects contained in the file. You need to enter the namespace in the Use New Namespace field. This lets you keep multiple objects with the same name in one scene. See Namespace on page 359.

The following figure shows the Merge Options dialog displaying the *IceSlip* file to merge and prepend the file name namespace.



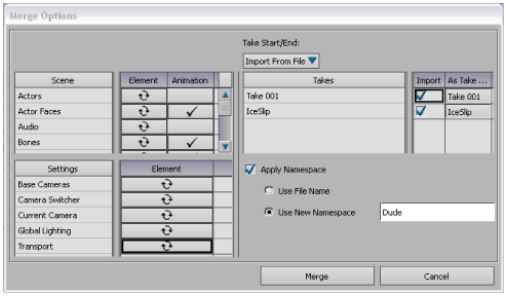
Namespace activated and set to default option

When you merge an *.fbx* file into the current scene with the Apply Namespace activated and set to Use File Name, all the objects within the file being merged use the file name as the namespace, as shown in the following figure.



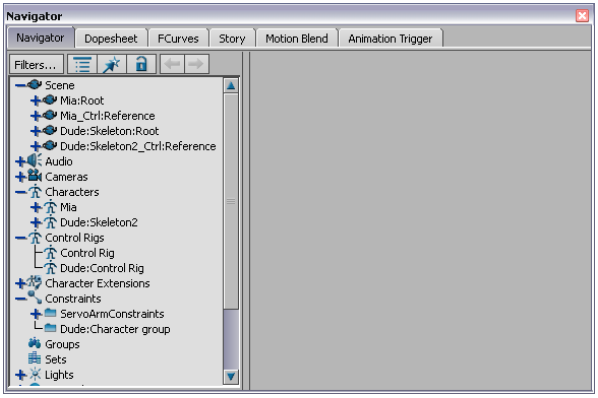
Objects' names prepended with the file name as the namespace

When you merge an *.fbx* file into the current scene, activate Apply Namespace and enter a namespace in the Namespace field as shown in the following figure, all the objects within the file being merged use the namespace specified in the Namespace field.



Namespace activated to use specified namespace

The following figure shows the objects' names display the prepended namespace specified in the Namespace field.

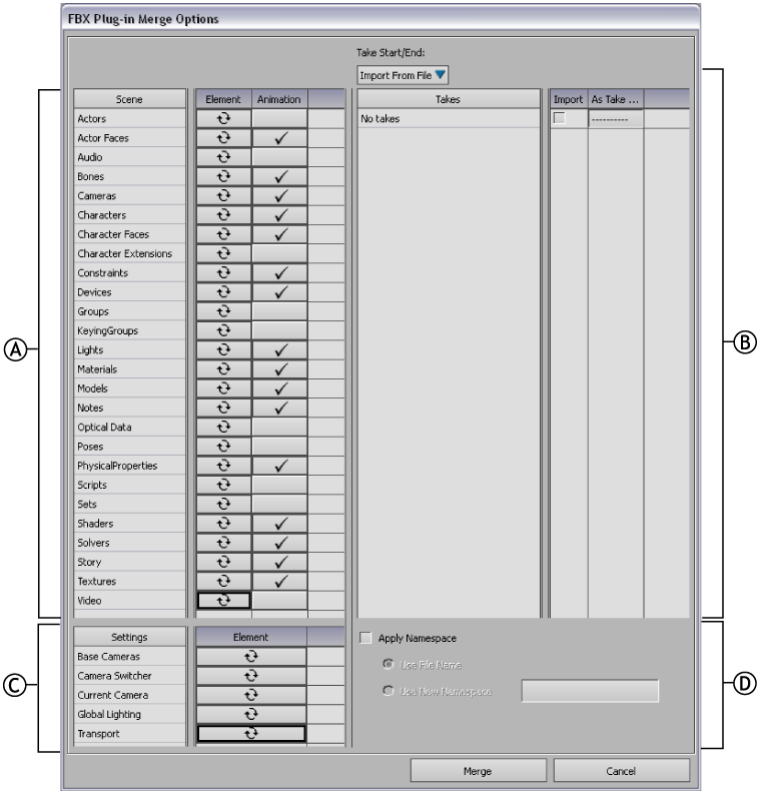


Objects' names prepended with the specified namespace

To change the default namespace setting, see Fields and Values preferences on page 138.

FBX Plug-in Merge Options dialog box

The FBX Plug-in Merge Options dialog box appears after you select an *.fbx*, *.3ds*, *.dae*, or *.obj* file to open in the Open File file browser. The FBX Plug-in Merge Options dialog box lets you select assets, settings, and takes to merge with or append to the current scene, and to prepend a namespace to all objects included in the incoming file.



FBX Plug-in Merge Options dialog: *A.* **Assets area** *B.* **Takes area** *C.* **Settings area** *D.* **Namespace area**

NOTE You can resize the FBX Plug-in Merge Options dialog box.

The FBX Plug-in Merge Options dialog box is split into four areas:

- Assets area on page 244
- Takes area on page 245
- Settings area on page 246
- Namespace area on page 247

Assets area

The FBX Plug-in Merge Options Assets area provides a list of all assets you can merge, replace, or append to your current scene.

Although each asset is listed in the Merge Assets area, it does not indicate that the file being merged contains assets of the same type. For example, if the file you have selected does not contain Character Extensions, the Character Extensions option is still listed.

In the FBX Plug-in Merge Options Assets area, the following symbols (under the Element column) indicate whether the assets are appended, merged, or discarded:

Symbol	Description
	Appends the asset from the file. Assets with the same name are not replaced.
	Merges the asset from the file, replacing any assets with the same name.
	Does not merge the asset.

For each asset's animation, the following symbols (under the Animation column) indicate whether the animation is loaded or discarded:

Symbol	Description
	Loads the asset's animation. This symbol is linked to the append setting in the asset column.
	Does not load the asset's animation.

To append or merge assets with the current scene:

- Right-click a scene element and choose Append All Elements, Merge All Elements, or Discard All Elements from the contextual menu.

To merge or discard settings:

- Right-click a settings element and choose Merge All Settings or Discard All Settings from the contextual menu.

Takes area

The FBX Plug-in Merge Options Takes area shows all the takes stored in the file you are merging with the current scene.

Use the Take Start/End field to select how the start and end of takes are set when they are merged. Take Start/End gives you the following options:

Take Start/End Options	Description
Leave As Is	Leaves the take start and end times unchanged. If you are creating a take, the take start and end times are merged from the file.
Import From File	Uses the start and end time codes specified by the file being merged.
Frame Animation	Frames the start and end of the animation for each take.

Take list Option	Description
Take name	Shows the name of the take as it was saved in the file. You cannot change this column.
Import	Marks the take for merging. When active, the corresponding take replaces takes with the same name. When disabled, the take is not merged.
As Take	Changes the name of the take when merged. This is useful if your scene has a take with the same name and you don't want to replace it with the take being merged.

Settings area

The FBX Plug-in Merge Options Settings area lets you choose MotionBuilder settings to merge with your current scene.

Each setting affects everything from the timing options in the Transport Controls, to the position of Producer cameras. The FBX Plug-in Merge Settings area consists of the following:

Setting	Description
Base cameras	Activate to merge the Producer cameras from the file into the current scene. See Producer cameras on page 425.
Camera switcher	Activate to merge the Camera Switcher from file into the current scene. To merge camera switches, you must also

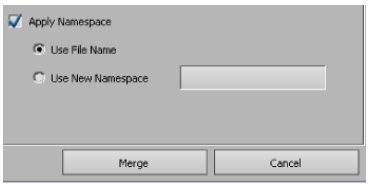
Setting	Description
	merge the take where the camera switches were set. See Camera switcher on page 483.
Current camera	Activate to switch the current camera to the current camera specified in the file. For example, if the file was saved with the Producer Front camera as the current camera, the scene switches to the Producer Front camera when the file is merged. See Making a camera current on page 420.
Global lighting	Activate to merge the default Global lighting from the file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser. See Global lights on page 521.
Transport	Activate to merge the timing options that include the frame rate and playback speed. Timing options are shown in the Transport Controls window. See Timing Controls on page 804.

For each setting, the following symbols indicate whether the setting is merged or discarded:

Symbol	Description
	Merges the file settings with the current scene.
	Does not merge the setting from the file, leaving the setting in the current scene unchanged.

Namespace area

The FBX Plug-in Merge Options Namespace area enables you to prepend a namespace for all objects included in the incoming file. Activate the Apply Namespace option to enable the Namespace options.



FBX Plug-in Merge Options Apply Namespace option

The following table provides a description of the Namespace options:

Option	Description
Use File Name	Uses the name of the file as the namespace for all objects contained within the file.
Use New Namespace	Lets you specify a namespace for all objects contained in the file. You need to enter the namespace in the Use New Namespace field. This lets you keep multiple objects with the same name in one scene. See Namespace on page 359.

When you merge a file into the current scene with the Apply Namespace activated and set to Use File Name, all the objects within the file being merged use the file name as the namespace.

When you merge a file into the current scene, activate Apply Namespace and enter a namespace in the Namespace field, all the objects within the file being merged use the namespace specified in the Namespace field.

To change the default namespace setting, see Fields and Values preferences on page 138.

Saving

12

NOTE Changes to the file I/O may not all be reflected in this chapter. For an overview of the changes to the file I/O, see File I/O Support.

MotionBuilder provides the following methods of saving objects, assets, and takes as *.fbx* files:

- Select File > Save from the MotionBuilder menu bar to save your scene with the same name as the last *.fbx* file that was opened or saved.
- Select File > Save As to save the current scene using a new name.
- Select File > Save Selection to save only the selected objects and assets.
- Select Python Tools > FBX Export to save save (export) *.fbx* files created in MotionBuilder 2011 to an earlier version of FBX file format.

  NOTE FBX files exported via Python Tools > FBX Export > FBX 2010 tool or the FBX Converter tool are FBX SDK files and not MotionBuilder files. This means that anything specific to MotionBuilder will be discarded (story information, Devices, ect). Also, FBX file format version 2010 does not support the MotionBuilder 2011 Animation layers.

Regardless of the saving method you choose, you have further save options that let you select the assets, settings, and takes to save. You can also specify Saving options such as embedding media and saving a separate file per take.

Saving an FBX file as ASCII/Binary

Whenever you save your FBX file using the File > Save or Save As options an FBX file, you can select either ASCII or Binary format from the Save File window. MotionBuilder will use the format you last selected as the default.

NOTE We do not recommend that you use the Save as ASCII option to edit FBX files with a text editor. Doing so risks making your file unstable or corrupt.

ASCII versus Binary files

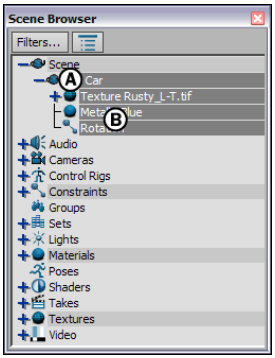
While binary is the normal format for FBX files, ASCII files give you a "plain language" version of the file format, which let you search the file for information retrieval. You can specify ASCII format for ORSDK or Python files as well.

Saving a selection of assets

To save a model and all of its assets:

1 Right-click the model in the Scene browser and choose Select Branch from the contextual menu.

The model and its constraint are selected.



Branch selected in the Scene browser *A.* **Old Car model** *B.* **Old Car's associated assets**

2 With the branch selected, select File > Save Selection.

The saving procedure is identical to selecting File > Save As. See Saving assets to an .fbx file on page 259.

TIP You do not have to select takes or associated materials (material and texture assets) when selecting assets for Save Selection. Take and material embedding are already specified during the saving process.

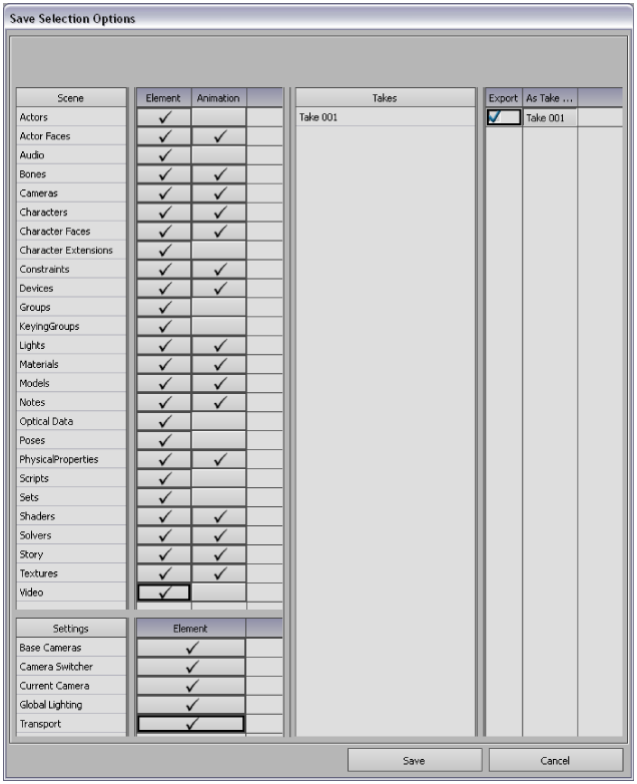
Saving an Actor and Marker set

If you use the same sensor positions for all your captures, you can start from a previously saved Marker set to map new motions to an Actor. You can save the Marker set data in an *.hik* file using the Export option in the Marker Set menu.

To save an Actor and its Marker set:

1. In the Scene browser, right-click an Actor with a defined Marker set and choose Select Branch from the contextual menu.
2. From the menu bar, select File > Save Selection.
3. In the Save File dialog box that appears, choose a directory in which to save your Marker set and Actor settings, type a name in the File name field, then click Save.

   The Save Selection Options dialog box appears.



Save Selection Options dialog box

4 In the Save Selection Options dialog box, disable the takes in the Export column, then click Save.

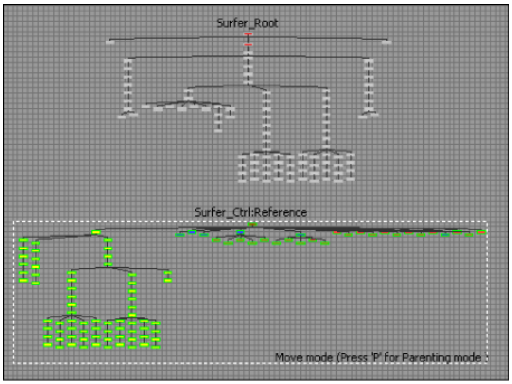
Only your Marker set and Actor settings data are saved in an *.fbx* file.

Saving a Control rig

When you save a Control rig, you have two options. You can save only the data that makes up a Control rig, or you can save the data and the Control rig effectors that visually represent the rig in the Viewer window.

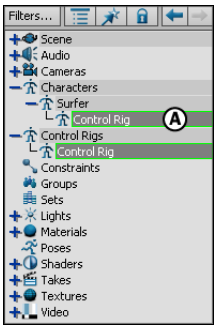
To save both the effectors and the Control rig data:

1 In the Viewer window, switch to Schematic view (*Ctrl-W*). Select all of the nodes in the Control rig you want to save.



Select the nodes of Surfer's Control rig in the Schematic view.

2 In the Scene browser, *Ctrl*-click to select the Control rig asset.



Scene browser *A.* **Select the Control rig to save.**

NOTE If you select the Control rig in the Scene browser, you do not select the Control rig effectors that display in the Viewer window which contain animation data and visually represent the rig.

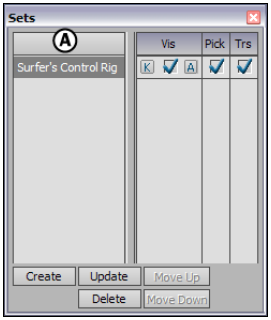
---

3 Create a set containing these selected items.

The new set is listed in the Sets window and in the Scene browser. You can expand the set in the Scene browser to ensure that you have included all of the nodes of the Control rig, as well as the Control rig data.

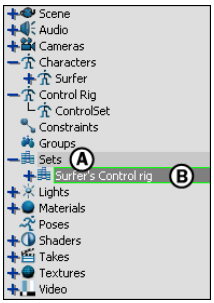
NOTE You can also add any Auxiliaries, pivots, constraints, handles, or any other objects and settings associated with your Control rig in this set.

4 Right-click the set, select Rename from the contextual menu, and rename the set to reflect the name of your Control rig.



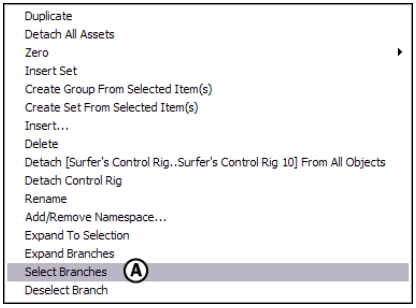
Sets window *A.* **Renamed set containing Control rig**

5 Deselect anything you have selected. In the Scene browser, expand the Sets heading and select the set containing the Control rig.



Scene browser *A.* **Expand the Sets heading.** *B.* **Select the Control rig set.**

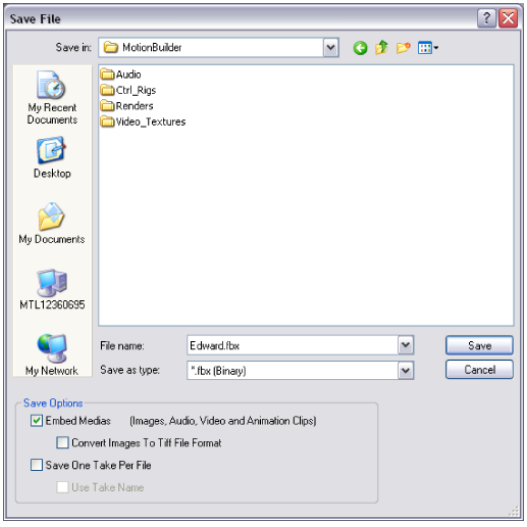
6 Right-click the set and choose Select Branches from the contextual menu.



Sets contextual menu *A.* **Select Branches**

7 Select File > Save Selection from the menu bar to save this Control rig.

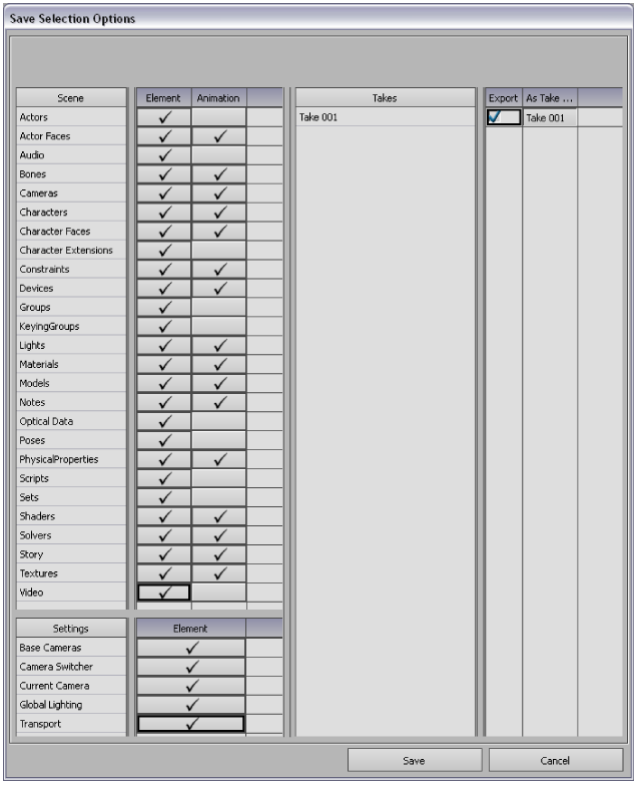
The Save File dialog appears.



Save File dialog box

8 Navigate to the directory of your choice, name the *.fbx* file, and click Save.

The Save Selection Options dialog box appears.



9 Click Save.

The Control rig is now saved as an *.fbx* file including both the data and the markers that display in the Viewer window.

See also:

- Control rigs on page 1431
- Creating a Control rig on page 1437
- Attaching a Control rig to a character on page 1439

Saving a pose

To save selected poses:

1. In the Scene browser Poses folder, *Ctrl*-click to select the poses you want to save.
2. From the menu bar, select File > Save Selection, then navigate to the directory you require and save the file with the name you prefer.

   The selected poses are saved in an *.fbx* file.

To save all poses:

1. Right-click the Poses folder in the Scene browser, and choose Select Branch from the contextual menu.
2. From the menu bar, select File > Save Selection, then navigate to the directory you require and save the file with the name you prefer.

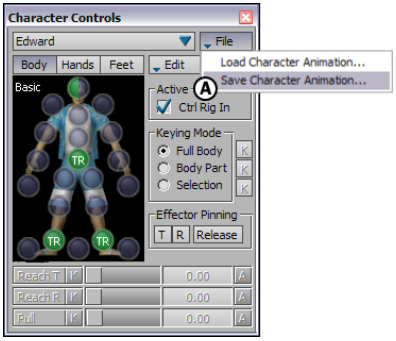
   All poses from the Poses folder are saved in an *.fbx* file.

For information about creating, updating, deleting, and copying and pasting poses, see Poses on page 1485.

Saving character animation

To save character animation:

1. In the Character Controls window, select a character with animation in the Current Character menu. Select File > Save Character Animation in the Character Controls.

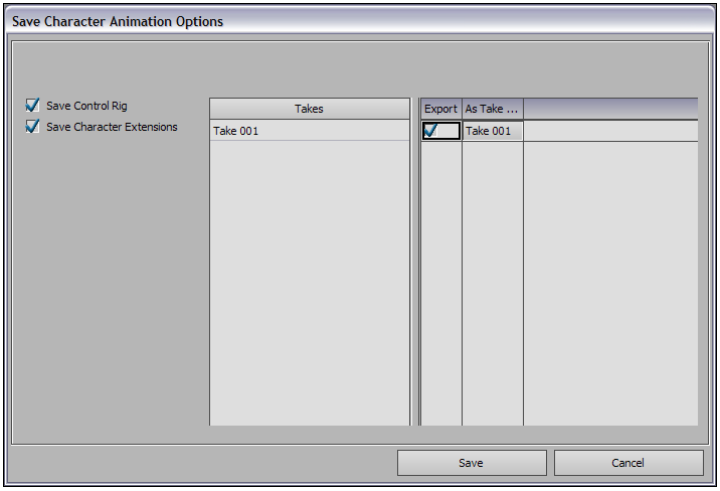


Character Controls *A.* **Select the Save Character Animation option**

The Save File dialog box appears.

2 Browse to the location you want to save the file, enter a file name, then click Save.

The Save Character Animation Options dialog box appears.



Save Character Animation Options dialog box

3 Select the options you want to use, and make sure the take you want to save is selected in the Takes list.

For more information on these options, see Save Character Animation Options dialog box on page 1585.

4 Click Save.

The character's animation is saved as an *.fbx* file. Now that you saved character animation using the Save Character Animation option, you can transfer it to any character using the Load Character Animation option. See Loading poses on page 220 for more information.

You can also copy or retarget this animation to other characters, use it as a Character Input, or use it as a character clip in the Story window.

See also:

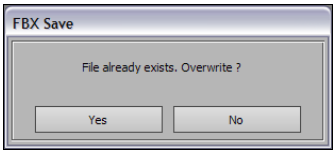
- Loading poses on page 220
- Save Character Animation Options dialog box on page 1585

Saving assets to an .fbx file

To save assets to an *.fbx* file:

1 To save the MotionBuilder scene using the same name, select File > Save. If you want to save the file under another name or save a new file, proceed to step 2.

The FBX Save dialog appears.



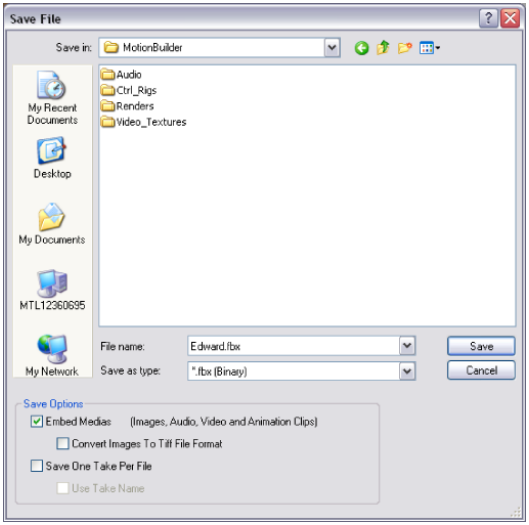
FBX Save dialog box

If you are saving more than one *.fbx* file, this dialog box includes the Yes to All button that replaces the current *.fbx* files with the same names.

The MotionBuilder scene is updated and saved.

2 To save a new MotionBuilder scene or to save a MotionBuilder scene under another name, select File > Save As.

The Save File dialog box appears.



Save File dialog box

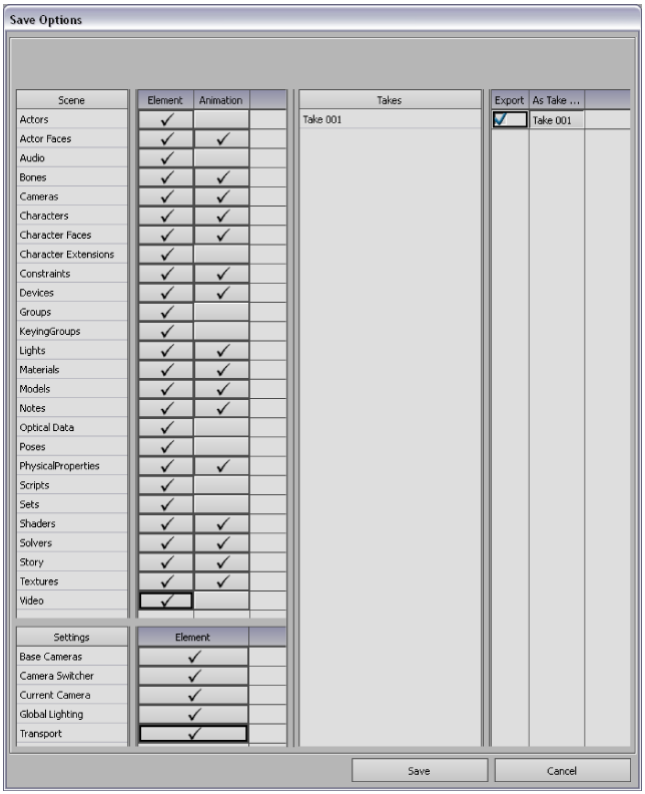
The Save File options include the following options.

Save options	Description
Embed Medias	Activate to embed image files, video clips, and audio clips in the saved .fbx file. When you activate Embed Medias, the additional option Convert Images To Tiff File Format lets you embed all images using the .tif file format, regardless of their original format. Disable Embed Medias to save only the path where media files are located. When you disable Embed Medias, make sure the media files are not moved or deleted from the path specified by your scene, otherwise the .fbx file that you save is unable to locate the media. If you transfer .fbx files between computers, it is recommended that you embed media.
Save One Take Per File	Activate to save each enabled take in the Save Takes list as a separate .fbx file. The name of each new .fbx file is given the original file's name and the name of the take it contains, unless you select the Use Take Name option. When you activate Save One Take Per File, each .fbx is saved using the take name. For example, if you entered sample.fbx as the file name and you have two takes named "Take1" and "Take2", activating One Take Per File saves two files named Sample-Take1.fbx and Sample-Take2.fbx. In addition, when you activate Embed Me-

Save options	Description
	dias, all media used in the file is embedded in each .fbx file saved.

3 Select the appropriate Save options and click Save.

The Save Options dialog appears.



Save Options dialog box

4 Use the Save Options dialog box to select which assets, settings, and takes to save.

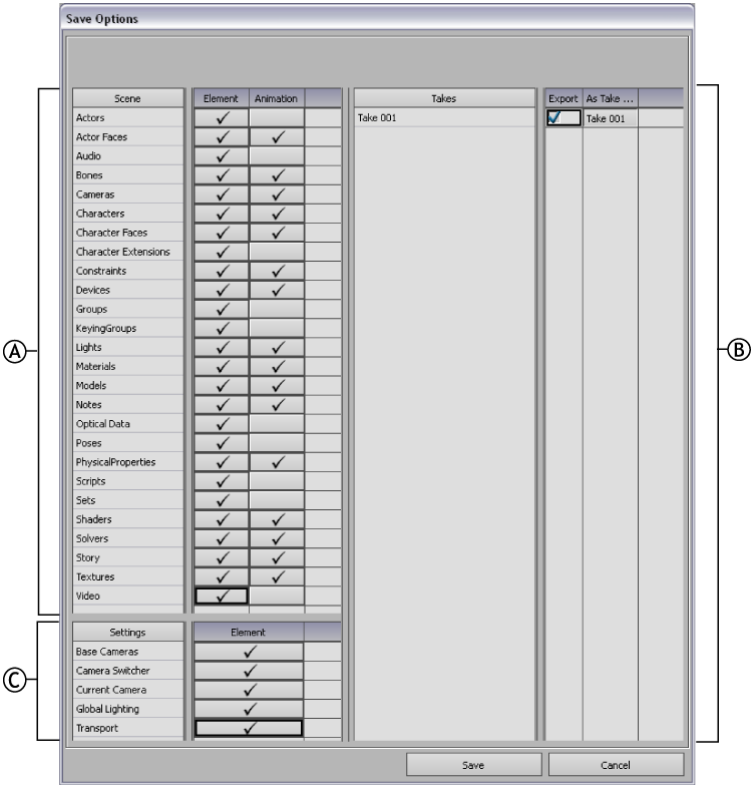
See Save Options dialog box on page 262.

5 Click Save to save the selected assets, settings, and takes to the specified *.fbx* file.

Save Options dialog box

The Save Options dialog box appears after you select Save in the Save File browser.

The Save Options dialog box lets you select assets, settings, and takes options to save from the current scene.



Save Options dialog: *A.* **Assets area** *B.* **Takes area** *C.* **Settings area**

NOTE You can resize the Save Options dialog box.

The Save Options dialog box is split into three areas:

- Assets area on page 263
- Takes area on page 264
- Settings area on page 264

Assets area

The Save Options Assets area provides a list of all MotionBuilder assets you can save.

Save Options Assets area

For both the Save Options Assets and Settings areas, the following symbols indicate whether a setting, asset, or the asset's animation is saved to the *.fbx* file:

Symbol	Description
✓	Saves the corresponding assets, settings, or animation to the *.fbx* file.
⊘	Does not save the corresponding assets, settings, or animation to the *.fbx* file.

You can right-click the heading of each column to set all items to save or discard.

Takes area

The Save Options Takes area shows all the takes in the scene. Use the Takes area to select which take(s) to be saved with your *.fbx* file. The Save Options Takes area consists of the following settings:

Takes options	Description
Take name	Shows the name of the take as it appears in MotionBuilder. You cannot change this column.
Export	Marks the take for saving. When active, the corresponding take is saved to the .fbx file.
As Take	Renames the take as it is saved to the .fbx file. If the Save One Take Per File and Use Take Name options are active, the name of the take in the As Take column is used over the take name in the scene.

Settings area

The Save Options Settings area lets you choose MotionBuilder settings to save with your file.

Save Options Settings area

The Save Options Settings area consists of the following settings:

Settings options	Description
Base Cameras	Activate to save the Producer cameras to the *.fbx* file. See Producer cameras on page 425.
Camera Switcher	Activate to save the current Camera Switcher from the *.fbx* file. In order to save the camera switches, you must also save the take where the camera switches were set. See Camera switcher on page 483.
Current Camera	Activate to save which camera is the current camera. See Making a camera current on page 420.

Settings options	Description
Global Lighting	Activate to save the default Global lighting to the *.fbx* file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser of the Navigator window. See Global lights on page 521.
Transport	Activate to save the timing options such as the frame rate and playback speed of your scene. Timing options are shown in the Transport Controls window. See Timing Controls on page 804.

Save Reminder button

The red Save Reminder button appears at the top of the Viewer window to prompt you to save. You can specify the saving preferences in the Preferences window.

Viewer window *A.* **Save Reminder button**

To show the Save Reminder menu, click the down arrow. The Save Reminder menu contains the following options:

Option	Description
Snooze	Resets the save reminder without saving your file.

Option	Description
Turn Off	Disables the save reminder.
Preferences	Opens the Preferences window so that you can access additional Save Reminder preferences. See the Save Reminder settings in the Saving preferences on page 153.

Importing

13

In addition to opening the *.fbx* file format, MotionBuilder lets you import the following motion data, scene, and skeleton file formats:

NOTE For an overview of the changes to the file I/O, see File I/O Support.

Import Format	Description
3Ds MaxScene (*.*3ds*)	3ds Max file format that you must open using the File > FBX Plug-in Import method. See Opening a file from another 3D package on page 198
Acclaim (*.*asf*, *.*amc*)	Acclaim format is a dual format where an *.asf* file contains a definition of a skeleton and one or more *.amc* files contain the motion data used by the skeleton. You can retain dummy nodes when loading Acclaim files. See Opening a file from another 3D package on page 198 and Acclaim .asf and .amc file format limitations on page 279.
Autodesk (*.*fbx*)	Autodesk *.fbx* file format (the native file format of MotionBuilder). See Opening an .fbx file on page 195.
Biovision (*.*bvh*)	Biovision file format for hierarchical or skeletal-based data. See Opening a motion (MoCap) file on page 200.
Collada (**dae*)	Sony Collada file format. See Opening a file from another 3D package on page 198.
Motion Analysis (*.*htr*)	Hierarchical Transformation Rotation, a hierarchical skeleton data format captured using Motion Analysis capture hardware. SeeOpening a motion (MoCap) file on page 200.
Motion Analysis (*.*trc*)	Motion Analysis *.trc* format. See Opening a motion (MoCap) file on page 200.

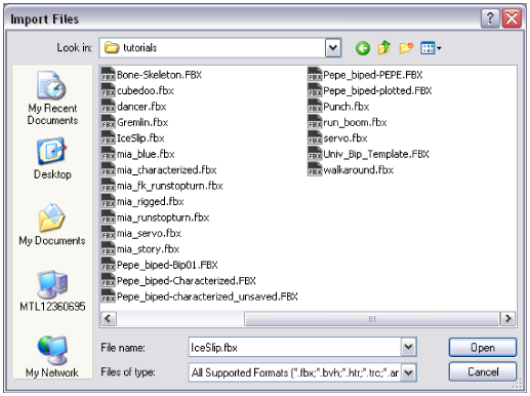
Import Format	Description
Obj (*.*obj*)	Autodesk Objects file format. See Opening a file from another 3D package on page 198.
Vicon (*.*c3d*)	Motion data file created with Vicon capture hardware. See Opening a motion (MoCap) file on page 200.

Some file formats provide additional options that display beneath the Create and Merge options in the Import Option dialog box.

NOTE Changes to the file IO are not reflected in this chapter for the Beta 1 release. For an overview of the file IO changes, see File I/O Support.

Importing Files

To import files, select File > Import from the MotionBuilder menu bar. The Import Files dialog box displays letting you choose one or more files for import.

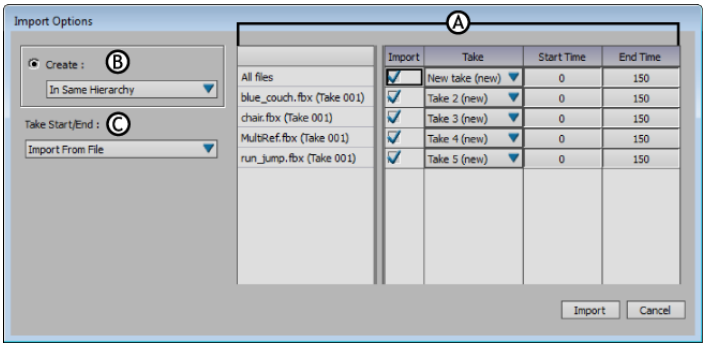


Import Files dialog

To select more than one file, select the file type, click the first file and *Ctrl*-click each file that you want to add to your selection.

Import Options dialog box

If you select a motion file or skeleton file format, the Import Options dialog box displays when you click Open.



Import Options dialog box *A.* **Import table** *B.* **Create or Merge area** *C.* **Custom import options**

The Import Options dialog box has the following three areas:

- Import table on page 269
- Create or Merge area on page 270
- Custom import options on page 272

The Import Options dialog box also displays when you select Options from the Import contextual menu. The Import contextual menu appears when you drag one or more recognized motion file formats over the Viewer window. When you drag, all motion files must be of the same format.

Import table

The Import table lists all the selected files for import, their start and end frames, samples, sample rate, and other options. The Import Table is the same for all data formats except scenes and *.fbx* files.

The top row, called All Files lets you change the value of a given column for all files at the same time. Values for each file are clamped to their absolute

minimum or maximum. For example, if you enter 30000 as the sample rate, the sample rate for all files is set to this maximum.

Column	Description
Files to Import	Lists all the selected files dragged from the Asset browser or selected using the Import File dialog box.
Import column	Use the Import check boxes to select which files to import.
Take column	Displays the name of the take where each animation is imported. If you import to a take that already has animation, it is replaced by the take you are importing. If you want to import to a new take, select New Take from the list of takes. You can also rename the take using this field.
Start and End	The Start and End time codes are expressed in the same time format as is shown in the Transport Controls. You can change the start and end time of each imported file to ensure, for example, that each animation starts at frame 0.
Samples	Displays the number of samples found in each imported file. You can change the duration by changing the number of samples.
Sampling Rate	The Sampling Rate field shows the frame rate from the imported file. Change the value in this column to speed up or slow down your animation based on the file's original sampling rate. Select Custom to use the adjacent Custom field to enter your own frame rate.
Custom	The Custom column lets you enter your own frame rate for the imported file.

Create or Merge area

The options in the Create or Merge area change if you select an object before attempting to import files.

For example, if you select an object before performing File > Import, the available create and merge options change. All Create options are listed in the following table:

Create Option	Description
In Same Hierarchy	Imports all motion files into the same hierarchy, over many takes.
In Separate Hierarchies	Creates a separate hierarchy for each motion file. Each file is imported into a separate take.

The default choice, either Create or Merge, changes as well. If an object is selected, Merge is selected. If no object is selected, Create is automatically selected The available Merge options also change if an object was selected before merging. All merge options are listed in the following table:

Merge Options	Description
In Selected Hierarchy	Finds the root node and merges data into the entire hierarchy. Only available when one model is selected.
In All Models	Imports motion into the hierarchies of all models in your scene. This is the only merge option when nothing is selected.
In Selected Models Only	Merges data with only the selected nodes or models.
In Selected Model and Children	Imports into a hierarchy starting with the selected node, treating the selected node as a root node. This is useful for importing only arm, leg, or upper body motion. Only available when one model is selected.
In Prefix Group	Finds the top node with the same prefix and imports the motion as if you selected In Selected Hierarchy. If the selected node has the prefix, this merge option is the same as selecting In Selected Model and Children. If no nodes are found with the prefix, this merge option operates the same as In Selected Hierarchy. Only available when one model is selected.

Create Unmatched Models

When importing files, Import checks the names, node type, and structure of the selected hierarchy. Activate Create Unmatched Models to create nodes to match the hierarchical structure of the imported file.

When disabled, data imports only to recognized nodes. If any differences are found between what you are importing and what is selected, the import stops.

Custom import options

The area beneath the Create and Merge options displays additional options that are available depending on the file format that you are importing. This topic lists the more commonly used file formats and their options.

3ds Max scene (*.3ds)

3ds Max file format (*.max*) is a scene format that opens its own custom dialog boxes.

Acclaim (*.asf and *.amc)

The Acclaim format is a dual file format where the *.asf* file contains a definition of the skeleton and the *.amc* file contains the motion data used by the skeleton. It is possible to have multiple *.amc* files for a single *.asf* file.

When importing any Acclaim file format files, you can select only one *.asf* file and zero or more *.amc* files. If you choose to select no *.amc* files, a dialog box warns you that you are loading a skeleton with no data. If you continue, a skeleton structure is imported without animation.

When importing this file format, three additional import options appear:

- Create a Reference Node
- Import Base rotation as Pre Rotation
- Import Base translation as Rotation pivot offsets

Acclaim ASF and AMC file import and export support the following:

- Base rotation is imported as Pre-Rotation, and Pre-Rotation is exported as Base Rotation.
- Base translation is imported as Rotation Offset and Rotation offset is exported as Base Translation.
- Rotation order

NOTE If you do not activate the Base Translation on Rotation Offset option, no translation limits are applied to the file export. If you do not activate the Base Rotation on Pre Rotation, no rotation limits are applied to the file export. This is because limits are applied to the original animation data. When these options are disabled, the animation is resampled and the original limits are lost.

See Acclaim .asf and .amc file format limitations on page 279.

Autodesk (*.fbx)

The Autodesk *.fbx* file format, in this context, refers to an *.fbx* animation file format. An *.fbx* animation file format contains only skeleton-based animation that are commonly created for the Animation Trigger window. See Animation Trigger window on page 1920.

When importing *.fbx* animation files, the Import table contains only the start and end columns.

Biovision (*.bvh)

The Biovision file format is a file format for hierarchical or skeletal-based data. When importing this format, an additional import option (Create Reference Node) lets you create a reference node when importing your *.bvh* or *.htr* skeleton.

Motion Analysis (*.htr)

The Motion Analysis *.htr* file format stands for Hierarchical Transformation Rotation. It is a hierarchical skeleton data format captured using Motion Analysis capture hardware.

When importing this file format, an additional import option (Create Reference Node) lets you create a reference node when importing your *.bvh* or *.htr* skeleton.

NOTE If a green property appears on an imported bone, it represents the Bone Length Data (HTR_BoneLength).

Motion Analysis (*.trc)

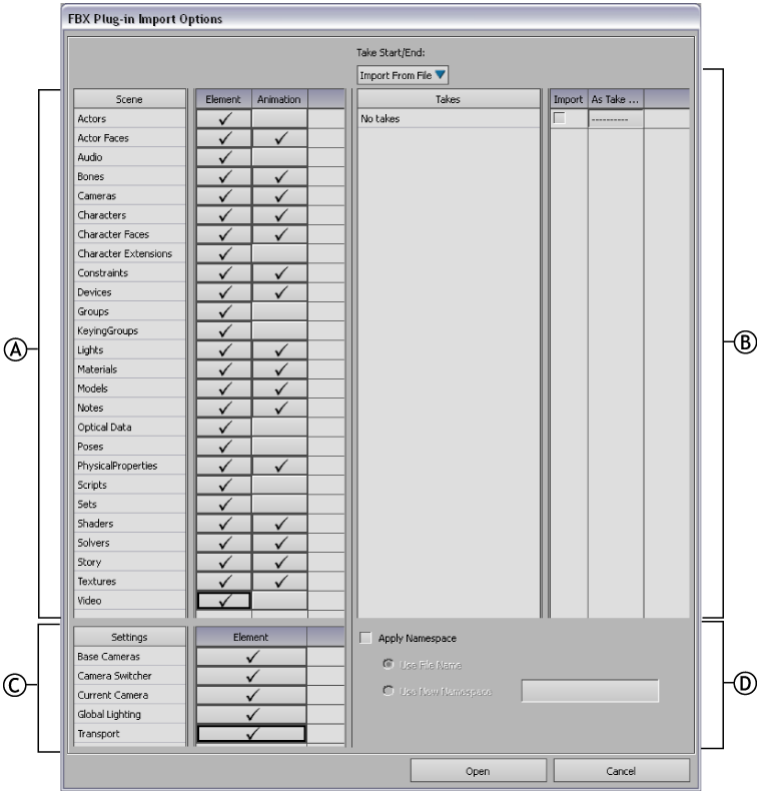
The Motion Analysis *.trc* file format is an optical capture file format. When importing this file format, an additional option lets you import data as optical segments.

Vicon (*.c3d)

The Vicon *.c3d* file format is an optical data file format captured using Vicon capture hardware. Two additional import options let you import data as optical segments and keep the Actor prefix when naming each optical marker.

FBX Plug-in Import Options dialog box

The FBX Plug-in Import Options dialog box appears after you select a file in the Open File file browser. The FBX Plug-in Import Options dialog box lets you select assets, settings, and takes options to import to the new scene, and prepend a namespace to all objects included in the incoming file.



FBX Plug-in Import Options dialog: *A.* **Assets area** *B.* **Takes area** *C.* **Settings area** *D.* **Namespace area**

NOTE You can resize the FBX Plug-in Import Options dialog box.

The FBX Plug-in Import Options dialog box is split into four areas:

- Assets area on page 275
- Takes area on page 276
- Settings area on page 277
- Namespace area on page 278

Assets area

The FBX Plug-in Import Options Assets area provides a list of the file's assets and assets' animation you can choose to import into MotionBuilder.

Although each asset is listed in the FBX Plug-in Import Options Assets area, it does not indicate that the file being imported contains these assets. For example, if the file you are importing does not contain Light assets, the Lights element is still listed.

In the FBX Plug-in Import Options Assets area, the following symbols (under the Element column) indicate whether the assets are imported or ignored:

Symbol	Description
✓	Imports the asset from the file.
⊘	Does not import the asset.

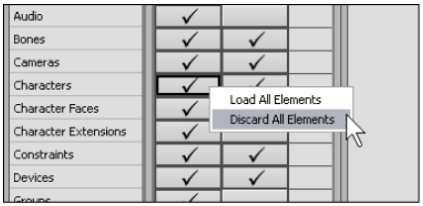
For each asset's animation, the following symbols (under the Animation column) indicate whether the animation is imported or ignored:

Symbol	Description
✓	Imports the asset's animation.
⊘	Does not import the asset's animation.

For each scene and settings element, you can choose to either import all elements, animation, and settings or discard all elements, animation, and settings.

To change Import options:

1 Right-click a scene element and choose Load All Elements or Discard All Elements from the contextual menu as shown in the following figure.



Import Options contextual menu

2 Right-click a settings element and choose Load All Settings or Discard All Settings from the contextual menu.

Takes area

The FBX Plug-in Import Options Takes area shows all the takes stored in the file that you are importing. You can also set how the start and end of each take is determined as well as the name given to each take.

Use the Take Start/End field to select how the start and end of each take is determined. Take Start/End gives you the following options:

Take Start/End Options	Description
Leave As Is	Leaves the take start and end times unchanged. If you are creating a take, the take start and end times are imported from the file.
Import From File	Uses the start and end timecodes specified by the file being imported.
Frame Animation	Frames the start and end of the animation for each take.

Use the Take list to select which takes to load from the file. The Take list is split into the following columns:

Take list Option	Function
Take name	Shows the name of the take as it was saved in the file. You cannot change this column.

Take list Option	Function
Import	Marks the take for loading. When disabled, the take is not loaded.
As Take	Changes the name of the take when loaded.

Settings area

The FBX Plug-in Import Options Settings area lets you choose settings you can load from the file being imported.

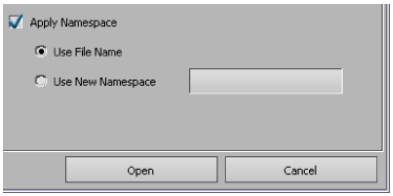
Each setting affects everything from the timing options in the Transport Controls, to the position of Producer cameras. The FBX Plug-in Import Options Settings area consists of the following:

Setting	Description
Base cameras	Activate to load the Producer cameras from the file. See Producer cameras on page 425.
Camera switcher	Activate to load the Camera Switcher from the file. To load camera switches, you must also load the take where the camera switches were set. See Camera switcher on page 483.
Current camera	Activate to switch the current camera to the current camera specified in the file. For example, if the file was saved with the Producer Front camera as the current camera, the scene switches to the Producer Front camera when the file is loaded. See Making a camera current on page 420.
Global lighting	Activate to load the default Global lighting from the file. The Global lighting consists of the default ambient color and the scene's fog settings. To view the scene's Global lighting, select Global Light from the Lights folder in the Scene browser. See Global lights on page 521.
Transport	Activate to load the timing options that include the frame rate and playback speed. Timing options are shown in the Transport Controls window. See Timing Controls on page 804.

Namespace area

The FBX Plug-in Import Options Namespace area lets you prepend a namespace for all objects included in the incoming file. When you import an object into a scene that contains another object with the same name, a namespace is added to the second object to resolve the naming conflict.

Activate the Apply Namespace option to enable the Namespace options.



FBX Plug-in Import Options Apply Namespace option

The following table provides a description of the Namespace options.

Option	Description
Use File Name	Uses the name of the file as the namespace for all objects contained within the file.
Use New Namespace	Lets you specify a namespace for all objects contained in the file. You need to enter the namespace in the Use New Namespace field. This lets you keep multiple objects with the same name in one scene. See Namespace on page 359.

When you import a file with the Apply Namespace activated and set to Use File Name, all the objects within the file use the file name as the namespace.

When you import a file, activate Apply Namespace and enter a namespace in the Namespace field, all the objects within the file use the namespace specified in the Namespace field.

To change the default namespace setting, see Fields and Values preferences on page 138.

Importing .bvh files into 3ds Max

You can use the FBX Plug-in to import **.bvh** files into 3ds Max.

To import a *.bvh* file into 3ds Max:

1. Create a BIPED in the Systems > Create panel.
2. Go to the BIPED settings under Motion.
3. Open the Motion Capture tab. Twelve icons appear but only three are active.
4. Click the first icon (top left, a folder and a camera) to display a file browser.
5. Select bvh as the File of Type.
6. Browse and select the *.bvh* file that you saved in MotionBuilder.

   TIP If you do not need to work with all the data in a raw motion-capture file, you can choose Use Key Reduction in 3ds Max to reduce keys for simpler key editing. Doing so minimizes the file size.

7. Activate the Point option under Knee and Elbow in Limb Orientation.
8. Click OK in the dialog box.
9. Play back the animation on the Biped.

Only one rotation order per file is supported.

Acclaim .asf and .amc file format limitations

The following limitations apply to Acclaim ASF and AMC import and export:

- SphericXYZ Rotation Order is not supported on export.
- When you export a bone with Degrees of Freedom (DOF) information not supported by ASF or AMC, for example, Post Rotation, all limits are deleted.

NOTE If you do not activate the Base Translation on Rotation Offset option, no translation limits are applied to the file export. If you do not activate the Base Rotation on Pre Rotation, no rotation limits are applied to the file export. This is because limits are applied to the original animation data. When these options are disabled, the animation is resampled and the original limits are lost

Point Cache support

MotionBuilder supports models with Point caching, however, the support is view-only: you can see Point caches created in other packages, but cannot create or edit them in MotionBuilder.

A model's Point cache files are stored in the Scene browser's Deformers folder.

To deactivate a Point cache deformation:

1. In the Navigator window, expand the Deformers folder.
2. Double-click the Point Cache deformation.
3. In the Properties window, disable the Point Cache deformation's Active option.

NOTE The Point cache information is stored in a *.fbx* file. You must always store this file in the same location as its associated *.fbx* file.

Point Cache limitations

You cannot see FCurve information about vertices on the model, as the Point cache information streams directly from the *.mc* file.

Because Point caching overwrites the object's other deformers, you are unable to modify an object's skin in the Skins window.

If you are exporting from Maya or 3ds Max and activate the Split mesh for per-vertex normals option in the FBX Exporter window, this may create problems with Point caching.

Exporting

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Exporting motion files is a method of transferring data from MotionBuilder to a variety of different motion file formats. MotionBuilder lets you export the following motion data, scene, and skeleton file formats:

NOTE For an overview of the changes to the file I/O, see File I/O Support.

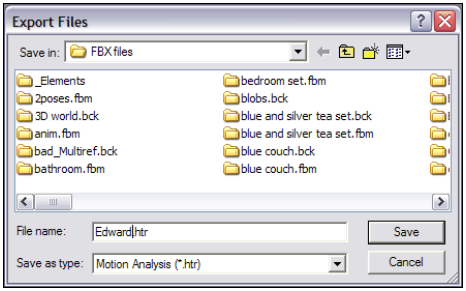
Import Format	Description
3D Studio Scene (*.3ds*)	3ds Max file format is a scene format that opens its own custom dialog boxes. See Exporting options for scenes on page 286.
Acclaim (**.asf*, **.amc*)	Acclaim format is a dual format where an *.asf* file contains a definition of a skeleton and one or more *.amc* files contain the motion data used by the skeleton.
Biovision (**.bvh*)	Biovision file format for hierarchical or skeletal-based data.
DXF scene (**.dxf*)	AutoCAD file format, which is a scene format that opens its own custom dialog boxes. See Exporting options for scenes on page 286.
Motion Analysis (**.htr*)	Hierarchical Transformation Rotation, a hierarchical skeleton data format captured using Motion Analysis capture hardware.
Motion Analysis (**.trc*)	Motion Analysis *.trc* format.
Obj (**.obj*)	Objects file format for loading object information into Maya.
Vicon (**.c3d*)	Motion data file created with Vicon capture hardware.

Some file formats provide additional options that display beneath the Existing Files options in the Export Option dialog box.

NOTE Changes to the file IO are not reflected in this chapter for the Beta 1 release. For an overview of the file IO changes, see File I/O Support.

Exporting motion files

To export motion files, select the root of the skeleton or the collection of sensors containing the data that you want to export, then select File > Export. The Export Files dialog box appears, letting you choose a file format and enter a file name for exporting.



Export Files dialog box

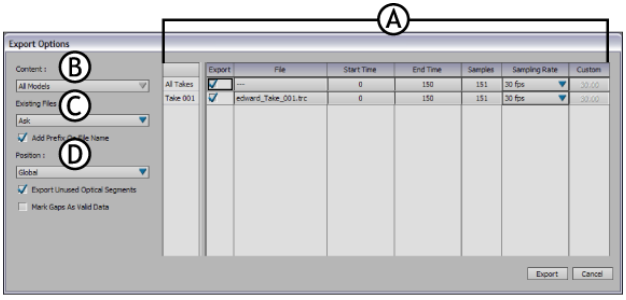
Export options depend on the file format you are exporting. Warning dialog boxes appear and the export is aborted if you do not select the proper node for the file format selected.

For example, you must select the root to export hierarchical formats (Biovision *.bvh*, Motion Analysis *.htr*, Acclaim *.asf* and *.amc*). The root node is where the translation occurs since translation is only saved for the root node.

When specifying a file name, the file name is added as a prefix to the name of the take being exported. To name each file with the same name as the take, delete the asterisk and type only the file format. For example, to export all takes with their take name and the *.bvh* extension, type “.bvh”.

Export Options dialog box

If you select a motion file or skeleton file format, the Export Options dialog box displays when you click Save.



Export Options dialog box with two takes *A.* **Export Table** *B.* **Content area** *C.* **Existing Files area** *D.* **Additional Export Options**

The Export Options dialog box is split into the following areas:

- Export Table on page 283
- Content area on page 284
- Existing Files area on page 285
- Additional export options on page 286

If you export a 3ds Max scene (*.3ds*), or a DXF Scene (*.dxf*), custom dialog boxes display. The Export Options dialog box does not display when exporting scenes. See Exporting options for scenes on page 286.

Export Table

The Export Table lists all the selected takes for export, their start and end frames, samples, sample rate, and other options. The Export Table is the same for all data formats except scenes and *.fbx* files. See Exporting options for scenes on page 286.

The top row is the All Takes Row. It lets you change the value of a given column for all files at the same time. Values for each file are clamped to their absolute minimum or maximum. For example, if you enter 30000 as the sample rate, the sample rate for all files is set to its maximum.

Files to export

Lists all takes in the current MotionBuilder scene.

Export

Use the Export check box to select the takes to export.

File

Displays the name of the file where each take is exported. You can rename the file using this field.

Start and End

The Start and End time codes are expressed in the same time format as is shown in the Transport Controls. You can change the start and end to change the part of the take that you are exporting.

Samples

Displays the number of samples, which is calculated by multiplying the duration (based on the start and end) by the sampling rate. You can change the duration by changing the number of samples or Sampling Rate. This changes the End timecode.

Sampling Rate

The Sampling Rate field, by default, is set to the frame rate as shown in the Transport Controls, or the frame rate of the selected optical model (if exporting optical data). Changing the Sampling Rate changes the End timecode. Select Custom to use the adjacent Custom field to enter your own sampling rate.

Custom

The Custom column lets you enter your own sampling rate for the exported file.

Content area

The options in the Content area changes if you select a node or the root of a hierarchy before attempting to export files. All Content options are listed in the following table:

Content Options	Description
Selected Models Only	Exports data from only the selected models in your scene.

Content Options	Description
All Models	Exports data from all models in your scene.
Selected Model and Children	Treats the selected node as a root node and exports its data and the data of its children. This is useful for exporting arm, leg, or upper body motion. Only available when one model is selected.
Prefix Group	Finds the top node in the hierarchy with the same prefix and exports all nodes in the hierarchy. Only available when one model is selected.
Hierarchy	Finds the root node and exports the entire hierarchy. Only available when one model is selected.

Existing Files area

The options in the Existing Files area let you select how to deal with files that have the same name as the files you are exporting. There are three possible choices:

Existing Options	Description
Ask	If a file is found with the same name, a dialog box displays asking if you want to Overwrite, Cancel, or Cancel All.
Overwrite	If a file is found with the same name, the file is automatically overwritten with the file you are exporting.
Merge	The merge option is supplied only when exporting Acclaim *.asf* files. The selected *.asf* file is read for the skeleton definition and the *.amc* files are created based on this definition.

Additional export options

The area beneath the Existing Files options displays additional options that display depending on the file format that you are exporting. This section lists some of the more common file formats and their options.

Acclaim (*.*asf*, *.*amc*), Biovision (*.*bvh*), Motion Analysis (*.*htr*),

An additional option lets you export position data in either local (based on the location of the immediate parent) or global coordinates (based on the center of the scene). See Motion Analysis .htr format limitations on page 289 and Acclaim .asf and .amc format limitations on page 289 for a list of limitations that affect the export of these files.

Autodesk (*.*fbx*)

When exporting *.fbx* animation files, the Export table contains only the start and end columns.

Motion Analysis (*.*trc*), Vicon (*.*c3d*)

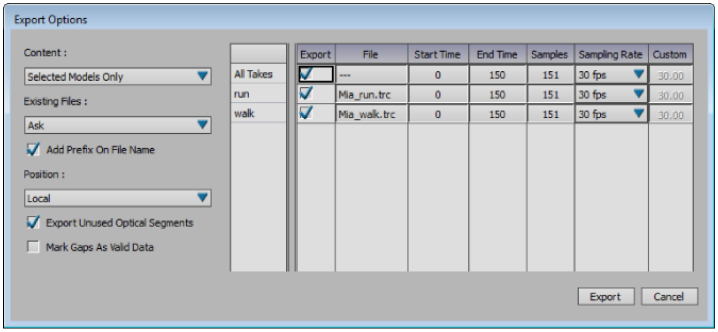
Two additional options let you export position data in either local or global coordinates, and mark gaps as valid data.

Exporting options for scenes

Depending on the scene you are exporting, other dialog boxes may appear, prompting you to enter additional information.

Use the file browser to choose a location and give the scene a descriptive file name. Make sure you save your scene with the proper extension. Otherwise, you may not be able to load your exported scene into other software packages.

Click OK to export your scene using the selected scene format. The Export Options dialog box appears, letting you select which parts of the scene you want to export.



Exporting options when exporting scenes

Depending on the scene format you are exporting, there may be limits to what can be exported.

Export BVH animation to Character Studio

If you want to use BIPED in Character Studio, you may have to export your animation as a Biovision (BVH) file. Before exporting your animation, you must create a biped-type skeleton with the proper naming conventions in MotionBuilder. You must also plot the animation onto the skeleton itself.

Character Studio imposes names for the skeleton's bones (nodes). If your skeleton does not use the following names (alternate names are shown in parentheses), then Character Studio rejects the skeleton when you import the *.bvh* file.

You must export your scene in *.bvh* format in order to bring it back into Character Studio.

NOTE Before you export a model from 3ds Max, make sure that you reset all transformations, the pivot, and the scale of your model.

Hips	Origin of the entire skeleton. Parent to LeftHip, RightHip, and Chest.
LeftHip (LeftUpLeg)	Must be child of Hips and parent to LeftKnee.
LeftKnee (LeftLowLeg)	Must be child of LeftHip and parent to LeftAnkle.

LeftAnkle(LeftFoot)	Must be child of LeftKnee.
RightHip (RightUpLeg)	Must be child of Hips and parent to RightKnee.
RightKnee (RightLowLeg)	Must be child of RightHip and parent to RightAnkle.
RightAnkle (RightFoot)	Must be child of RightKnee.
Chest	Must be child of Hips and parent to Left-Collar, RightCollar, and Neck.
LeftCollar	Must be child of Chest and parent to Left-Shoulder.
LeftShoulder (LeftUpArm)	Must be child of LeftCollar and parent to LeftElbow.
LeftElbow (LeftLowArm)	Must be child of LeftShoulder and parent to LeftWrist.
LeftWrist (LeftHand)	Must be child of LeftElbow.
RightCollar	Must be child of Chest and parent to RightShoulder.
RightShoulder (RightUpArm)	Must be child of RightCollar and parent to RightElbow.
RightElbow (RightLowArm)	Must be child of RightShoulder and parent to RightWrist.
RightWrist (RightHand)	Must be child of RightElbow.
Neck	Must be child of Chest and parent to Head.
Head	Must be child of Neck.

Motion Analysis .htr format limitations

The following limitations affect the export of Motion Analysis **.htr** files:

- Limits are not supported.
- Only one rotation order per file is supported.

Acclaim .asf and .amc format limitations

The following limitations affect the export of Acclaim *.asf* and *.amc* files:

- Limits are not supported
- Spheric XYZ Rotation Order is not supported
- Files without Base Poses (Rotation Offset) must have the Write Translation option active on export.
- Translation resets to the Translation Base Pose because MotionBuilder does not use the Translation Candidate.

Optimizing characters in 3ds Max for export to MotionBuilder

This section provides information about how to build characters, skeletons, apply skinning, and so on, in 3ds Max so it is read correctly by MotionBuilder.

To create a character in 3ds Max:

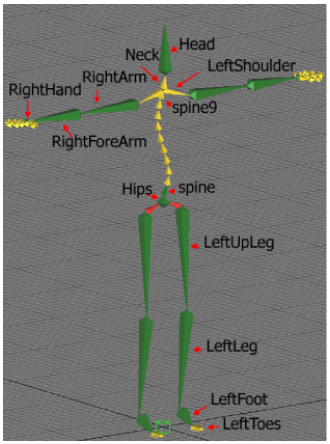
1. Build a mesh.
2. Apply the UV mapping.
3. Build a skeleton. See Optimizing 3ds Max skeletons for export to MotionBuilder on page 290.
4. Skin the character. See Optimizing 3ds Max skinning for export to MotionBuilder on page 292.

Optimizing 3ds Max skeletons for export to MotionBuilder

This section describes how to create a skeleton in 3ds Max for use in MotionBuilder.

To build a skeleton:

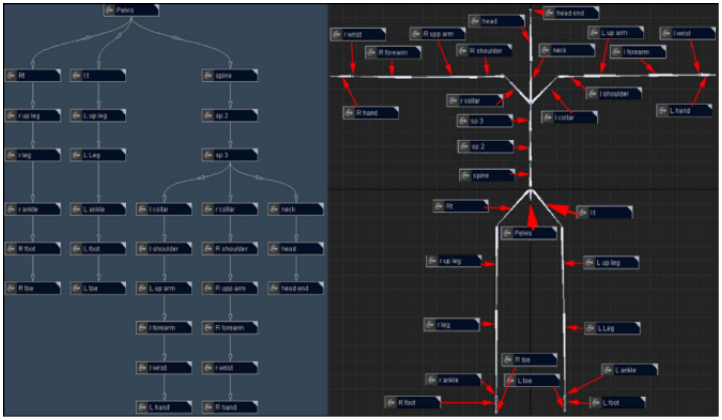
1 Create a skeleton in 3ds Max without IK chains (history independent). Refer to the following example.



3ds Max Hierarchy example

NOTE The green bones represent bones that must be dropped into the base slots of the Define pane in the Character Tool in MotionBuilder.

2 Build the skeleton using a standard hierarchy such as the one shown in the “Example Skeleton with IK Chains” diagram, below.



Example skeleton with IK chains

3 If you are mirroring bone chains to prevent negative scaling on the bone, select the Bone Mirror option. You can find the Mirror Bones option in 3ds Max Animation > Bone Tools > Object Properties > Mirror rollout.

NOTE We recommend that you export skeletons and mesh before skinning (vertex assignment) your characters so you can detect any negative and/or uniform scaling. Negative scaling of objects with weighting applied to them is not supported in MotionBuilder.

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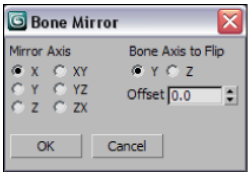
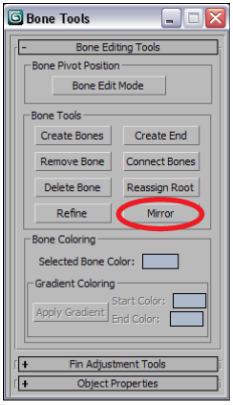
4 

Bone Mirror options

5 Select all the bones.

6 Select Animation > Bone Tools > Object Properties > Mirror from the 3ds Max menu bar.



Select the Mirror option.

NOTE Bones are considered Geometry, which lets you use Scale and Squash channels. However, these channels are not supported in MotionBuilder.

The skeleton is now ready to be exported into MotionBuilder. Use the *.fbx* file format for merging back into 3ds Max.

You can export geometry as bones in MotionBuilder, but it is treated as bones and is only visible in X-Ray mode.

Optimizing 3ds Max skinning for export to MotionBuilder

The following are some tips to preparing 3ds Max skinning so it can be read correctly in MotionBuilder.

- 3ds Max Weighting is supported only when applied to an Editable mesh or Editable poly.
- Skin and Physique are the only two 3ds Max weighting modifiers supported by MotionBuilder.
- You can apply Skin modifiers to two different objects in the same scene.
- Negative scaling on meshes that act as weight on a skeleton is not supported.

Physique Modifier Issues

Only Rigid envelopes are supported in MotionBuilder. Deformable and Partial blending envelopes are automatically converted to rigid envelopes in MotionBuilder.

Optimizing Maya scenes for export to MotionBuilder

The following topics provide information for optimizing Maya scenes prior exporting the scenes to MotionBuilder using the FBX plug-in.

Exporting NURBS from Maya using FBX plug-in

If you use the Maya FBX Plug-in to export to MotionBuilder, make sure that you use the option for the current FBX version for your export. If you do not do this, NURBS are lost and mesh normals may be inverted.

NOTE You can download the Autodesk FBX Plug-in for Maya by going to *http://www.autodesk.com/fbx* and clicking the **Downloads** link to the left.

In the FBX File Format FBX20100 version (under the Advanced Options of the FBX Exporter for Maya) , normals in normal per polygon/vertex mode are transformed to normals per vertex and hard edges become smooth edges.

See the Maya FBX Plug-ins documentation for details on each export version.

NOTE The Maya FBX plug-in is compatible with Windows XP/Vista, Mac OS® X, or Linux® operating systems running the Maya software product.

Exporting FBIK rigs from Maya using FBX plug-in

FBIK rigs must be exported from Maya with the current FBX plug-in version.

NOTE FBIK rigs exported from Maya with a version of FBX plug-in previous to version 2009.3 require the control rig settings Pull Iteration to be set to 10 to have full body mode.

To download the latest FBX plug-in:

1. Go to *http://www.autodesk.com/fbx*.
2. Click the **Downloads** link to the left.

3 Select the **FBX Plug-ins, Converter, and QuickTime Viewer Downloads** link.

4 Select the latest version of FBX plug-in for the Maya software version you are using.

Converting

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To convert FBX files to or from different versions of MotionBuilder, you must use the FBX Converter. The FBX Converter is a free utility that lets you transfer FBX files between different versions of MotionBuilder. It also lets you convert you FBX files to OBJ, DXF, and other 3DS files to the FBX file format, and vice versa. It enables you to transfer your entertainment, design, or visualization project data from one 3D application to another – including any professional 3D animation package.

The FBX Converter is available for Windows, Macintosh OS X, and Linux operating systems.

To download the latest FBX Converter:

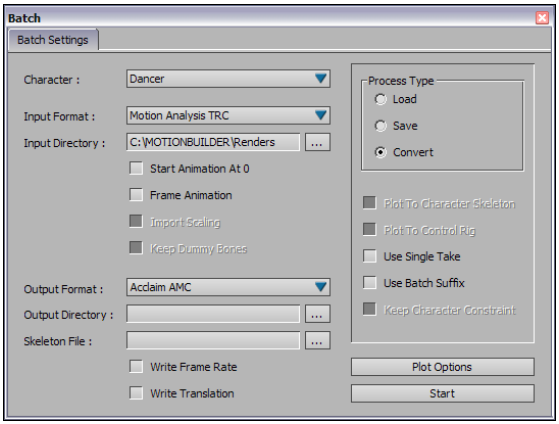
1. Got to *http://www.autodesk.com/fbx*.
2. Select the FBX Converter link and download the software.

NOTE The FBX Converter is included with MotionBuilder versions prior MotionBuilder version 2009.

Batch processing

16

The Batch window lets you convert multiple data files between different formats. You can batch load a series of data files onto the current character, or save all your takes to a specified data format.



Batch window

You can also save all takes mapped to a selected Actor, Character, or Control rig as separate motion files, and convert files from one format to another.

Before using the Batch window, you must have a character with mapped data from one of the data files that you want to load, save, or convert. All data files or takes must be from the same capture session, and from the same device.

When you import a motion file and map its motion to an Actor and then to a character, you are creating a guide for converting the other data files.

For example, if you have four motion files stored in Motion Analysis *.trc* format to convert to Acclaim *.amc* format, you can manually convert each file by loading each *.trc* motion file, mapping the data to an Actor and then a character, plotting the data to the character, then exporting each character as an *.amc* file.

The Batch window simplifies this process by letting you base all conversions on a single mapped character. To convert the same four *.trc* files previously mentioned, you only need to load the first *.trc* file, map its data to an Actor, then to a Character. You can use the Character as a guide to automatically convert the remaining motion files to *.amc* format.

NOTE You cannot use the Batch window to convert .fbx files created with FBX Plug-ins versions 200611 and later. If you want to perform a batch conversion, you must first use the FBX Plug-ins or FBX Converter to save the files in MB 7.5 / 2006.08 format and then perform the batch conversion. You can download the FBX Plug-ins and the FBX Converter at *http://www.autodesk.com/fbx*.

The Batch window is divided into two areas:

- Batch Input and Output area on page 301
- Batch Process Type area on page 303

  NOTE You cannot import biped animation and map it to a quadruped, or vice versa. For more information, see Bipeds and quadrupeds on page 1290

- Batch loading motion files on page 298
- Batch saving files on page 299
- Batch conversion on page 299
- Batch errors on page 305

Batch loading motion files

You can use the Batch window to load a series of data files onto the current character.

To batch load motion files:

1. Select the character on which you want to plot a group of files, then click Load.
2. Choose the format of the files you want to load (Input Format), the directory containing the files you want to load (Input Directory), and the Skeleton File used by the selected Input Format. See Batch Input and Output area on page 301.

3 Select Plot To Character or Plot To Control Rig if you want to plot the motion in your scene. See Batch Process Type area on page 303.

4 Click Start to load all the files from the Input directory and create a new take for each file.

When using Optical data, you must link your selected Character to an Actor with a Marker set that was specifically created for the group of files you want to load. The Actor input must be active.

Batch saving files

Use the Batch window to save all your takes to a specified data format, or save all takes mapped to a selected Actor, Character, or Control rig as separate motion files.

To batch save files:

1 Select the Character asset linked to the model with the data you want to save, then click Save.

2 Choose the format to which you want to convert each take (Output Format), select the directory to save the processed data files (Output Directory), and select a Skeleton File, if you are using Acclaim *.amc* format. See Batch Input and Output area on page 301.

The Batch process saves the data from the selected Character by default. If you would rather save the motion files from the Character's Control rig, activate the Save From Control Rig option. See Batch Process Type area on page 303.

3 Click Start to save a new file to the specified Output Directory for each take.

Batch conversion

Use the Batch window to convert multiple data files between different formats.

To batch convert files:

1 Select the Character asset you want to use to convert data files, then click Convert.

2 Select the file format you want to convert (Input Format), select the directory containing the files you want to convert (Input Directory), then select the skeleton used by the selected Input Format (Skeleton File). See Batch Input and Output area on page 301.

3 Choose the format to which you want to convert each take (Output Format) and the directory in which you want to save the processed files (Output Directory). See Batch Input and Output area on page 301.

4 Activate the Use Single Take function to use only one take to convert all files. Use Single Take if your computer is low in memory and cannot load many takes. See Batch Process Type area on page 303.

5 To complete the process, click Start to load all files from the Input directory. Load and save a new file to the Output directory for each Input file.

When using Optical data, you must specify a reference for an Actor when using the Batch window to do a batch convert. For example, if you convert from optical data to a character skeleton, you should specify the optical root as the Actor reference.

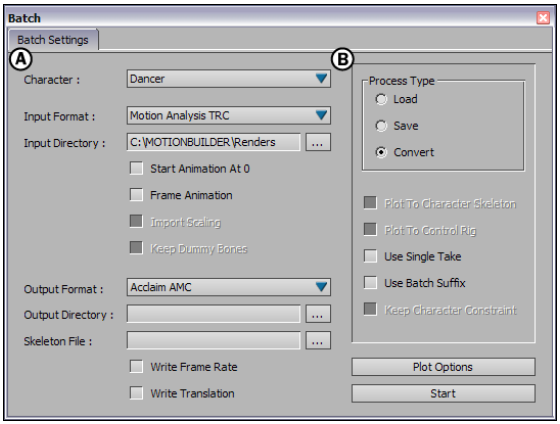
NOTE You cannot use the Batch window to convert .fbx files created with FBX Plug-ins versions 200611 and later. If you want to perform a batch conversion, you must first use the FBX Plug-ins or FBX Converter to save the files in MB 7.5 / 2006.08 format and then perform the batch conversion. You can download the FBX Plug-ins and the FBX Converter at *http://www.autodesk.com/fbx*.

Batch window

The Batch window lets you convert multiple data files between different formats. You can batch load a series of data files onto the current character, or save all your takes to a specified data format.

The Batch window is divided into two areas:

- Batch Input and Output area on page 301
- Batch Process Type area on page 303



Batch window *A*. Batch Input and Output area *B*. Batch Process Type area.

Batch Input and Output area

The Input and Output area lets you specify the input and output format and directory, as well as the skeleton.

Option	Function
Character menu	The Character menu displays all Character assets used in a scene. Use the Character menu to select a Character in a scene.
Input Format menu	Use the Input Format menu to specify the format of the files you want to load. All files used in a batch process must be the same format. For example, you cannot batch input Vicon .c3d and Acclaim .amc files together; you must perform two separate processes.
Input Directory field	Double-click the Input Directory field to type the path of the directory containing the files you want to load. You can also click the Open Directory (...) button to open an Open Directory window to browse for the directory.

Option	Function
Start Animation at 0 option	Activate the Start Animation at 0 option to correct any time shifts that affect animation keys. The Start Animation at 0 option sets the start time for all .fbx files loaded in the Batch window at time 0.
Frame Animation option	Activate the Frame Animation option to set the timeline start and end time to correspond with the start and end time of the animation data in the currently loaded motion file.
Import Scaling option	Since most motion file formats contain only translation and rotation animation data, MotionBuilder automatically sets any scaling animation data to a default setting of 1.0 upon file loading. Because this default setting can create errors with character appearances in certain situations, it is best to disable the Import Scaling option. This lets you leave the scaling animation of loaded motion files untouched.
Keep Dummy Bones option	When the Process Type is set to either Load or Convert and the selected input format is Acclaim .amc format, the Keep Dummy Bones option is active. Enable this option to retain the file's dummy bones.
Output Format menu	Use the Output Format menu to specify the format of the files that you want to convert.
Output Directory field	Double-click the Output Directory field to type the path of the directory in which you want to save the processed data files. You can also click the Open Directory (...) button to open an Open Directory window to browse for the directory. All processed files are saved in this directory.

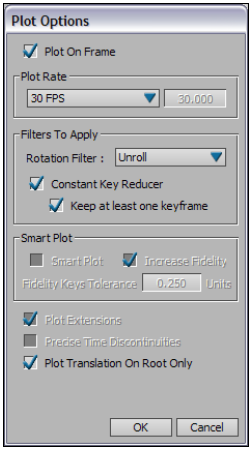
Option	Function
Skeleton File field	Double-click the Skeleton File field to specify a skeleton file to be used by Input or Output Format if you are using the Acclaim .amc format. The Acclaim .amc format requires a skeleton file. This setting is specific to Load or Merge processes only. If no file is chosen, MotionBuilder creates a new file. If a file already exists, a merge is created.
Write Frame Rate option	Activate the Write Frame Rate option to write the frame rate in Acclaim .amc files. When Write Frame Rate is active, you are loading, converting, or saving with the frame rate specified in MotionBuilder.
Write Translation	Activate the Write Translation option to save any translation animation data included with Acclaim .amc motion file formats. This lets you save anything describing animation translations, for example, the movement of a prop or slight stretching between the bones. Activating this option ensures that MotionBuilder always saves the translation animation data.

Batch Process Type area

The Process Type area lets you select options for the type of batch process you are using.

Option	Description
Load option	Activate the Load option to import motion files into separate takes. By default, the name of each take inherits the name of each file. See the Use Single Take option in this table for information on adding the suffix (batch) to each file.
Save option	Activate the Save option to save the data plotted to a Character or Control rig to individual data files.Each take saves in a

Option	Description
	separate file. By default, the name of each file is inherited from the name of each take. You do not have to link the Character you select to an Actor or other source. All takes must contain data plotted to the Character. Otherwise, nothing is saved for the take.
Convert	Activate the Convert option to convert data files. This is similar to loading and plotting a collection of data files to a Character, then saving the plotted results to individual data files. Using Convert simplifies the loading of motion files in one format and saving in another, into a single step.
Plot To Character Skeleton/Control Rig option	These options are only available when batch loading files. If neither of these options are selected, no data is plotted in your scene. Select either Plot To Character or Plot to Control Rig to determine the location to which you want to plot your data when you batch load files.
Save From Control Rig option	This option is only available when batch saving files. Use this option when you do not want the Batch process to save the plotted motion from the selected Character.
Keep Character Constraint option	This option is available when you are batch saving using .fbx files. Enable Keep Character Constraint to save the Character within each .fbx file.
Use Single Take option	This option is only available when you are batch converting files. Activate the Use Single Take function to use only one take to convert all files. Use Single Take if your computer is low in memory and cannot load many takes. To complete the process, click Start to load all files from the Input

Option	Description
	directory. Load and save a new file to the Output directory for each Input file.
Use Batch Suffix option	This option is available when you are batch loading, saving, and converting files. Activate the Use Batch Suffix option when you want the batch suffix to appear on your files. For example, if Use Batch Suffix is active when you save two .c3d files named “run_walk” and “walk_stand”, the new files are named run_walk(batch).c3d and walk_stand(batch).c3d.
Plot Options button 	Click Plot Options to open the Plot Options window, where you can set the options for plotting animation to the Skeleton or to the Control rig. Click Plot Options to open the Plot Options window, where you can set the options for plotting animation to the Skeleton or to the Control rig. All of the options in the Plot Options window are identical to those found in the Plot Properties window. See Plot Properties window on page 1893.
Start	Click Start when you are ready to load, save, or convert your batch files. Make sure you have all necessary options selected in the Batch window.

Batch errors

When batch loading, saving, or converting, there may be situations in which a Batch Error dialog box opens, informing you of one of the following errors:

Input Actor is not specified

The Character source is not set to Actor Input, or the Actor that the Character is using as its source does not have a Marker set.

Actor input markerset is not correctly associated with models

Indicates a problem with the Actor that the Character uses as its source. The Actor's Marker set was not set up properly, and it may be missing required mapping.

Can't open ASF skeleton file

This message appears when you try to batch load or convert with an Acclaim *.amc* file that does not have a matching *.asf* skeleton file. Use the Skeleton File field to specify the path name of the skeleton file(s).

Not enough memory to complete operation

When batch loading, this message appears if you fill all available memory. If this message appears while performing a batch convert operation, activate Use Single Take to use the same take for all conversions.

NOTE You cannot use the Batch window to convert .fbx files created with FBX Plug-ins versions 200611 and later. If you want to perform a batch conversion, you must first use the FBX Plug-ins or FBX Converter to save the files in MB 7.5 / 2006.08 format and then perform the batch conversion. You can download the FBX Plug-ins and the FBX Converter at *http://www.autodesk.com/fbx*.

Rendering

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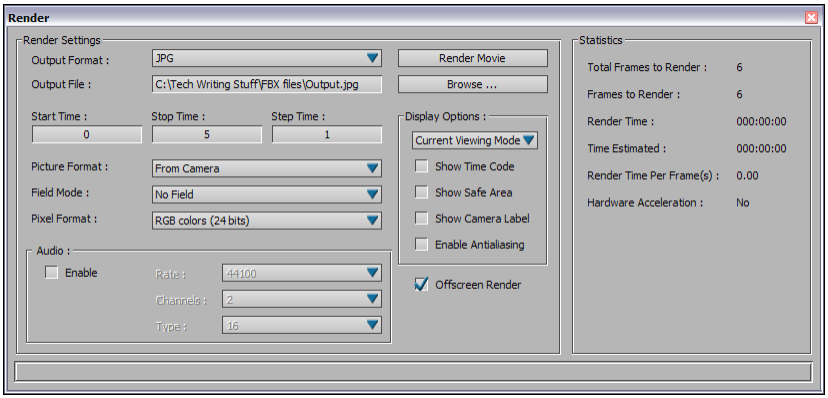
In MotionBuilder, you can always view your animations in real-time as you work. You can also use the rendering tools, such as the Render window after you have completed your animation to render the scene and create test clips of your animation.



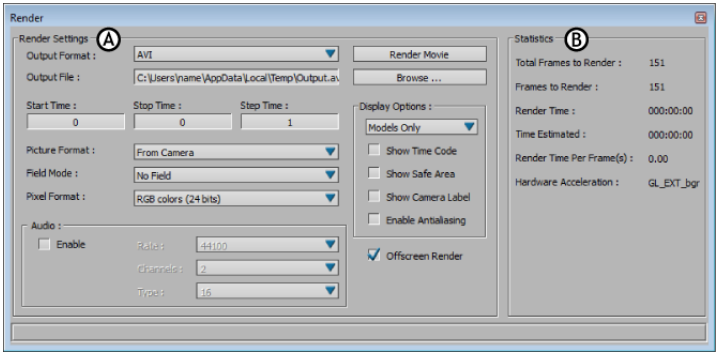
Render window

Render window

The Render window lets you do the following:

- Render takes to *.avi* or *.swf* files, or to a series of *.tif*, *.tiff*, *.jpg*, or *.tga* files.
- Create and modify settings for capturing *.avi*, *.swf*, *.tif*, *.tiff*, *.jpg*, or *.tga* files.
- Create test clips of your animation.

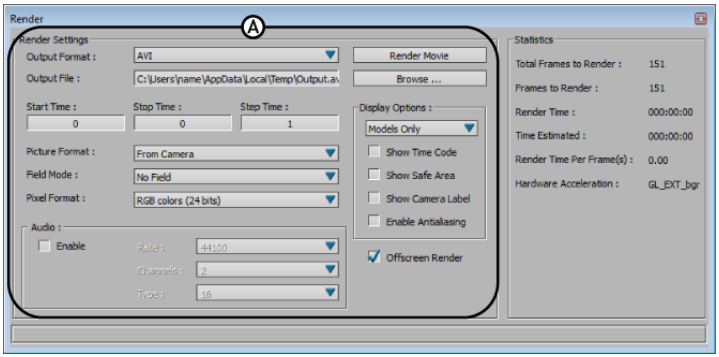
The Render window consists of two areas (A and B): the Render Settings area on page 308, and the Statistics area on page 313.



Render window *A.* **Render Settings area** *B.* **Statistics area**

Render Settings area

The Render Settings area lets you modify the length, speed, size, color, and format of your rendered files.



Render window *A.* **Render Settings area**

Output Format menu

The Output Format menu lets you select from the following render file formats:

Format	Description
AVI	Renders all specified frames to a single *.avi* file. When you select AVI as the Output Format and click Render Movie, the Video Compression dialog box appears. See Video Compression dialog box on page 316.

Format	Description
SWF (Flash)	Renders the scene as a *.swf* movie file. When you select SWF (Flash) as the Output Format and click Render Movie, Flash Render Options dialog box appears. See Flash Render Options dialog box on page 317 for more information.
TGA	Renders each specified frame to a separate *.tga* file. The file name of the first frame is *<name>0000.tga* (where *<name>* is specified in the Output File Name field). The next frame is saved to *<name>0001.tga*, then to *<name>0002.tga*, and so on.
JPG	Renders each specified frame to a separate *.jpg* file. The file name of the first frame is *<name>0000.jpg* (where *<name>* is specified in the Output File Name field). The next frame is saved to *<name>0001.jpg*, then to *<name>0002.jpg*, and so on.
TIF/TIFF	Renders each specified frame to a separate *.tif* file. The file name of the first frame is *<name>0000.tif* (where *<name>* is specified in the Output File Name field). The next frame is saved to *<name>0001.tif*, then to *<name>0002.tif*, and so on.
YUV	Renders the take in YUV color format, ideal for television output.
MOV	Renders all specified frames to a single *.mov* file. When you select MOV as the Output Format and click Render Movie, the Compression Settings dialog box appears. See Compression Settings dialog box on page 322.

Output File field

Use the Output File field to enter the path and name of the output file. Click Browse to navigate your file system, and select where to save the rendered file.

If you type in the path and file name, remember to name your file using the proper extension so the rendered file can be loaded by other software.

Browse button

Click Browse to open a file browser to let you locate the directory where you can save your rendered file.

Start, Stop, and Step Time fields

The Start, Stop, and Step Times appear in frames per second or timecode format depending on the settings in the Transport Controls window.

Use the Start Time field to set the starting frame or timecode. All animation before the start frame or timecode is not included in the rendered file.

Use the Stop Time field to set the end frame or timecode. All animation after the stop timecode is not included in the rendered file. When you click Render Movie, the scene is rendered from the Start Time until the Stop Time.

Use the Step Time field to set the increment used when rendering between the Start and Stop Times. By default, the increment is set to one frame.

Picture Format menu

Use the Picture Format menu to select the resolution of the image to be rendered.

Changing the image size also changes the size of the preview window. MotionBuilder supports many resolutions from D1 NTSC (720 x 486) to full screen (1280 x 1024).

You can also set the image format by selecting the From Camera option and configuring the Current Camera's settings. See Camera settings on page 439 for more information on configuring camera settings.

Field Mode menu

Depending on the format you choose in the Format Mode menu, you may also want to select a field rendering mode from the Field Mode menu.

NOTE Field Mode is not available when rendering .swf files.

Pixel Format menu

Use the Pixel Format menu to select the color depth of your image. Selecting the color depth may change the Hardware acceleration shown in the Statistics area on page 313. MotionBuilder supports standard color depths.

Audio area

Activate the Enable option so you can render the audio in your scenes.

NOTE The Audio option is available only when creating .avi and .mov renders.

Rate menu

The Rate menu lets you set a sampling rate for your computer's audio hardware.

Channels menu

The Channels menu lets you choose whether the render is a stereo or mono file. You have two choices:

Option	Description
2 (Stereo)	Stereo audio sources contain separate left and right channels and display two waveforms.
1 (Mono)	Mono audio sources contain a single channel and display one waveform.

Type menu

The Type menu lets you select the number of bits used by your computer's audio hardware. You have the choice between 8 and 16-bits.

Render Movie button

Click Render Movie to render your scene to the selected Output File, using the selected Output Format.

Depending on what type of Output Format you have selected in the Render Settings pane, additional dialog boxes may appear first to let you define other settings. For example, when you select AVI as the Output Format, the Video Compression dialog box appears.

Refer to the descriptions of each format under Output Format menu on page 308 for more information on the additional dialog boxes.

Display Options menu

The Display Options menu contains options concerning what information you want to appear on the rendered take.

Select the appropriate render type from the Display Options menu. The following selections let you choose what is visible in the final render.

Option	Description
Current Viewing Mode	Select Current Viewing Mode to make the final render show whatever is currently shown in the Viewer window, including skeletons, markers, selected items and so on.
Normal	Select Normal to make the final render with only the model, without skeletons or markers.
Models Only	Activate Models Only to hide all markers, Nulls, skeletons, cameras, and other objects that are related to the MotionBuilder interface.
X-Ray	Select X-Ray to have the final render show everything that is shown in the Viewer window's X-Ray mode.

Show Time Code

Activate Show Time Code to have the timecode appear on the rendered take.

Show Safe Area

Activate Show Safe Area to have the Safe areas display in the rendered take.

Show Camera Label

Activate Show Camera Label to have the Camera label (the white text in the bottom left corner of the Viewer window) display in the rendered take.

Enable Antialiasing

Activate Enable Antialiasing to add a slight blur when rendering. See Anti-aliasing and oversampling on page 481 for more information.

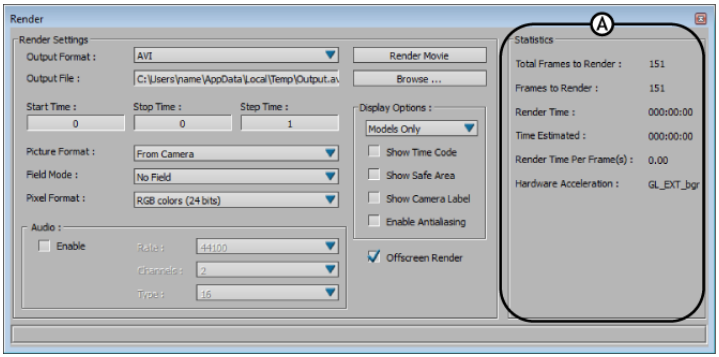
Pixel Format, Antialiasing, Show Time Code and Safe Area are not available when rendering *.swf* files.

Offscreen Render

Activate Offscreen Render to hide the Render Preview window while rendering. When Offscreen Render is activated, the render progress bar at the bottom of the Render window indicates the status of the rendering process. Hiding the Render Preview window saves system resources. This option is active by default.

Statistics area

The Statistics area displays the render status while your scene plays in the Render window.



Render window *A.* **Statistics area**

The Statistics area is only provided as a reference. You can modify the Statistics fields using the options in the Render Settings pane.

Field	Description
Total Frames to Render	Gives the total number of frames between the Start and Stop times.
Frames to Render	While rendering, acts as a counter showing how many frames remain to render.
Render Time	Indicates the elapsed rendering time, measured in seconds.
Time Estimated	Estimates the amount of time remaining to render the rest of your take.
Render Time Per Frame(s)	Shows the amount of time it takes to render each frame.
Hardware Acceleration	Displays the hardware accelerator used to render. The accelerator shown depends on your computer system.

- Video Compression dialog box on page 316
- Flash Render Options dialog box on page 317

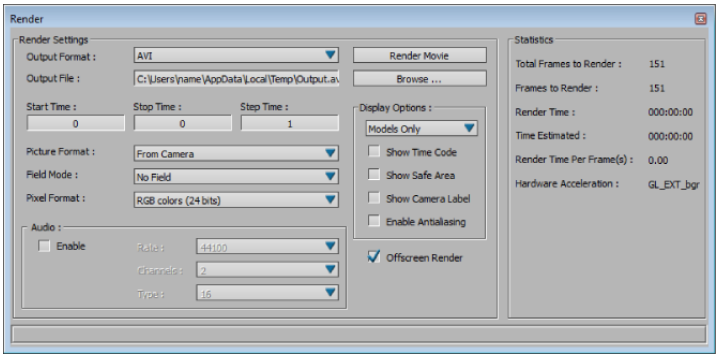
■ Compression Settings dialog box on page 322

Rendering a scene

You can use the render window to create test clips or stills of your animation.

To render a scene:

1 Select File > Render from the menu bar. The Render window appears.



Render window

NOTE If your current video buffer mode does not support an Alpha channel, a warning message appears each time you open the Render window. Click Hide this Message if you do not want this message to appear again.

2 Click Browse to set the destination path for your rendered file(s).

3 Set a start and stop time in the Render window's Start and Stop Time fields.

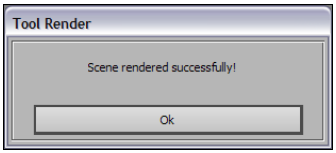
4 Set a Picture format. See Picture Format menu on page 310 for information about Picture formats.

5 Select an output format from the Output Format menu. See Output Format menu on page 308 for a description of the different Output formats you can use.

6 Click Render Movie. Depending on which output format you select, a window may appear with specific compression formats settings. Adjust these as needed.

7 Click OK.

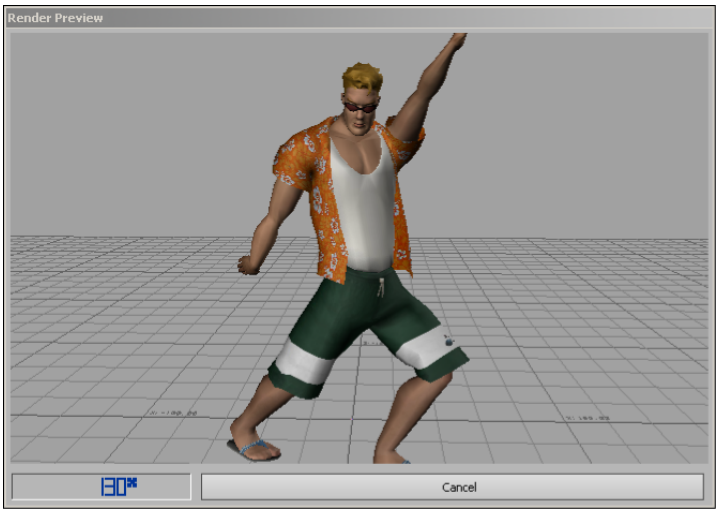
The selected segment of the scene is rendered into the format specified in the Output Format menu and saved to the destination specified in the Render window Output File field. A window appears to tell you the scene has rendered successfully.



A window appears to tell you the scene has rendered successfully.

Render Preview window

When the Offscreen Render option is deactivated, the Render Preview window opens as you render your scene, showing a preview of the frames being rendered. It also shows a frame count in frames per minute or timecode format, depending on the settings in the Transport Controls window.



Render Preview window

Depending on what Output Format you select in the Render Settings, the Render Preview window appears after you click Render Movie, or after you click Render Movie and define additional settings in the resulting dialog boxes.

For example, if AVI is selected as the Output Format when you click Render Movie, the Video Compression dialog box appears first, asking you to select the type of Video compression. The Render Preview window then appears after you click OK.

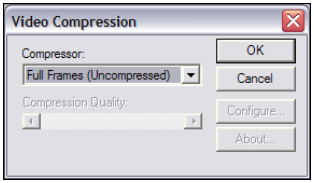
When rendering is completed, a dialog box appears to tell you that the scene was rendered successfully.

NOTE If you want to render with an Alpha channel but your buffer does not support Alpha channels, MotionBuilder switches to a software-generated Alpha channel.

- Render window on page 307
- Render Settings area on page 308

Video Compression dialog box

The Video Compression dialog box appears when you have selected AVI, click the Render Movie button in the Render window.



Video Compression dialog box

The Video Compression dialog box contains a menu with different file formats to which you can output your file. The types of compression available depend on your computer system.

If you select the Indeo video 5.10 codec, a compression slider appears, and the Configure button is enabled.

Click Kin the Video Compression dialog box to confirm that you want to render.

Compression Quality Slider

A Compression Quality slider appears when you use certain output formats, for example, the Indeo video 5.10 codec.

Use this slider to adjust the amount of compression used when the file is output to this format, with 100 being maximum compression and minimum image quality, and 0 being minimum compression and maximum image quality.

Configure Button

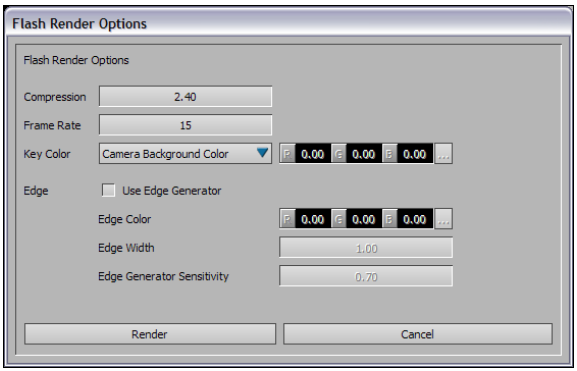
The Configure button is activated when you select certain compression formats, such as the Indeo video 5.10 codec.

Click Configure to display a Configuration window. Depending on the compression standard used, the Configure window shows different settings related to the compression format. For further information, consult the documentation that accompanies the compression format.

- Render window on page 307
- Render Settings area on page 308

Flash Render Options dialog box

The Flash Render Options dialog box appears when you render a take with SWF (Flash) selected in the Output Format field.



Flash Render Options dialog box

This dialog box lets you add internal and external edges to your character, set the compression and frame rates, and select the Key Color for your *.swf* file.

During rendering, Internal and External edges do not show in the Render Preview window, however, they do appear in the rendered clip.

Flash versions 4.0 and higher can play the rendered *.swf* file.

Compression

The Compression field lets you define the compression factor for your *.swf* file. This compression rate also affects the error rate for lines in the rendered image.

A higher compression rate displays images with less linear definition, and produces a smaller file size. With a lower compression rate, the rendered lines better fit your curve region, but the final file size is significantly larger.

Frame Rate

Use the Frame Rate field to set the frame rate per second for the output *.swf* file. The default frame rate is fifteen.

Flash movies typically use a frame rate of 12 frames per second. To achieve a similar frame rate, set MotionBuilder to 30 frames per second, and specify a step of 2 in the Step Time field. This forces the renderer to generate a frame at every second frame, resulting in a Flash movie with a frame rate of 15 frames per second.

Key Color

Use the Key Color menu to select a color to be rendered as transparent. The Key Color menu contains the following options:

Camera Background Color

Renders the background color of the camera transparent. When this option is selected, any other objects or materials in your file that are the same color as the background color are also transparent in the output file.

Specific Color

Lets you define your own color to be interpreted as transparent using the RGB color value fields beside the Key Color menu.

No Color Key

Your file renders without a Key Color.

Edge

The Edge area includes the Use Edge Generator option, as well as fields to define the Edge Color, Edge Width, and Edge Generator Sensitivity.

Use Edge Generator

Activate Use Edge Generator to make the Render window analyze color differences so that borders are added between shaded areas in your scene.

Use Edge Generator uses the color difference between two regions to determine if an edge is displayed. The Edge Generator Sensitivity value lets you adjust at which point the color difference creates an edge.

Edge Color

Use the Edge Color fields to select the display color for Edge Generator borders.

Edge Width

Use the Edge Width field to define the Edge Generator border's thickness.

Edge Generator Sensitivity

Use the Edge Generator Sensitivity field to determine the degree of color variance required for a border to be added between two shaded areas. A lower value in this field results in fewer edges being added to your scene.

- Flash Renderer limitations on page 319
- Rendering a scene on page 314

Flash Renderer limitations

The Render window lets you render your takes as Adobe® Macromedia Flash®.*swf* movie files. However, not all scenes, models, and shaders translate well into Flash *.swf* movies.

To successfully export your scene as a Flash movie, you should take note of the limitations described in the following sections.

Multi-material Models

The Flash Renderer does not support models with multiple materials or textures. Try to use only two or three colors, as the Flash Renderer must convert the material or texture data into vectors.

All models should be either single material models or have one of the compatible shaders applied to them. If you attempt to export a model with many materials, it may render as gray. You can hide all models you do not want to export.

Textures

Only very simple textures should be used with the Flash Renderer. Ideally, there should be only two or three colors, no gradients, no anti-aliasing, and only simple images, such as a star.

If you have several pixels with different colors, the vector creation process (picture-to-Flash conversion) generates several regions. The file size is much larger than an *.avi* render.

The Flash Renderer takes the rendered picture and finds a uniform color region. The color must match perfectly; the Flash Renderer does not support color thresholds.

Shaders

You can render a Flash *.swf* file using shaders, with a few exceptions. The following shaders do not work with the Flash Renderer:

- Live Shadow shader
- Matte shader
- Reflection shader
- Selective Lighting shader
- Shadow Map shader
- Wire Frame shader

To render a file using the remaining shaders, follow the procedures provided for each shader, in the following sections.

Edge Cartoon Shader

Before you use an Edge Cartoon shader for rendering, try to generate edges with the Use Edge Generator option in the Flash Render Options dialog box. Edges created in this way take up less space than those rendered with the Edge Cartoon shader. See Edge on page 319 for more information on Edge generation.

NOTE If you use the Edge Cartoon shader with Flash rendering, you can get better results if you set a larger Minimum Width value. The larger the Minimum Width value, the more pixel space the Edge Generator uses to create a uniform region for the entire continuous edge.

Flat Shader

There are no problems with the Flat shader when you use the Flash Renderer.

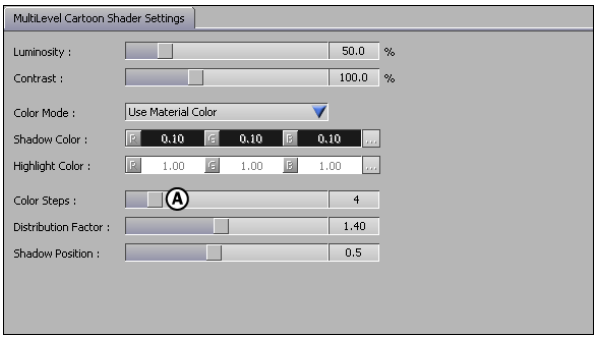
Lighted Shader

Rendering with the Lighted shader is good for low polygon models. No gradients appear when you render with a Lighted shader; they appear only as a flat color.

Multilevel Cartoon Shader

The Multilevel Cartoon shader lets you apply a posterized effect with full control over the luminosity, contrast, and number of steps in the gradient between the shadow and highlight colors.

The Flash Renderer only supports up to four Color Steps between the Shadow Color and Highlight Color. If you specify more than four steps, the gradient between the Shadow and Highlight Color adjusts automatically to only four steps.



MultiLevel Cartoon Shader Settings *A.* **Color Steps**

For the best results, use two or three steps, with increased steps resulting in a complex rendering of the *.swf* file.

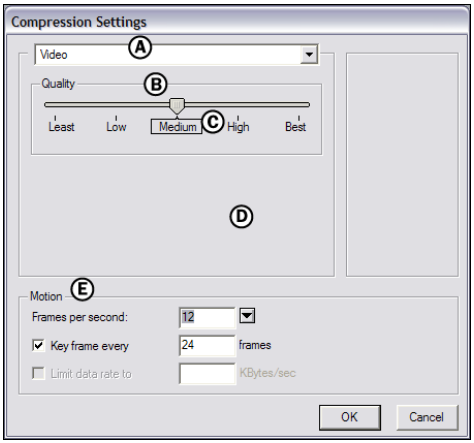
Particle Shader

If you use the Particle shader when rendering, always use the Matte Display Mode, as the Flash Renderer is vector-based and cannot support particles.

- Render window on page 307
- Flash Render Options dialog box on page 317

Compression Settings dialog box

If you select MOV from the Output Format menu in the Render Settings area and click Render Movie, the Compression Settings dialog box opens to let you set the compression options for the render file.



Compression Settings dialog box *A.* **Compression Settings menu** *B.* **Depth menu** *C.* **Quality slider** *D.* **Options area** *E.* **Motion area**

The Compression Settings dialog box includes the following options:

Compression Settings menu

Choose a compression type from the compression settings menu:

- Animation

- Cinepak
- Component Video
- DV- PAL
- DV-DVCPRO-NTSC
- DV-DCVPRO-PAL
- H261
- H263
- Intel® Indeo Video 4.4
- Motion JPG A
- Motion JPG B
- MPEG-4 video
- None
- Photo JPG
- Sorenson Video
- Sorenson Video 3
- Video

Depth

The Depth menu only appears if you select Animation, Cinepak, Graphics, Motion JPG A/B, None, Photo JPG, and Sorenson Video 3 formats. Use this menu to set the color depth for your render.

Quality

The Quality slider only appears if you select Animation, Cinepak, DV- PAL, DV-DVCPRO-NTSC, DV-DCVPRO-PAL, Graphics, H261, H263, Intel Indeo Video 4.4,Motion JPG A/B, MPEG-4 Video, None, Photo JPG, Sorenson Video, Sorenson Video 3, and Video formats. Use the Quality slider to set the resolution of your render, from Least to Best.

Options

Click the Options button to set extra options specific to the compression format you set.

Option	Description
H263	The H263 Encoder options let you specify the encoded image resolution.
Intel Indeo Video 4.4	The Intel Indeo Video 4.4 Encoder Configurations options let you set encoder controls, transparency and activate an access key.
Motion JPG A/B	The Motion JPG A/B Field settings options let you specify the field numbers and dominance when using the Motion JPG format.
Photo JPG	The Photo JPG options let you optimize the render for streaming, and let you use RFC 2035 compatibility for less error correction.
Sorenson Video/Sorenson Video 3	The Sorenson Video settings option lets you view information about the render's compression quality, with information about things such as the key frame size and the frame dropping rate.

Motion

The Motion area of the Compression Settings dialog box lets you control the frame rate of your render, as well as some specific controls that vary depending on the compression format chosen.

- Render window on page 307
- Render Settings area on page 308

Rendering a .tga, .tif, .tiff, or .yuv file

You can render your scene as a *.tga*, *.tif*, *.tiff*, or *.yuv* file.

To render a *.tga*, *.tif*, *.tiff*, or *.yuv* of your scene:

1 Select File > Render from the menu bar. The Render window appears.

2 Select.*tga*, *.tif*, *.tiff*, or *.yuv* from the Output menu.

3 Set a start and stop time in the Render window's Start and Stop Time fields.

4 Click Render Movie. An image file is created for each frame specified in step 3.

Rendering an .avi or .mov file

You can render files in the *.avi* or *.mov* movie format.

To render a movie in *.mov* or *.avi* format:

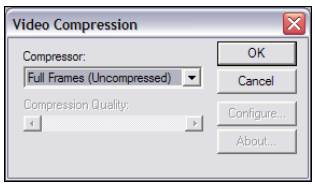
1 Select File > Render from the menu bar. The Render window appears.

2 Select *.avi* or *.mov* from the Output menu.

3 Set a start and stop time in the Render window's Start and Stop Time fields.

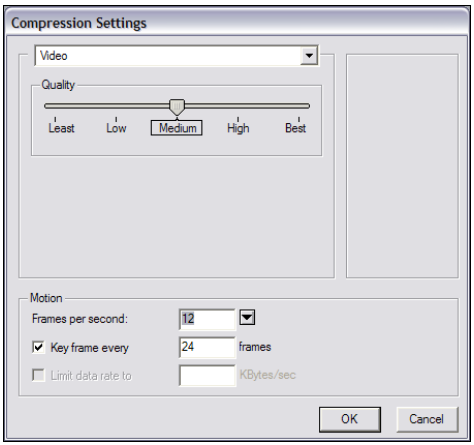
4 Click Render Movie.

- If you selected *.avi* as your file format, the Video Compression dialog box appears. See Video Compression dialog box on page 316 for more information.



Video compression dialog box

- If you selected .mov as your file format, the Compression settings dialog box appears. See Compression Settings dialog box on page 322 for more information.



Compression Settings dialog box

5 Select the appropriate compression settings in the dialog box.

6 Click OK.

The selected segment of the scene is rendered into *.avi* or *.mov* format and saved to the destination specified in the Render window Output File field.

Rendering scenes as .jpg files

You can render scenes as *.jpg* images.

To render a scene as *.jpg* images:

1 Select File > Render from the menu bar. The Render window appears.

2 Select JPG from the Output menu.

3 Set a start and stop time in the Render window's Start and Stop Time fields.

4 Click Render Movie. The Image Options window appears.

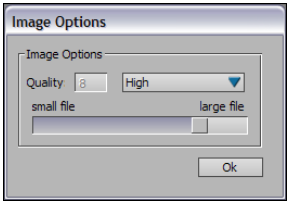


Image Options window

5 Use the Render slider bar to set the final size of the rendered *.jpg* image(s). You can also select a preset of Low, Medium, High, or Maximum from the Quality menu.

6 Click OK.

The selected segment of the scene is rendered into *.jpg* format and saved to the destination specified in the Render window Output File field.

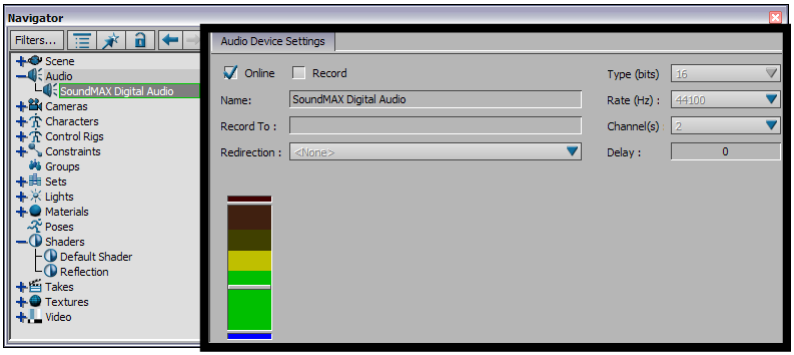
NOTE An image file is created for each frame specified in step 3.

Audio

18

The Audio settings let you load and view audio files and devices, as well as record audio files (in *.wav* format).

The Audio settings in the Navigator window change depending on what is selected in the Scene browser.



Audio Device Settings

- If the Audio folder is double-clicked, the Global Audio settings appear with a field for setting the playback delay.
- If an audio device is double-clicked in the Scene browser, the Audio Device Settings appear with information and settings that correspond to your computer's default audio device.
- If an audio file is double-clicked in the Scene browser, the Audio Settings appear with information and settings that correspond to the audio file you just clicked.

Before you use the Audio settings, ensure that Enable Audio is activated in the Preferences window's Loading pane.

NOTE MotionBuilder supports *.wav* and *.mp3* files. If the QuickTime® Runtime Library is installed, MotionBuilder supports many more file formats for playback. (The QuickTime Runtime library is installed when you install Apple QuickTime. Install QuickTime from *http://www.apple.com/quicktime/*).

■ Connecting to an audio device on page 330

Connecting to an audio device

MotionBuilder recognizes all audio hardware connected to the computer and displays it in the Audio folder.

To connect an audio device:

1. Select your audio device in the Scene browser Audio folder.
2. Activate the Online option to start communication with the Audio device when you are ready to start recording.

   Once Online is activated, the audio input displays in the Record area.
3. Test the levels and settings before you click Record.

   NOTE Activating Online does not start the recording process, it simply makes MotionBuilder open the connection to the selected audio hardware.

To set a new audio device:

1. If you have installed new audio hardware, reset your default audio device using your computer's audio settings.
2. Restart MotionBuilder.
3. Choose the audio device that is selected as the default device on your computer with the Audio settings Destination menu.

■ Accessing audio from disk or memory on page 338

■ Recording audio on page 333

Loading audio files

There are two ways to load audio files, through the Menu bar and through the Transport controls.

To open an audio file using the Menu bar:

1. In the MotionBuilder Menu bar, Select File > Import Audio.

   The Import Audio file browser appears.

2. Browse for a *.wav* or *.mp3* file.
3. Click Open.
4. The file is loaded in your scene and the Audio settings appear in the Navigator window.

To open an audio file using the Transport Controls:

1. Right-click the Action Timeline in the Transport Controls and select Audio > Open Audio Clip from the contextual menu.

   The Import Audio file browser appears.

2. Browse for a *.wav* or *.mp3* file. Click Open.
3. The file is loaded in your scene and the Audio settings appear in the Navigator window.

   NOTE If audio files are already in the Asset or Scene browsers, simply drag them into the Viewer window.

- Playing audio files on page 331
- Connecting to an audio device on page 330

Playing audio files

You can load and play *.wav* and *.mp3* audio files.

To play an audio file:

1. Load an audio file into the Audio settings.
2. Double-click the audio file in the Scene browser.

3 Click Play in the Audio settings or Transport Controls to preview the audio file.

4 Click Stop to stop the file.

NOTE MotionBuilder supports *.wav* and *.mp3* files but if you install the QuickTime® Runtime Library, MotionBuilder supports many more file formats for playback. (The QuickTime Runtime library is installed when you install Apple QuickTime. Install QuickTime from www.apple.com/quicktime/).

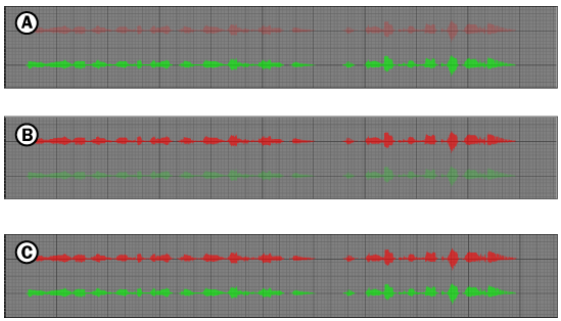
■ Playing back audio channels on page 332

Playing back audio channels

The Use Channel menu lets you select Left, Right, or Left+Right channel playback.

NOTE When you select only one channel, it plays in both speakers.

- Select the Right channel, to show only the red (right) waveform in the Waveform area.
- Select the Left channel, to show only the green (left) waveform in the Waveform area.
- Select Left + Right to play the Left and Right channels together; both the green and red waveforms are shown in the Waveform area.



Waveform channels *A.* **Left channel only** *B.* **Right channel only** *C.* **Both channels**

If a channel is disabled it is still displayed, but it is grayed-out.

- Accessing audio from disk or memory on page 338
- Loading audio files on page 331
- Playing audio files on page 331

Recording audio

Use the Audio settings to record audio files in *.wav* format.

To record .wav files with the Audio settings:

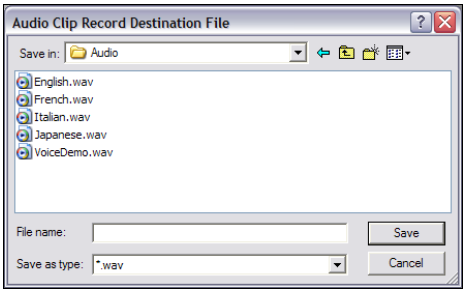
1 Select the hardware that you want to use to record a **.wav** file in the Scene browser.

TIP When recording, monitor the audio levels to make sure that a waveform appears. Otherwise, your **.wav** file may be inaudible.

---

2 Activate both the Online and Record options.

3 A dialog box appears so you can select a location to save your *.wav* file.



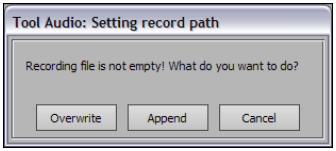
Audio Clip Record Destination File window

4 When you are ready to record, click Record in the Transport Controls.

Transport Controls *A.* **Record button**

5 Both the path and file name of the new *.wav* file appear in the field beside the Record button.

6 Select Overwrite or Create in the Record Path dialog box.



Record Path dialog box

7 If you select Create, the Record Path dialog box appears asking if you want to copy the current take.

8 Cue the audio for recording using the Record button in the Transport Controls window.

9 Click Play to begin recording, and click Stop to end it.

10 A *.wav* file is created and added to the chosen directory as well as to the Audio folder in the Scene browser.

To hear your recorded *.wav* file, select the *.wav* file from the Audio folder, and click Play in the Transport Controls window.

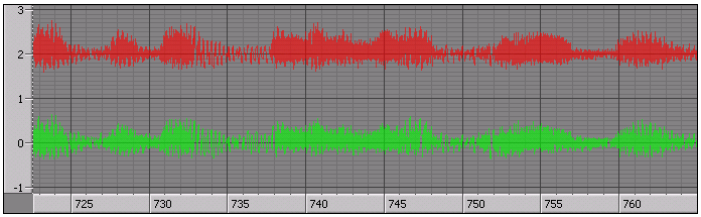
To record in mono or stereo:

➤ Before recording, select an option from the Audio Device Properties area Use Channel menu:

- Select 1 to record in mono. Mono audio sources contain a single channel and display one waveform.
- Select 2 to record in stereo. Stereo audio sources contain separate left and right channels and display two waveforms.
- Creating an audio delay on page 337
- Connecting to an audio device on page 330

Audio waveform

A waveform is a graphical depiction of the continuous fluctuation in the amplitude of a sound over time. Waveforms show us the sound's volume as time progresses; the larger the waveform, the louder the sound.



Audio waveform

Red waveforms are used to depict the right channel and green waveforms depict the left channel.

- Navigating the Audio waveform area on page 335
- Loading audio files on page 331
- Playing audio files on page 331

Navigating the Audio waveform area

You can navigate the Waveform area by *Ctrl*-dragging left, right, up, and down to zoom in and out. You can also scroll the waveform by *Shift*-dragging up and down.

There are two areas where you can scrub or shuttle through an audio file: on the audio waveform or in the Transport Controls:

To shuttle through an audio file's waveform:

1. Activate Enable Shuttle in the Audio Settings.

   NOTE If more than one audio file is used in the scene, only one of these files can have shuttling activated.

2. J-drag in the Viewer window or audio waveform.

   The speed at which the track shuttles varies depending on the distance between where you click, and how far you drag.

The further you drag to the right, the faster the track shuttles forward. The further you drag to the left, the faster the track shuttles backward.

TIP The audio file shuttles at the speed set in the Transport Controls. Disable shuttling if your disk access is slow.

To scrub through a track to hear the audio on a specific frame:

1. Select Snap on Frames in the Transport Controls.
2. Move the timeline indicator back and forth.

   You can also use the Previous frame and Next frame buttons to scrub through the track frame by frame.

- Navigating the Audio waveform area on page 335
- Connecting to an audio device on page 330
- Caching audio on page 337

Creating an audio offset

To trigger a *.wav* file so it plays at a time other than the beginning of the take, enter a value in the Audio Settings In Point field.

To create an audio offset:

1. Load an audio file in the Audio settings.
2. Double-click the In Point field, and enter a value or drag right on the value until the In Point timecode equals the amount of time you want to offset the audio file.

   The waveform moves to the appropriate place in the Waveform area.

NOTE The In Point field displays the same measurement as the Frame Rate field in the Transport Controls window.

- Loading audio files on page 331
- Creating an audio delay on page 337
- Accessing audio from disk or memory on page 338

Creating an audio delay

You can create an audio delay if you are streaming live audio with the Voice device to compensate for the time it takes the voice device to process the phonemes of the live audio.

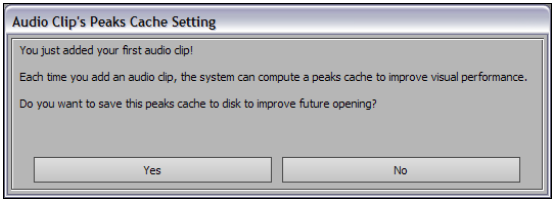
To create an audio delay:

1. Before recording or playing audio, select an audio device from the Redirection menu.
2. Enter a value to in the Delay field.
3. Record or play your audio.

- Loading audio files on page 331
- Creating an audio offset on page 336
- Accessing audio from disk or memory on page 338

Caching audio

The first time you load an audio file, the Audio Clip's Peaks Cache Setting dialog box appears.



Audio Clip's Peaks Cache Setting dialog box

NOTE This option is only offered the first time you load an audio file.

If you choose to save your audio cache files, they are saved to the same location where your audio files are stored.

- Loading audio files on page 331
- Accessing audio from disk or memory on page 338

Accessing audio from disk or memory

If you do not have much available memory on your computer, it may be more efficient to access large *.wav* files from disk. However, if your hard disk has a slow access time, it may not be possible to play the *.wav* file in real-time.

To access your audio file from either disk or memory:

1. Load an audio file in the Audio settings.
2. In the Audio settings Media Access menu, choose either Disk or Memory.

- Caching audio on page 337
- Creating an audio delay on page 337

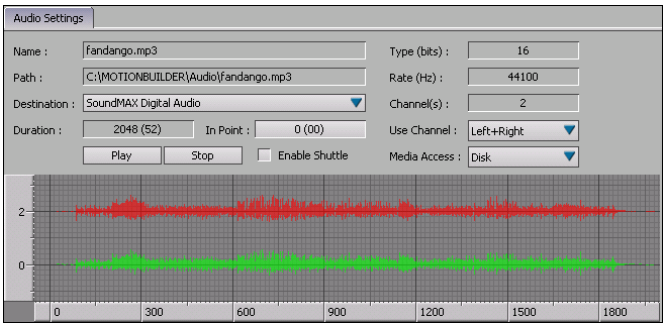
Audio settings

The Audio settings display in the Navigator window when an audio clip is selected from the Scene browser. It is divided into two areas:

- Audio Properties area on page 338
- Audio Waveform area on page 340

Audio Properties area

When an audio clip is selected from the Audio folder, the Audio Properties area shows the selected clip's settings.



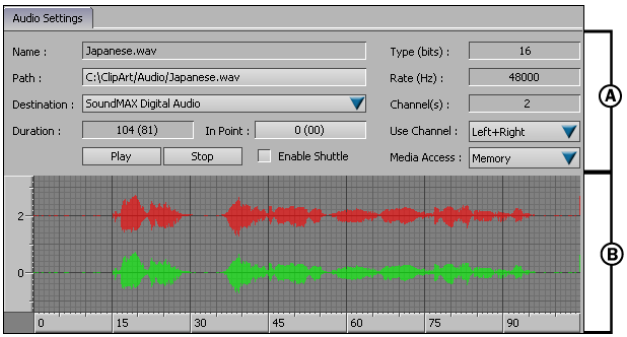
The .wav file's settings display in the Audio settings.

Setting	Description
Name	Shows the name of the audio file currently loaded in the Audio settings.
Path	Shows the location of the selected audio file.
Destination	Lets you choose the audio device that is selected as the default device on your computer.
Duration	Shows the length of the audio clip, and uses the same measurement as what is set in the Frame Rate field in the Transport Controls.
In Point	Lets you enter a value to offset the beginning of the *.wav* file, letting you start the file at a time other than the start of the take. For example, if you want the **.wav** file to begin several minutes into the take, double-click the In Point field, and enter a value or drag right on the value until the In Point timecode equals the amount of time you want to offset the audio file. The waveform moves to the appropriate place in the Waveform area.The In Point field displays the same measurement as the Frame Rate field in the Transport Controls window.
Play	Previews the audio file.
Stop	Stops the audio file from playing.
Enable Shuttle	Activates audio shuttling. If more than one audio file is used in the scene, only one of these files can have shuttling activated.Disable shuttling if your disk access is slow.
Type	Shows the bit rate used by your computer's audio hardware.

Setting	Description
Rate	Shows the sampling rate (in Hertz) of your computer's audio hardware.
Channel	Shows you whether the audio clip is stereo or mono. There are two settings: 1 (mono) or 2 (stereo).
Use Channel	Lets you select channel playback. There are three options: Left, Right, or Left+Right.If you select the Right channel, only the red (right) waveform is shown in the Waveform area. If you select the Left channel, only the green (left) waveform is shown in the Waveform area. When you select only one channel, it plays in both speakers.Select Left + Right to play the Left and Right channels together; both the green and red waveforms are shown in the Waveform area.
Media Access	Lets you choose between loading the **.wav** file directly from disk and loading the **.wav** file into memory.If you do not have much available memory on your computer, it may be more efficient to access large **.wav** files from disk. However, if your hard disk has a slow access time, it may not be possible to play the **.wav** file in real-time.

Audio Waveform area

The Waveform area shows a waveform of the audio file loaded in the Audio settings.



Audio Device Settings *A.* **Audio Properties area** *B.* **Waveform area**

If only one channel is displayed in the Waveform area, your audio file is playing in Mono. If you know that the file is not a Mono recording, verify your audio device settings.

NOTE When an audio file is loaded into the Audio settings, a waveform also appears on the Action timeline in the Transport Controls window.

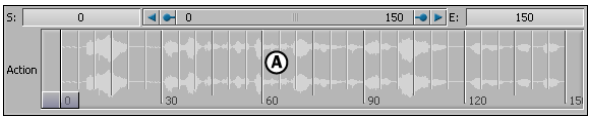
- Playing audio files on page 331
- Connecting to an audio device on page 330

Audio display in the Action Timeline

In addition to displaying keyframes, the Action timeline can show *.wav* files. Audio files let you use an audio reference when creating your animation.

You can add audio files and select audio options using the Transport contextual menu. You can also drag audio files from the Asset browser onto the Action timeline.

For example, the following figure shows audio waveforms for left and right channels on the Action timeline.



Action timeline *A.* **Waveforms for right and left audio channels display.**

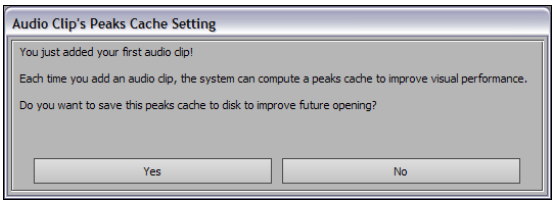
- Loading audio files on page 331
- Navigating the Audio waveform area on page 335

Peaks Cache dialog box

The first time you load an audio file, the Audio Clip's Peaks Cache Setting dialog box appears, letting you save the audio cache on the hard disk.

NOTE This option is only offered the first time you load an audio file.

The audio cache is used to display peaks in the audio view. Saving the audio cache to your hard disk saves memory by preventing the peaks from being recomputed.



Audio Clip's Peaks Cache Setting dialog box

If you choose to save your audio cache files, they are saved to the same location where your *.wav* audio files are stored.

- Accessing audio from disk or memory on page 338
- Playing audio files on page 331

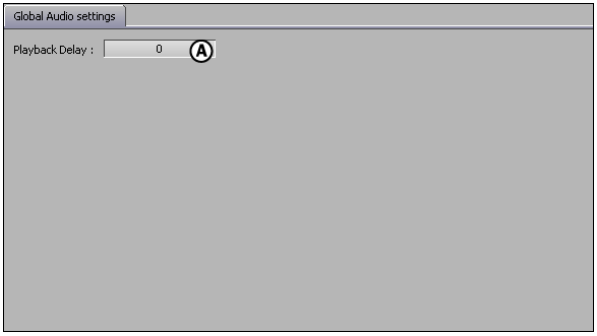
Global Audio settings

To view the Global Audio settings, click the Audio root folder in the Scene browser.

The Global Audio settings display the Playback Delay setting. See Playback Delay setting on page 342 for more information.

Playback Delay setting

Use the Playback Delay setting to delay the audio clip playback in your scene in order to sync the sound to your animation. Sometimes a delay is necessary if the processing speed of the animation creates sound synchronization problems.



Global Audio settings *A.* **Playback Delay**

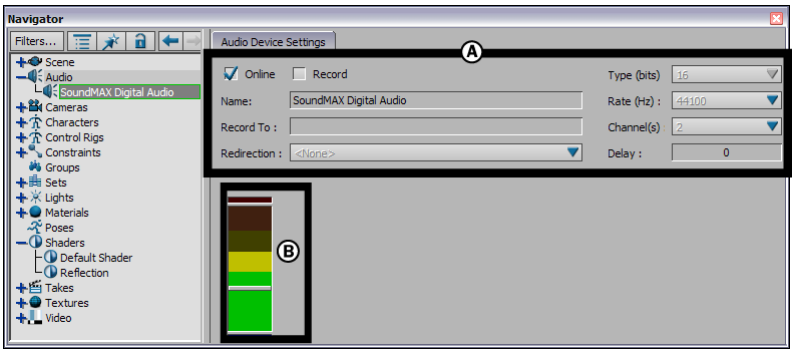
- Connecting to an audio device on page 330
- Playing audio files on page 331
- Recording audio on page 333

Audio Device settings

When you select an audio device in the Scene browser, the Audio Device Settings display in the Navigator window.

The Audio Device settings are divided into two areas:

- Device Properties area on page 344
- Record area on page 345



Audio Device Settings *A.***Device Properties area** *B.* **Record area**

Device Properties area

When an audio device is selected from the Audio folder, the Device Properties area shows the selected device's settings.

NOTE You can only modify the Redirection, Rate, and Channel(s) fields in the Device Properties area; the other fields are read from the hardware and cannot be changed.

The following settings are found in the Device Properties area:

Setting	Description
Online	Starts communication with the Audio device when you are ready to start recording.Once Online is activated, the audio input displays in the Record area, and you can test the levels and settings before you click Record. Activating Online does not start the recording process, it makes the Audio device open the connection to the selected audio hardware.
Record	Opens the Audio Clip Record Destination window, where you can name and select the destination of the file to be recorded. Activating Record does not start the recording process, it only allows the input audio to be controlled by the Transport Controls.
Name	Shows the name of the audio device currently selected in the Scene browser.
Record To	Shows the path of the *.wav* file to be recorded. You can specify this path in the Audio Clip Record Destination window when you activate the Record option.
Redirection	Lets you select the audio output device to which you want to output the recorded audio. Any audio output hardware connected to your computer, and which is automatically detected and added by MotionBuilder, can be selected.
Type	Shows the number of bits used by the selected audio device.
Rate	Lets you select the sampling rate (in Hertz) of the selected audio device.
Channel	Lets you select 1 or 2 channel recording.

Setting	Description
Delay	Delays output from Redirection menu to an audio device.

Record area

The Record area displays a threshold meter that indicates the input level of the audio device. When the device is online, the meter reacts by displaying threshold levels that the input device captures.

- Recording audio on page 333
- Playing audio files on page 331
- Connecting to an audio device on page 330

Video settings

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The Video settings let you organize the video clips and images used by the Texture settings. You can use the Video settings as a storage and linking area for all live video and recorded clips. Whenever you add a video clip or image to MotionBuilder, the Video settings appear in the Navigator window.

NOTE MotionBuilder supports .avi, .qt, and .mov video files.

Applying video to objects

To apply video to your scene:

1. Drag a Texture asset from the Asset browser onto the object on which you want the video to appear.
2. In the Texture settings Media menu, select a video texture.

You can also apply video to a camera's Back Plate or to objects in your scene.

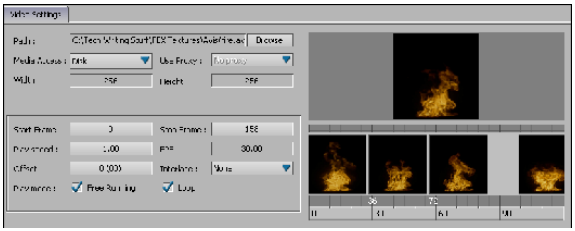
To apply a video or image to a camera:

➤ Select a video or image file from the Video folder in the Scene browser, and drop it onto the camera.

The selected video or image file is applied to the current camera as the Back Plate. See Back Plate pane on page 463for more information about the camera Back Plate.

Video settings

The Video settings let you select various file and playback options for the current video or image.



Video settings

Path

The Path field displays the path of the selected media.

Media access

The Media Access menu lets you specify whether a video plays from a disk or from memory.

- Disk: Plays the proxy video from the disk.
- Memory: Pre-loads and plays the proxy video from memory. This play method is faster than playing from disk. If the video file is too long, you cannot load it into memory.
- Disk Async: Pre-loads the video from memory seconds before being displayed.

Use proxy

The Use Proxy menu lets you assign an alternate version of your video file. This is useful if you want to use a low resolution file or placeholder video while you compose the scene.

When you select a proxy setting, a proxy must exist for the selected file. You must determine when to use the proxy file instead of the original high resolution file.

Create a proxy file in the same directory as the high resolution file, and use the file name format:`<X>proxy.avi`, (where <X> is the name of the high resolution file).

The Proxy Menu contains the following options:

- No Proxy: Specifies that a proxy file does not exist for the selected video file.
- On Play: Specifies that the proxy for the selected video file plays in place of the original high resolution file.
- Always: Specifies that the proxy for the selected video always plays.

Width/Height

The Width/Height fields display the frame size of the selected media.

Start/Stop frame

Enter a frame number in the Start or Stop Frame fields to specify at which frame to start or stop your video.

Play speed

Enter a value in the Play Speed field to specify how fast or slow the video file plays.

FPS

The FPS field shows the frames per second rate of the current video file.

Interlace

Use the Interlace menu to select the Interlace setting. Interlace settings are dependent on the type of VTR and TV used.

Setting	Purpose
Fields	Specifies that the video file is shown as a complete resolution picture with both even and odd fields. This changes the way the video is displayed.
None	Specifies that there is no interlacing during the playing or recording of the video file.
Half Frame Even	Specifies that the video file is interlaced at half of true resolution, and even lines are used.

Setting	Purpose
Half Frame Odd	Specifies that the video file is interlaced at half of true resolution, and odd lines are used.
Full Frame Even	Specifies that the video file is interlaced at full resolution, and even lines are used.
Full Frame Odd	Specifies that the video file is interlaced at full resolution, and odd lines are used.
Full Frame Even/Odd	Specifies that the video file is interlaced at full resolution, and alternating even and odd lines are used.
Full Frame Odd/Even	Specifies that the video file is interlaced at full resolution, and alternating odd and even lines are used.

Offset

Enter a value in the Offset field to offset the video's time code. If a video file is offset, it starts at the same time as the animation, but plays at the specified offset time code. The Offset is displayed in the same measurement as the Frame Rate field in the Transport Controls window.

Play mode

Use the Play Mode options to set a play type for the selected media.

Option	Description
Free Running	Specifies the loaded video file as free running. Free Running plays the video file automatically, without the need to use the Transport Controlswindow.
Loop	Loops the selected video file.

Video Media viewer

The Video Media viewer displays the selected image or video. When the video plays in your scene, it also plays in the viewer.

If a video is selected, the Video Media viewer shows the frames of the clip beneath the video preview. Ctrl-drag or Shift-drag the video frames to zoom in or out.

Version control

20

MotionBuilder has its own version control manager that uses simplified versions of the Microsoft Visual SourceSafe and the Avid Alienbrain version control software products.

Version control is useful for development teams, letting them protect and track their work with Check In and Out options for all shared files.

MotionBuilder version control manager does not apply to external objects such as textures and video clips. To include these, use the Embed Media option when saving your files.

- Activating Version Control on page 353
- Accessing Version Control Menu on page 354
- Microsoft Visual SourceSafe on page 355
- Avid Alienbrain on page 356

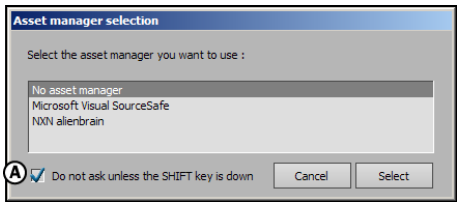
Activating Version Control

To activate version control, you need to have the Visual SourceSafe software product, the Alienbrain software product, or both software products installed.

To activate version control:

1 Launch MotionBuilder.

The Asset manager selection dialog box appears, enabling you to choose which asset manager to use in MotionBuilder.



A. **Option enabled by default**

NOTE The asset managers that are shown in the Asset manager selection dialog box are the version control software products installed on your system.

---

2 Click an option from the list of asset managers.

If you select No asset manager, MotionBuilder does not use a file management system. Therefore, there is no Version Control menu available in the MotionBuilder menu bar.

If you select Microsoft Visual SourceSafe, a simplified version of the Visual SourceSafe software product is used and if you select Alienbrain, the Alienbrain software product's integrated features are used.

3 Disable the option "Do not ask unless the Shift key is down" if you want the Asset manager selection dialog box to appear every time you launch MotionBuilder.

Accessing Version Control Menu

To access the MotionBuilder Version Control menu, you need to have the Alienbrain version control software product, the Visual SourceSafe version control software product, or both—the Alienbrain and the Visual SourceSafe version control software products installed.

To access the Version Control menu:

1 Launch MotionBuilder.

2 In the Asset manager selection dialog box, click an asset manager from the list of asset managers.

3 Click Select.

The Version Control menu appears in the MotionBuilder menu bar.

The Version Control menus for the Microsoft Visual SourceSafe and the Alienbrain software products are similar, but have a few different options that are discussed in the following topics:

- Microsoft Visual SourceSafe on page 355
- Avid Alienbrain on page 356

Microsoft Visual SourceSafe

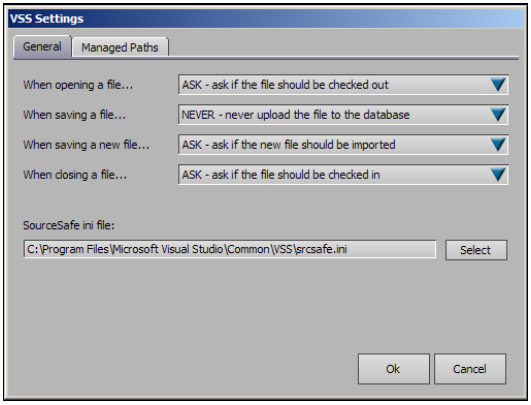
If you select Visual SourceSafe as your Asset manager, a connection to the database is established automatically when MotionBuilder loads.

The Open, Save, and Save As commands are synchronized with the database projects, letting you work locally while still connected to the project's database.

Before you can use Visual SourceSafe, you must manually select the file paths to be managed in the Visual SourceSafe settings window. You can set managed paths in the Managed Paths pane. See Adding Managed Paths in VSS on page 356.

VSS settings configuration

Configure the Visual SourceSafe settings by choosing Version Control > Show Settings from the menu bar. The VSS Settings window appears.



VSS Settings window: General Pane

You can set managed paths in the Managed Paths pane. See Adding Managed Paths in VSS on page 356.

The Asset manager assumes that any files created or accessed within the specified directory are intended for versioning and storage on the central server. When you create a new project move it into the specified directory so it can be managed by the Asset manager.

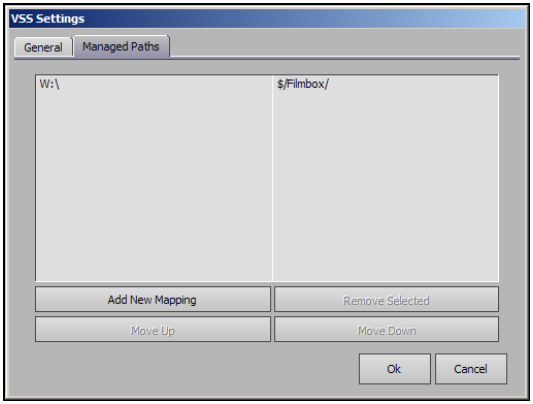
Configuring Drives with VSS

You must manually select the drives to be managed by the Visual SourceSafe Asset manager in the Visual SourceSafe settings window.

To set managed paths in the Visual SourceSafe Asset manager, choose local directories and map them to remote directories in the database.

Adding Managed Paths in VSS

To add a managed path, click the Managed Paths tab in the VSS Settings window, click Add New Mapping and specify the new path.



VSS Settings window: Managed Paths pane

Avid Alienbrain

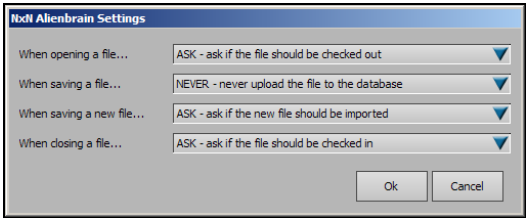
If you select Alienbrain as your Asset manager, you have all of the features of the Visual SourceSafe Asset manager with a few extra features.

The Open, Save, and Save As commands are modified when you use the Alienbrain Asset manager. These commands are mapped to drives and are synchronized with the database projects, letting you work locally while still

connected to the project's database. See Configuring drives with Alienbrain on page 358 for information on how the Asset manager manages drives.

Alienbrain settings configuration

Configure the Alienbrain settings by choosing Version Control > Show Settings from the menu bar. The Alienbrain Settings window appears.



Alienbrain Settings window

The Asset manager assumes that any files created or accessed within the specified directory are intended for versioning and storage on the central server.

When you create a new project, move it into the specified directory so that you can manage it with the Asset manager.

You can configure Save settings by choosing Version Control > Show Settings from the menu bar.

File Options with Alienbrain

When you select Alienbrain as your Asset manager, the following options appear in the File menu:

Open from Database option

The Open From Database option opens the Open File dialog box so you can select a file to open directly from the database.

Add to Database option

The Add to Database option lets you select a folder in which to store a file in the database. You can use Add to Database with scenes that have never been saved or scenes that already exist locally.

Upload to Database option

The Upload to Database option lets you save your changes directly to the database. Use this feature to create backup copies of your work.

When you select Upload to Database, the file is automatically saved to your local drive first.

Database connection

If you select Alienbrain, a connection is established when an operation requests it. For example, when you open a file, or save a file under a managed path.

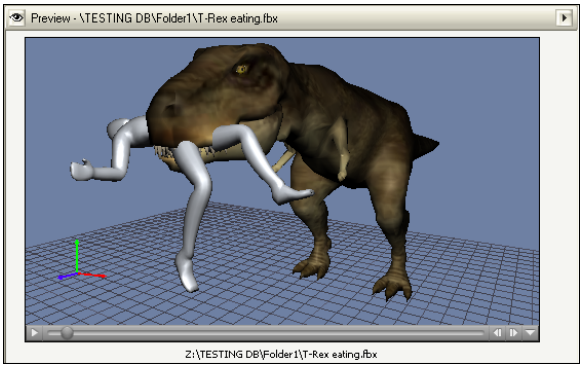
Configuring drives with Alienbrain

The mapping of managed drives for Alienbrain is automatic. The database is mapped to drive Z by default.

Alienbrain FBX file preview

Alienbrain supports *.fbx* file previewing.

If you select an *.fbx* file in Alienbrain, your scene appears in the Preview window. The scene can be rotated, played, viewed through different cameras, and so on.



Alienbrain Preview window

For more information about the Alienbrain preview window, consult the Alienbrain documentation.

Part 4: Setting up your Scene

MotionBuilder provides you with many tools that enable you to keep your scenes manageable and well-organized. This section includes topics that introduce the basic elements of a scene, as well as the various methods you can use to organize those elements.

The Scene browser, Navigator window, Asset browser, and Viewer window are all valuable tools that help you work with and keep track of all elements in your scene.

You can sort the objects in a scene into groups and sets to select and arrange them logically, and you can use the various views and windows to maintain a comprehensive inventory of every object you are working with.

Understanding how scenes are built in and how you can effectively organize them can also help to familiarize you with the basics of MotionBuilder. For example, nodes and assets are the basic building blocks of a scene. You can create groups and sets of various assets to select and manipulate them as one.

Another good way to organize your work in MotionBuilder is to create custom icons for your *.fbx* files so that when they display in the Asset browser they are easily identifiable.

Namespace

A namespace is a group of objects collected under a name. A namespace is also a unique path. Therefore, each item in a namespace is identified by its name along with the namespace to which it belongs. For example, objects in the Namespace “Galaxy” could be “Galaxy:Moon”, “Galaxy:Rocket”, or “Galaxy:Alien”.

NOTE A colon (:) character is automatically added to separate the names of namespaces and nodes.

When namespaces are used, you can have two objects with the same name in a scene, as long as they have different namespaces. For example, “Mars:Alien” and “Moon:Alien” objects can be in the same scene as long as the namespace is unique to each object.

When you merge an object into a scene that contains another object with the same name, you can choose to prepend a namespace to the incoming object to resolve the naming conflict.

An asset can be in any namespace, regardless of how they are in a scene. You can give nodes from a Control rig hierarchy one or multiple namespaces, or give a parent object one namespace and a child object another.

Prepending namespaces to objects or objects’ branches can facilitate scene management optimization. This can be especially useful if you have very large scene files.

NOTE Objects’ properties and property references also take into account namespaces.

You can add, replace, and remove namespaces as you build a scene file. You can also append namespaces to other namespaces in the scene. See Namespaces within namespaces on page 366.

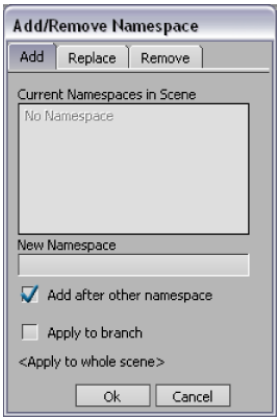
NOTE A namespace is limited to a length of 1024 characters.

To prepend a namespace to an object:

1. Select the object via the Scene browser or Viewer window.
2. From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

   NOTE You can also right-click an object or node and choose Add/Remove Namespace from the contextual menu.

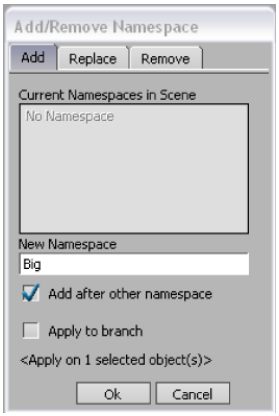
   The Add/Remove Namespace dialog box appears, displaying namespaces in the current scene.



Add/Remove Namespace dialog box

3 Click the “Add” tab.

4 Click in the “New Namespace” field and enter characters.



Namespace specified for selected object

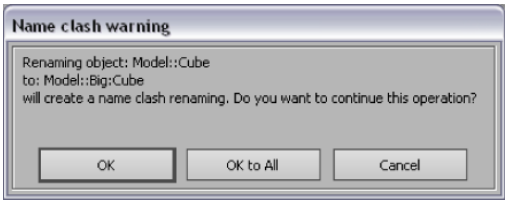
Enabling or disabling the option “Add after other namespace” option when there are no namespaces in the scene has no effect.

WARNING Adding namespaces to objects may affect the merge-back of the animation as this process is based on the names of objects.

5 Click OK.

The specified namespace is added to the object, giving the object a unique name.

If you have two objects in a scene that carry the same name (for example "Cube") but one of the objects has a namespace prepended (for example "Big:Cube"), prepending the same namespace (for example "Big") to the object carrying the same name (for example "Cube") gives the following warning message.



Name Clash Warning dialog box

If you choose to proceed with the action, a number is prepended to the object's name to give the object a unique name (for example "Big:Cube1").

To prepend a namespace to a branch:

1 Select the top object in a branch via the Scene browser or Viewer window.

TIP To view the hierarchy of the objects in your scene and ensure you select the object at the top of the hierarchy via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

---

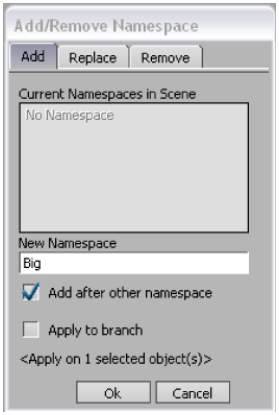
2 From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

NOTE You can also right-click an object or node and choose Add/Remove Namespace from the contextual menu.

The Add/Remove Namespace dialog box appears, displaying namespaces in the current scene.

3 Click the "Add" tab.

4 Click in the "New Namespace" field and enter characters.



Namespace specified for branch

Enabling or disabling the option “Add after other namespace” option when there are no namespaces in the scene has no effect.

5 Enable the “Apply to branch” option.

WARNING Adding namespaces to objects or branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

6 Click OK.

The specified namespace is added to the object’s branch.

NOTE If the name is not unique, you get a warning message enabling you to either proceed with the action or cancel the action. If you proceed with the action, a number is prepended to each object within the branch to provide unique names.

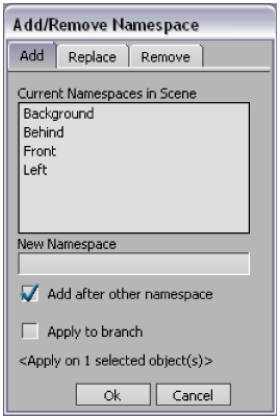
To replace a namespace prepended to an object:

1 Select the object via the Scene browser or Viewer window.

2 From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

NOTE You can also right-click an object or node and choose Add/Remove Namespace from the contextual menu.

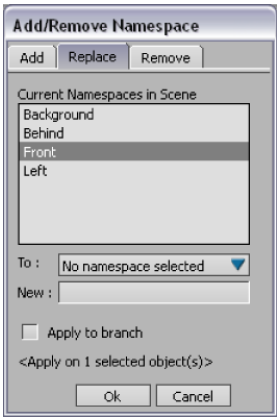
The Add/Remove Namespace dialog box appears displaying the namespaces in the current scene.



Namespaces in current scene displayed

3 Click the “Replace” tab.

The selected object’s namespace is highlighted.



4 Click in the “New” field and enter a name.

WARNING Changing namespaces of objects may affect the merge-back of the animation as this process is based on the names of objects.

5 Click OK.

The object's namespace is replaced by the specified name.

To replace a namespace prepended to an object's branch:

TIP To view the hierarchy of the objects in your scene and ensure you select the object at the top of the hierarchy via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

---

1. Follow the preceding procedure (for replacing a namespace prepended to an object) up to step 5.
2. Enable "Apply to branch" option.

   WARNING Changing namespaces of objects or branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

   ---

3. Click OK.

   The object's branch namespace is replaced by the specified name.

To remove a namespace prepended to an object's name:

1. Select the object via the Scene browser or Viewer window.
2. From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

   NOTE You can also right-click an object or node and choose Add/Remove Namespace from the contextual menu.

   The Add/Remove Namespace dialog box appears displaying the namespaces in the current scene.

3. Click the "Remove" tab.

   The selected object's namespace is highlighted.

   WARNING Removing namespaces of objects may affect the merge-back of the animation as this process is based on the names of objects.

   ---

4. Click OK.

   The namespace is removed from the selected object.

To remove a namespace prepended to an object's branch:

1 Select the object 's branch via the Scene browser or Viewer window.

TIP To view the hierarchy of the objects in your scene and ensure you select the object at the top of the hierarchy via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

2 From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

NOTE You can also right-click a branch or the top node of a branch and choose Add/Remove Namespace from the contextual menu.

The Add/Remove Namespace dialog box appears displaying the namespaces in the current scene.

3 Click the "Remove" tab.

The selected branch's namespace is highlighted.

4 Enable "Apply to branch".

WARNING Removing namespaces prepended to branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

5 Click OK.

The namespace is removed from the selected branch.

Namespaces within namespaces

A namespace acts like a directory in a file system. It is the unique ID of an object or branch. The assets assigned to a namespace are like files in a directory folder. You can store a namespace inside another namespace, just as you would store a directory inside another directory.

A namespace is a unique path. The whole path is considered a namespace. So, Moon:Alien is a path, but Galaxy:Moon:Alien is a separate path because it does not reference Moon:Alien in the Galaxy and therefore increments Moon. Moon:Alien and Galaxy:Moon:Alien are two separate and cooperative elements that do not require renaming.

For example, the spine bone of an Alien character, shown as "Alien:Spine", could be placed in the "Moon" namespace, which would then be Moon:Alien:Spine. The Moon namespace and all its associated asset could

then be stored in a “Galaxy” namespace, creating Galaxy:Moon:Alien:Spine, and so on.

Just as you cannot have two subdirectories with the same name inside a directory, you cannot have two objects with the same name in a namespace. For example, in the namespace “Galaxy”, there cannot be two “Galaxy:Moon” objects. Refer to the procedures in the following topic (Creating hierarchy namespaces on page 367).

Creating hierarchy namespaces

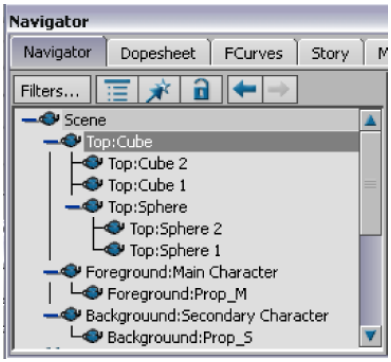
You can add prefixes to any hierarchy to change its namespace. However, keep in mind that if you prepend a namespace to objects or branches, this may affect the merge-back of the animation as the process is based on the name of the objects.

To prepend namespaces for objects in a hierarchy:

1 Select via the Scene browser or Viewer window the object(s) or branch you want to rename or replace prefixes.

TIP If you want to prepend namespaces at the top of an element’s branch to include all objects in the branch via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

The following example shows objects with namespaces.

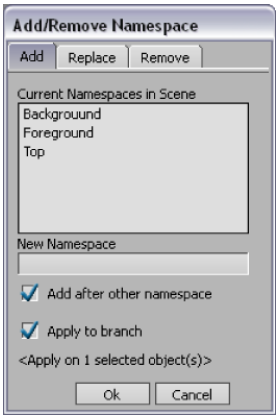


Scene browser displaying namespaces

2 From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

NOTE You can also right-click object(s) (or nodes) or a branch and choose Add/Remove Namespace from the contextual menu.

The Add/Remove Namespace dialog box appears, displaying in numeric alpha order the namespaces in the scene.

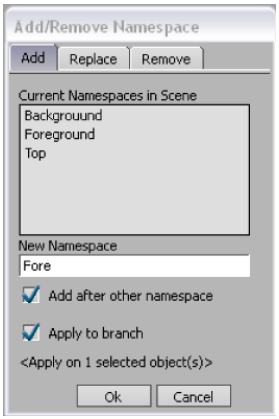


Add/Remove Namespace dialog box displaying namespaces in scene

3 Click the “Add” tab.

4 To add a namespace after a prefix, Activate the “Add after other namespace” option.

5 Enter characters in the “New Namespace” field.



Add/Remove Namespace dialog box displaying namespaces to prepend to branch

6 Ensure the following options are enabled:

- Add after other namespace
  When this option is enabled, the name entered in the “New Namespace” field is prepended to the current namespace(s).

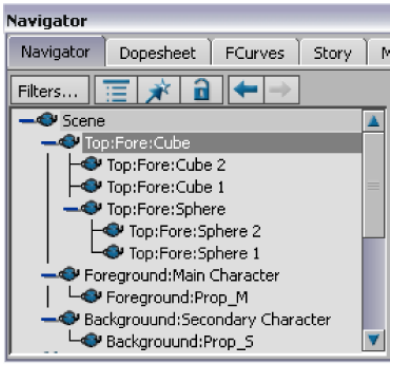
- Apply to branch
  When this option is enabled, the name entered in the “New Namespace” field is prepended to the whole branch.

NOTE To change only the first occurrence of the prefix, leave the Apply to branch option disabled.

WARNING Prepending namespaces to objects or branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

7 Click OK.

The namespace is applied throughout the selected object’s hierarchy as shown in the following figure.



Two namespaces prepended to selected branch

Replacing namespaces in a hierarchy

You can rename prefixes in any hierarchy at any given time during your project creation. However, keep in mind that if you change an object’s or branch’s namespace, this may affect the merge-back of the animation as the process is based on the name of the objects.

To replace or rename an object's namespace in a hierarchy:

1 Select in the Scene browser or Viewer window the object(s) with prefixes you want to replace or rename.

TIP If you want to replace or rename namespaces at the top of an element's branch to include all objects in the branch via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

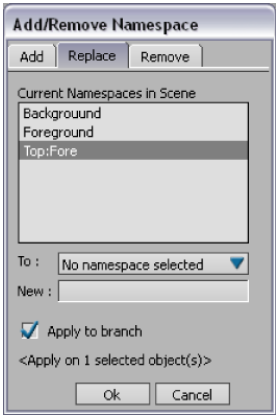
2 From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

NOTE You can also right-click objects (or nodes) or a branch and choose Add/Remove Namespace from the contextual menu.

The Add/Remove Namespace dialog box appears, displaying in numeric alpha order the namespaces in the scene.

3 Click the "Replace" tab.

The selected object's or branch's namespace is highlighted.



Selected object's namespace highlighted in Add/Remove Namespace

4 Click in the "New" field and enter a prefix.

NOTE You can enter multiple prefixes by separating them with a colon (:). For example, enter Leg:Arm to create a search for both Leg and Arm prefixes.

WARNING Replacing namespaces for objects or branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

5 Click OK.

The namespace for the selected object is replaced with the name specified in the Add/Remove Namespace "New" field.

NOTE If you selected a name that is identical to a name of object(s) in the current scene, a Name clash warning dialog appears, enabling you to proceed with the action or cancel the action. If you choose to proceed with the action, a prefix is prepended to the name to ensure the object carries a unique name.

To replace or rename a branch's namespace in a hierarchy:

TIP To select an element's branch via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

1 Follow the preceding procedure (for replacing or renaming an object's namespace in a hierarchy) up to step 5.

2 Enable the "Apply to branch" option.

Applying a prefix to a branch enables you to search for every instance of the prefix(es) occurring on the selected object(s).

WARNING Replacing namespaces for objects or branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

3 Click OK.

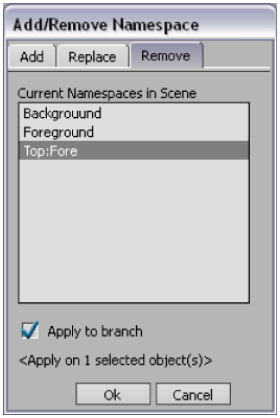
The namespace for the selected branch is replaced with the name specified in the Add/Remove Namespace "New" field.

NOTE If the result of the change requested gives a name that is identical to a name of object(s) in the current scene, a Name clash warning dialog appears, enabling you to proceed with the action or cancel the action. If you choose to proceed with the action, a prefix is prepended to the name to ensure the objects carry unique names.

Deleting namespaces in a hierarchy

You can remove a prefix or prefixes in a hierarchy to change the namespace of objects or branches at any given time during your project creation. However, keep in mind that if you change an object's or branch's namespace, this may affect the merge-back of the animation as the process is based on the name of the objects.

The procedure for removing namespaces is similar to the procedure for replacing namespaces. Instead of clicking the "Replace" tab from the Add/Remove Namespace dialog box, you need to click the "Remove" tab.



To delete a prefix:

1 Select in the Scene browser or Viewer window the object(s) or branch whose prefix(es) you want to delete.

TIP To select an element's branch via the Viewer window, switch to the Schematic view by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

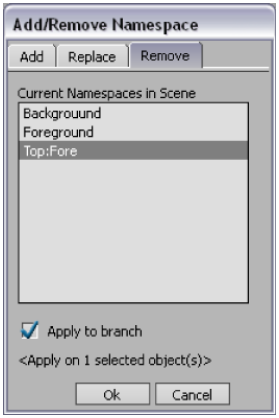
---

2 From the MotionBuilder menu bar, select Edit > Add/Remove Namespace.

NOTE You can also right-click objects (or nodes) or a branch and choose Add/Remove Namespace from the contextual menu.

The Add/Remove Namespace dialog box appears, displaying in numeric alpha order the namespaces in the scene.

3 Click the "Remove" tab.



Selected object's or branch's namespace highlighted

4 Do one of the following:

- If you want to delete the namespace for the selected object, disable "Apply to branch" option.
- If you want to deleted the namespace for all objects within the selected branch, enable "Apply to branch" option.

WARNING Deleting namespaces for objects or branches may affect the merge-back of the animation as this process is based on the names of objects and branches.

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5 Click OK.

Scenes

21

The 3D scene is the environment where your 3D models exist. The Viewer window is where you interact with the 3D scene and set up your animations. You can set your scene on a grid with its own dimensions and limits. In the Viewer window, you can import, select, transform, copy, tweak, and animate your models.

All the action and animation is depicted in the Viewer window. You can change the Viewer window point-of-view through the use of different cameras. Cameras let you move in and around a scene without changing the orientation of any of the models.

These cameras are not only how you view your scene, but you can also use them to record the scene. You can have multiple cameras filming a scene, and cut back and forth between them by using the Camera Switcher.

Lights complete the 3D scene view, letting you simulate realistic or fantastic lighting effects for your scenes. The Asset list in the Scene browser alphabetically lists all the assets added to your scene in a hierarchy with your scene as the root.

There are various ways you can view and organize all of the elements of a scene, including the creation of groups and sets. You can also create different configurations in the Scene browser to organize the way you view assets in the scene.

You can view a graphical representation of all the objects in your scene by switching to the Schematic view.

- Schematic view on page 392
- Cameras on page 419
- Lighting on page 493
- Scene browser on page 92
- Sets on page 413
- Groups on page 407

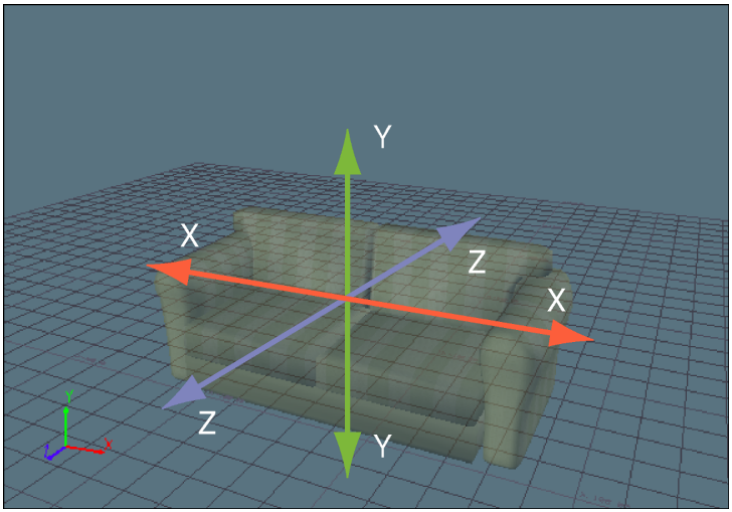
3D Space

In two-dimensional space, such as a drawing, every object has two coordinates (X and Y) that define the horizontal and vertical space the object occupies, and its location. When you move to three-dimensional (or 3D) space, another coordinate (Z) is needed to represent an object's depth.

Since 3D animation works within the two-dimensional interface of a computer, using the XYZ coordinate system provides the illusion of three dimensions.

All 3D objects consist of groups of values (X, Y, Z) in 3D space that define the object's orientation. These XYZ coordinates also let you situate an object in 3D space.

Most 3D software represents the X, Y, and Z axes using perpendicular arrows that intersect at the center (origin) of an object . The origin is the reference point for the object. These arrows are typically color-coded as red (X), green (Y), and blue (Z).



Y defines the up and down axis, X the left and right axis, and Z the forward and back axis.

In the previous figure, the X coordinate defines the horizontal space in the scene, while Y defines the vertical space, and Z adds the third dimension by defining the depth to and away from the origin.

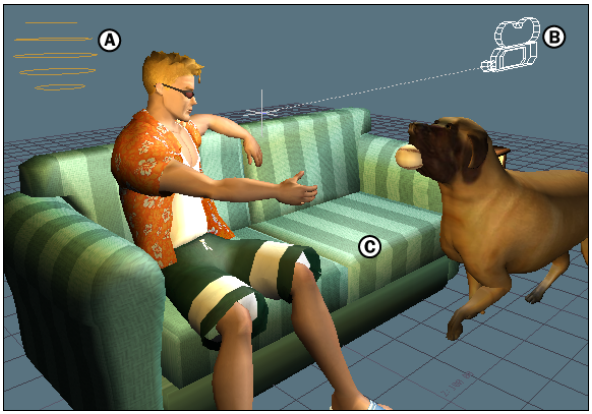
Every object in three-dimensional space can move horizontally (left and right), vertically (up and down), and forward and backward.

- Transforming objects on page 681

Setting up the scene

Similar to readying a film set, the scene contains all the needed elements, such as characters, props, lights, and cameras.

You view and add elements to your scene using the Asset browser and Viewer window. The Viewer window shows all the models and elements in your scene, lets you select different camera views, and create animation.



A scene *A.* **Light** *B.* **Camera** *C.* **Models**

You can also apply textures, materials, and shaders to the models in your scene to enhance their appearance, see Surfaces on page 529 and Shaders on page 585.

- Viewer window on page 49
- Cameras on page 419
- Lighting on page 493

Assets

22

Assets are objects that you can add to a scene, including characters, devices, elements, shaders, *.fbx* files, and so on.

Assets are listed in the Asset browser in a hierarchical tree structure. You can add them to the scene by dragging them from the Asset browser folders. You can also create favorite paths in the Asset browser to make shortcuts to your own *.fbx* files.

Some types of assets included with MotionBuilder in the Asset browser Templates folder include:

- Character assets on page 1271
- Constraints (Animating with Constraints on page 1023)
- Elements on page 380
- Device assets on page 1211
- Materials on page 531
- Adding assets to a scene on page 200
- Adding a favorite path on page 88

Types of assets

There are many different types of assets available with MotionBuilder. This topic gives a short description of some of the assets you can find in the Asset browser window.

3D Curve asset

A curve that can be attached to a constraint to create an animation path. Dragging this asset into the Viewer window lets you create a set of points that make up a spline. See Creating an animated path with a 3D Curve on page 1113.

Elements

In the Asset browser, the Elements folder contains a variety of 3D objects that you can add to the scene. For example, you can add a camera or light to adjust the way you view the scene, or you can add a 3D cube to test the effects of certain shaders. You can add video to a scene by first adding a Plane element, and you can build a skeleton using the Skeleton Root and Skeleton reference.

Cube asset

A 3D cube object. You can use cubes to test shaders, textures, materials or create environmental effects using the Particle shader.

Marker asset

A general purpose object you can use for everything from character rigging to creating floor constraints.

Note asset

A property that lets you create text comments for information sharing. You can add notes to individual objects in a scene, or groups of objects.

Refer to Attaching and removing Notes on page 384 and Note properties on page 385 for more information.

Null asset

An axis that you can parent to other objects for additional transformation. To learn how to hide nulls in your scene, see Hiding nulls on page 385.

Plane asset

A flat 3D object that you can use for walls, floors, to display video clips, and to create shadows and reflection maps. See Applying shadows to objects on page 657.

Script asset

A script text file containing Python commands for automating operations such as adding cameras, plotting, and other features. For more on scripting, see the *MotionBuilder Python Scripting Guide*.

■ Adding assets to a scene on page 200

Browsing assets

In the Asset browser, all items are arranged hierarchically within folders that you can expand or collapse.

To expand a folder, click the plus sign (+) next to the folder name. To collapse a folder, click the minus sign (-) next to the folder name.

The Asset browser lets you display the contents of folders in various layouts. For example, you can split the window horizontally or vertically to display contents in a separate pane.

In the second pane, you can display assets and other files with additional details as thumbnails or in a list. You can also use custom icons for your own files.

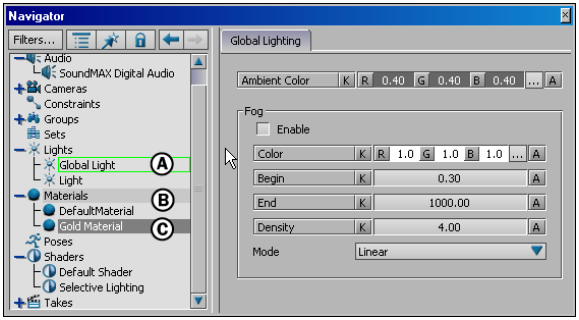
■ Types of assets on page 379

■ Adding assets to a scene on page 200

■ Asset browser on page 79

Selecting assets

To select assets in a scene, click or double-click them in the Asset list of the Scene browser. When you select assets in the Asset list, three different colors indicate the selection and what displays in the Asset Settings area: The green outline indicates the asset's settings are displayed in the Asset Settings area. The light gray color identifies the asset's branch. The dark gray color indentifies the selected asset.



Asset list selection colors *A.* **Green outline** *B.* **Light gray** *C.* **Dark gray**

The following table describes the selection colors:

Color	Indicates
Dark Gray	The currently selected asset or folder. This is not necessarily the same asset appearing in the Navigator window. You can have more than one selected asset.
Light Gray	At least one asset is selected within its folder or hierarchy.
Green Outline	The asset displays in the Asset Settings area of the Navigator window. Only one asset can display in each Navigator window.

To select an asset within the same folder, click once to select and view the asset's settings. For example, if the Producer Perspective camera is selected, click the Producer Top camera to select and display the Producer Top camera's settings.

You can append an asset to an object in the scene, either in the Viewer window or in the Scene browser. For example, you can add a texture to a plane by dragging the texture asset over a plane. The Texture settings appear in the Navigator window, letting you set the texture's properties.

- Scene browser on page 92
- Types of assets on page 379

Creating custom icons

You can create your own custom icons in the Asset browser so you can identify your *.fbx* files.

There are two ways to create custom icons. You can either render a thumbnail image from one of your scenes, or you can supply an image our your own.

The quickest way to create an icon for a particular *.fbx* file is to load the scene, then render a thumbnail image of an identifiable part of the scene.

To render a thumbnail image:

1. Select the Producer Perspective camera in the Viewer window.
2. Position the camera view so your scene is well-represented.
3. Choose File > Render Thumbnail from the menu bar.

   The Thumbnail Preview window appears. The thumbnail is based on the current frame and the position of the current camera.

Thumbnail Preview window

4. Click Ok to accept the thumbnail or Cancel to adjust your camera and retake the thumbnail.
5. Save the *.fbx* file for the thumbnail you created.
6. Right-click in the Asset browser and select Refresh Directory from the contextual menu.

   Your custom icon displays to represent the *.fbx* file.

To draw a custom icon:

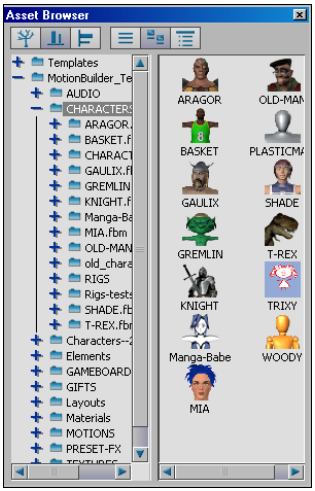
1. In your chosen image creation software, create an image measuring 36 x 36 pixels in *.tif* format.

2 Save the image file at the same directory level as the corresponding *.fbx* file.

3 Name the file using the main file name followed by *.fbxicon.tif*.

For example, if your *.fbx* file is "*Mia.fbx*", name your icon file "*Mia.fbxicon.tif*".

When your *.fbx* file displays in the Asset browser, the custom icon replaces the default MotionBuilder icon, as shown in the following image.



Asset browser showing custom icon

NOTE If your **.fbx** file has both a thumbnail and an image icon, the rendered thumbnail is shown.

■ Asset browser on page 79

Attaching and removing Notes

To attach a Note to an object:

1 Drag a Note asset from the Asset browser over the object to which you want to add a Note. You can drag Notes onto objects in the Viewer window or in the Scene browser.

The Note is attached to the object and listed in both the Scene and Notes folders in the Scene browser.

2 Select the Note and open the Properties window.

3 Enter text in the Static comment section.

NOTE To attach a note to multiple objects, drag the Note from the Scene browser Notes folder on top of other items in the Viewer window or Scene browser.

To detach a Note from an object:

1 Expand the Scene browser's Notes folder and locate the Note you want to detach.

2 Right-click the Note.

3 Select Delete. Select Detach Note from all objects to remove every instance of the Note in the scene.

4 You can remove a Note from an object by locating the object in the Scene folder and deleting it from an object. Doing this removes only this instance of the Note.

You can view a Note's settings in the Properties window by selecting the Note in the Scene browser.

■ Note properties on page 385

Hiding nulls

To hide nulls in your scene, select None from the Look menu in the Properties window Null group.

The Maya import process creates a null for every group in the scene and these nulls are visible when you export the file from Maya into MotionBuilder.

Note properties

Note properties display in the Properties and FCurves windows.

Name

Double-click the Name field to enter a new name for your Note.

Static Comment

Double click the Static Comment field to enter text for your Note.

Asset contextual menu

This topic describes some of the more commonly found items in the Asset contextual menu, which lets you perform actions on assets, change your selection, reorganize your assets into folders, and so on.

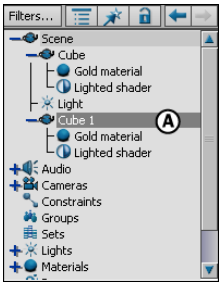
To open the Asset contextual menu, right-click in the Asset list in the Scene browser. Depending on your selection and where you right-click, the options in the contextual menu may change. For example, right-clicking on a folder shows different options from right-clicking on an asset.

The contextual menu applies to the asset on which you right-click, and applies to the selection when you right-click a selected asset.

Duplicate

Duplicates the asset on which you right-click. The duplicated asset inherits all the associated properties and assets of the original asset.

For example, duplicating a cube creates a second cube with the same attached assets.



Scene browser *A.* **Duplicated cube (Cube 1) inherits all dependencies of original cube (Cube).**

Create Group/Set From Selected Item(s)

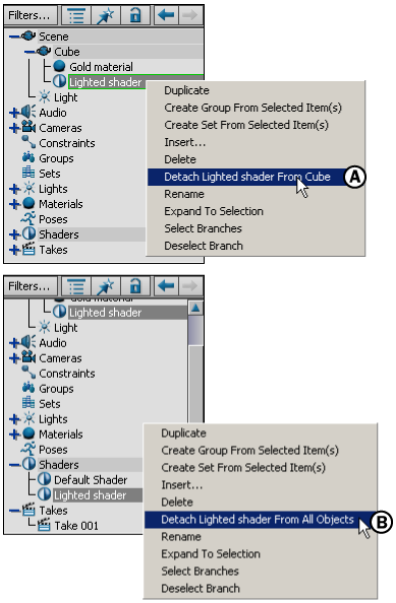
Lets you create a new Group or Set consisting of the selected assets in the Scene browser.

Detach/Detach All Assets

Lets you detach all assets from a model or other asset with materials, textures, and shaders. This menu item changes depending on the selected assets and where you right-click.

Right-click a material, texture, or shader in the Scene folder to detach the asset from its parent. For example, if you right-click a shader attached to a cube, the contextual menu item asks if you want to detach the shader from the cube.

Right-click a material, texture, or shader in its dedicated folder to detach the asset from all attached objects. For example, right-clicking a shader in the Shaders folder displays a menu option that lets you detach the shader from all attached objects.



A. **Detach From Asset** *B.* **Detach From all Objects**

Zero

Provides an additional submenu that lets you set all transformations to zero. This item only appears when you right-click a model or other asset with transformation values (translation, rotation, scaling).

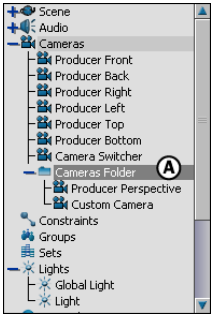
Make Camera Current

Makes the camera on which you right-click the current camera. This item displays in the contextual menu when you right-click a camera in the Cameras folder.

Insert Folder

Lets you add additional folders to the Asset list when you right-click a folder. You can reorganize your list of assets by dragging them into folders.

For example, you can separate your custom cameras in their own folder by right-clicking the Cameras folder and selecting Insert Folder from the contextual menu. The new folder inherits its Asset folder name. Rename folders by right-clicking the folder, and selecting Rename from the contextual menu.



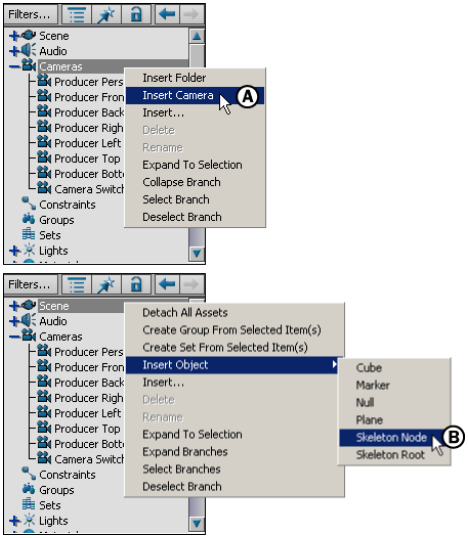
A. **Added folder in the Cameras group inherits its parent folder name (Cameras Folder).**

You can add folders to any Asset folder, but you cannot add folders under the Scene folder since it displays a hierarchical view of your entire scene.

Insert <Asset>

Lets you add an asset to your scene where <asset> matches the folder that you right-click.

For example, right-clicking the Cameras folder lets you add a custom camera, while right-clicking the Scene folder provides an additional submenu, letting you add any object.



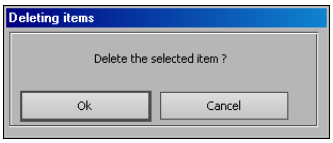
Insert <asset> *A.* **Insert Camera** *B.* **Insert Object**

Insert

Opens the Asset browser to let you add assets to your scene. If the Asset browser is already open, this command makes the Asset browser the active window.

Delete

Deletes either the asset that you right-click, or all the selected assets when you right-click a selected asset. Click Ok in the dialog box that appears to confirm deletion of the selected asset.



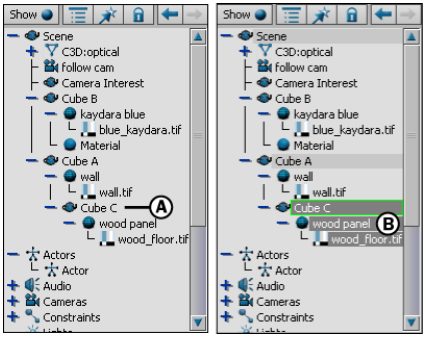
Deleting items dialog box

Rename

Lets you rename the asset that you right-click. To rename the asset, type a new name in the field that appears and press Enter.

Select/Unselect Branch

Selects or deselects all the assets connected to the branch that you right-click. For example, right-clicking on a cube and choosing Select Branch selects the cube and its child assets.



Select Branch *A.* **Right-click on Cube C and choose Select Branch.** *B.* **Cube C and all its child assets are selected.**

You can also use Select Branch and Unselect Branch with Asset folders. For example, you can right-click the Textures folder and choose Select Branch to select all the textures in your scene.

Expand To Selection

Expands the hierarchy that you right-click to show the selected asset(s). Assets that display in light grey indicate that one of its children are selected.

Expand/Collapse Selected Branches

Expands or collapses all selected branches. Collapse Selected Branches only appears in the contextual menu after a branch is selected. For Collapse Selected Branches to work, make sure you right-click an asset within a selected branch.

- Groups on page 407
- Sets on page 413

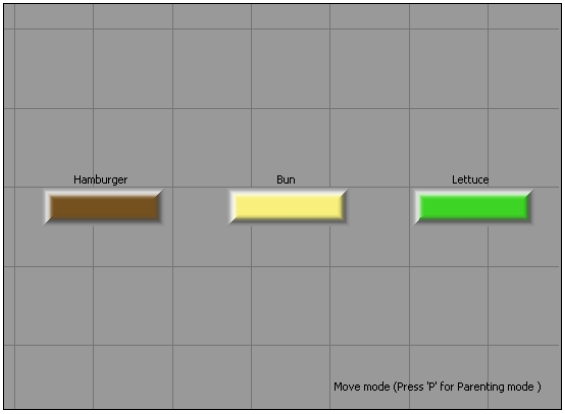
Nodes

23

In the Schematic view, behind the scenes in MotionBuilder, every 3D object is represented by a rectangular node. For example, each bone in a character model's skeleton is represented by a node. You can switch to the Schematic view in the Viewer window to see the nodes that make up your scene.

Nodes are always arranged in a hierarchy that reflects how they are constructed. Each node has a label that indicates what it represents, and if you zoom out far enough, only the labels of the root nodes display. Since nodes graphically represent every object in your scene as a simple rectangle, they make it easy to focus on the relationships between objects.

Nodes that represent models are light gray by default or they are the color of their material, as shown in the following graphic. Nodes that represent markers, nulls, camera interests, and skeleton roots are red by default.



Three models represented by nodes in the Schematic view.

Nodes that represent hidden assets display in dark gray. To make hidden assets visible, select them and press Shift-S. Nodes that represent visible assets are light gray or the color of their designated material.

You can use the Schematic view to arrange nodes into parent-child relationships, and create hierarchies to represent more complex objects.

See also:

- Setting up your Scene on page 359

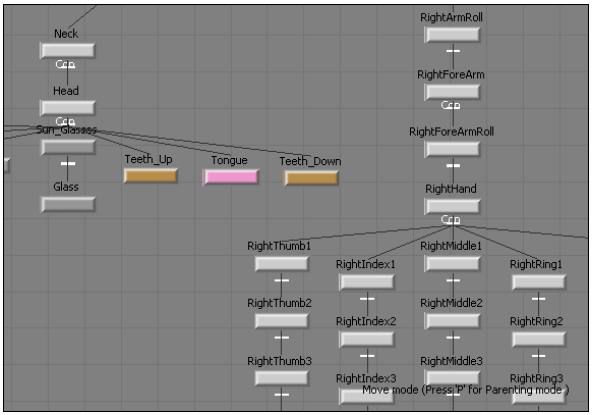
Schematic view

The Schematic view is like a “backstage area” to your scenes, where the object hierarchies in your scene are graphically displayed using nodes. You can switch to the Schematic view in the Viewer window by pressing *Ctrl-W*, or by selecting Schematic from the View menu. To switch back to the camera view, press *Ctrl-W*.

In the Schematic view, each hierarchy of nodes in your scene shows either a set of sensors from a device, the parent-child relationships of a loaded model, or the parent-child relationships you have created between objects.

TIP You can customize the color of the nodes that represent lights, skeleton nodes, and imported skeleton limbs using the color setting in the Properties window.

Depending on the position of the object in the hierarchy, you can hide entire parent hierarchies or individual child nodes. In the following figure, a model hierarchy displays in the Schematic view. The word “Con” in the Schematic view indicates that a model or other object is used in a constraint.



A model’s hierarchy displays in the Schematic view. *A.* **Constraint is used with this element.**

See also:

- Nodes on page 391
- Viewer window on page 49
- Parenting and hierarchies on page 400
- Creating parent-child relationships on page 403
- Organizing hierarchies on page 402

Accessing the Schematic view

To switch to the Schematic view and view a hierarchy of the nodes in your scene, do one of the following:

- Select Schematic from the Viewer window View menu.
- Click in the Viewer window, then press *Ctrl-W*.

To switch out of the Schematic view, back to the previous camera view, press *Ctrl-W* again, or select another View from the View menu.

See also:

- Schematic view on page 392
- Viewer window on page 49

Selecting nodes in the Schematic view

To select nodes in the Schematic view:

➤ Double-click or Spacebar-drag around them.

To select the parent of a hierarchy and all of its children:

➤ Spacebar-right-click the parent. *Ctrl*-click on nodes to add them to the selection.

NOTE When you select models, cameras, or other objects in the Schematic view, they are also selected in the camera view(s).

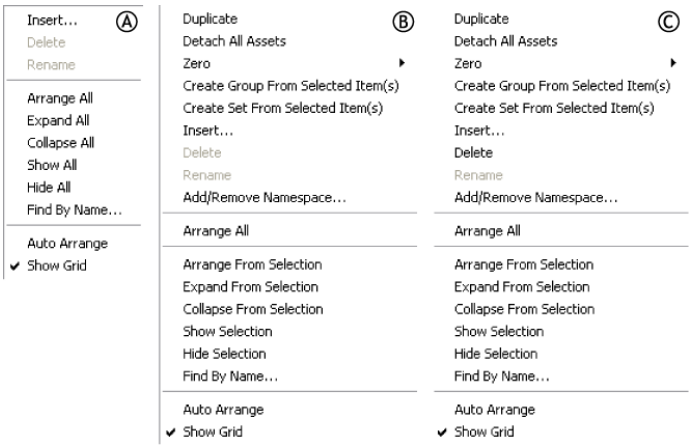
See also:

- Nodes on page 391
- Schematic view on page 392

Schematic view contextual menu

Right-clicking in the Schematic view displays a contextual menu that contains options that are specific to the Schematic view.

Like the camera view contextual menu, the options in the Schematic view contextual menu change depending on what you click and on whether anything is selected.



Schematic view contextual menus *A.* **Menu available when right-clicking an empty space** *B.* **Menu available when right-clicking a node** *C.* **Menu available when more than one node is selected and you right-click**

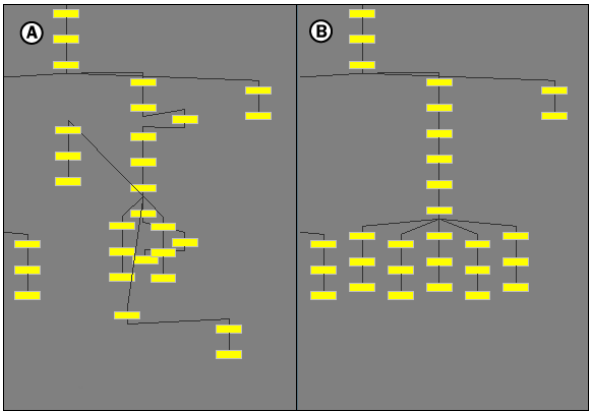
The Duplicate, Detach All Assets, Insert, Delete, and Rename options are common to both the Schematic and Camera views. See Viewer contextual menu on page 74 for more information on these options.

The following are the options specific to the Schematic view contextual menu.

Arrange All

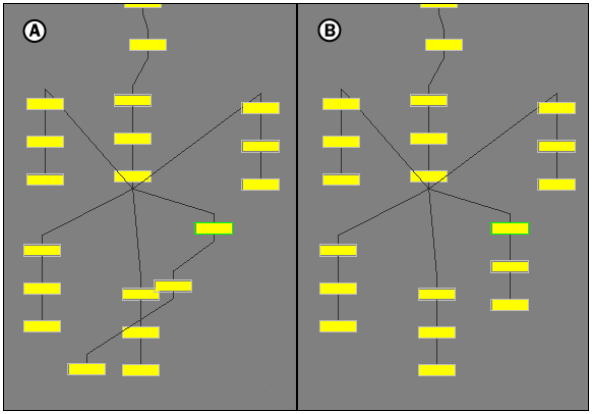
Rearranges the hierarchy display so that it is organized, keeping nodes from overlapping or from being too far apart.

When no assets are selected, Arrange All repositions the hierarchy displays of the entire Schematic view.



A. **Disorganized hierarchy displayed** *B.* **Arrange All is activated**

When one or more assets are selected, use Arrange From Selection option to reposition only the children of the selected node or nodes.

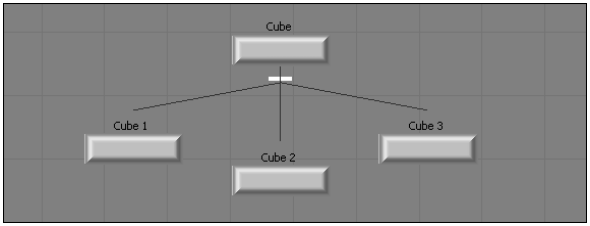


A. **The hierarchy displayed is disorganized. One asset is selected.** *B.* **Arrange From Selection reorganizes only the selected asset and its children.**

When you merge an *.fbx* file to another file, the saved arrangement of appended assets appears below all assets already showing in the Schematic view.

Expand All

Expands every hierarchy display that is collapsed.

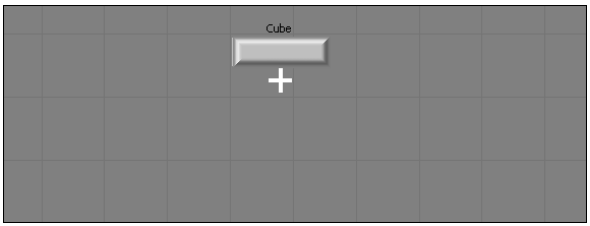


This hierarchy display is expanded. A minus sign displays under the root node "Cube."

When one or more assets are selected, use Expand From Selection expands only the children of the selected node or nodes.

Collapse All

Collapses every hierarchy display so that only the root nodes remain visible.



This hierarchy display is collapsed. A plus sign displays under the root node "Cube."

When one or more assets are selected, use Collapse From Selection to collapse only the children of the selected node or nodes.

Show All

Shows all assets in your scene. Use Show Selection to show only all selected assets.

For more information about parenting in the Schematic view, see Parenting and hierarchies on page 400 and Schematic view on page 392.

Hide All

Hides all assets. Use Hide Selection to hide only selected assets. In the Schematic view, nodes that represent hidden assets display in dark gray.

A. **All assets are shown, displaying in various colors.** *B.* **All assets are hidden, displaying in dark gray.**

Find by Name

Lets you find an asset by searching for its name. The Find Model By Name dialog box automatically includes an asset's namespace. Enter the name of the asset and click Ok.

TIP You can enter * as a wildcard to find an asset with or without the namespace.

The asset is selected and framed. This feature is not case sensitive.

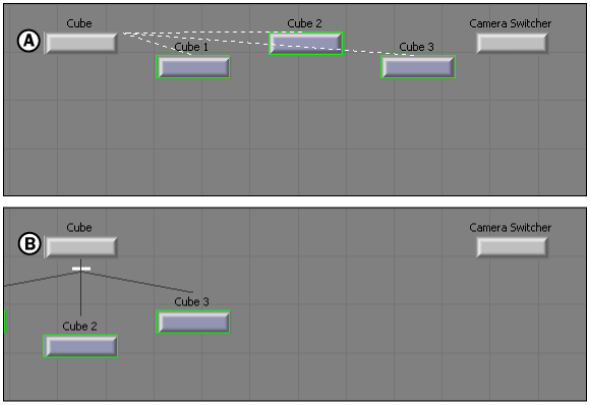
The Find Model By Name dialog box

NOTE You can also access the Find Model By Name by pressing *Shift-N*.

Auto Arrange

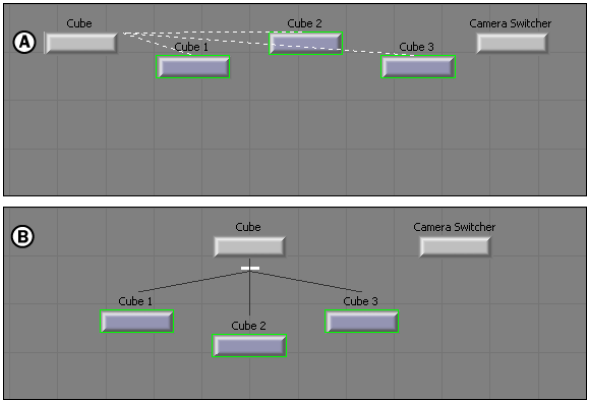
When the Auto Arrange option is enabled, it automatically repositions nodes in so that they are optimized and accessible. It is disabled by default.

For example, Auto Arrange can be useful when you are creating parent-child relationships.



Auto Arrange is disabled. *A.* **Cube 1, Cube 2, and Cube 3 are constrained to Cube.** *B.* **The child nodes move underneath the parent node, and do not display fully in the Viewer window.**

When Auto Arrange is enabled, child and parent nodes are repositioned so that they do not overlap or move too far away when you are parenting.



Auto Arrange is enabled. *A.* **Cube 1, Cube 2, and Cube 3 are constrained to Cube.** *B.* **The child nodes move under the parent node, and the parent node is also repositioned.**

Show Grid

Shows and hides the grid. You can also press *Ctrl-G* to show and hide the grid.

Schematic View keyboard shortcuts

The following list the keyboard shortcuts available when working with Schematic view.

NOTE To use a keyboard shortcut, your cursor must be over the camera view you want to affect.

To toggle between the Schematic view and the camera view

Press *Ctrl-W*.

To create multiple panes

1. Press *Ctrl-1*, *Ctrl-2*, *Ctrl-3*, or *Ctrl-4* to create one, two, three, or four separate panes in the Viewer window.
2. Click in one of the panes, then press *Ctrl-W* to switch that pane to the Schematic view.

To toggle between the regular Viewer window and full screen:

Move the cursor over the Viewer window and press *Ctrl-S*. All other windows are hidden.

To zoom in on a specific region:

Z-drag.

To zoom in or out:

Ctrl-drag up to zoom in and *Ctrl*-drag down to zoom out.

To translate the view:

Shift-drag in any direction to move the entire 3D view.

To show the Display Rate:

Press Shift-F.

The Display Rate appears in the upper left side of the Viewer window.

To display the Memory Status:

Press Shift-M.

The Memory Status appears in the upper right side of the Viewer window. The memory status shows the amount of memory available on the computer.

To frame everything:

Press A.

To frame selected objects:

Press F.

Parenting and hierarchies

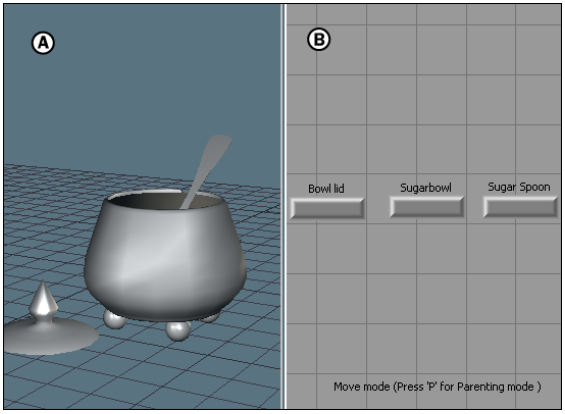
Parenting is a way of linking objects together so that they are connected by reference. When you move one connected object, it affects the other object. Linking objects in this way is called Parenting, as the source object is considered a “Parent” and the target object a “Child”.

When you connect a parent and child, the child object goes wherever its parent object goes. The translation, scaling, and rotation of the parent object applies equally to the child object. A local offset is often added to the child object so that it does not occupy the same space as its parent.

By parenting many objects together and adding the appropriate offsets to each, you can create hierarchies of objects that compose more complex objects, such as human models and skeletons.

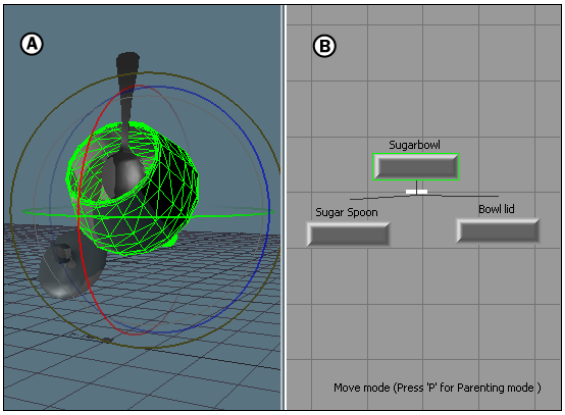
In the Viewer window, you can view the hierarchies in your scene using the Schematic view. The Schematic view uses rectangular nodes to represent the objects in your scene, making it easy to arrange and manipulate your hierarchies.

For example, in the following figure, sugar bowl, lid, and spoon models are shown as separate objects. In the hierarchy, they are shown as equals. Each model can be moved independently.



Unparented sugar bowl, lid, and spoon models *A.* Viewer window *B.* Schematic view of the same objects.

In the following figure, the sugar bowl is parented to the lid and the spoon. When you rotate the bowl, the spoon and the lid follow it. In a hierarchy, the spoon and lid are shown as children of the sugar bowl node.



Parented sugar bowl, lid, and spoon models *A.* Viewer window *B.* Hierarchical Schematic view of the same objects.

See also:

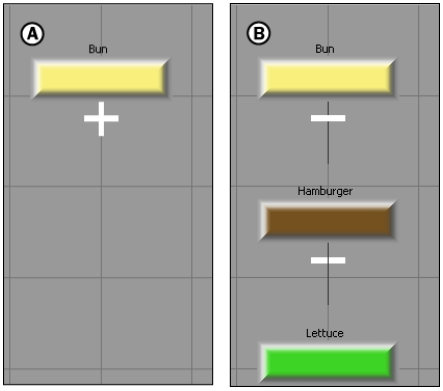
- Nodes on page 391
- Schematic view on page 392
- Creating parent-child relationships on page 403

- Creating a Control rig on page 1437

Organizing hierarchies

There are different ways you can organize the hierarchies of nodes in the Schematic view when Auto-Arrange is not active. You can drag, arrange, expand, and collapse them. When the scene is saved, all hierarchies are saved in the position in which you place them.

Collapse and expand hierarchies by clicking the minus and plus signs below each reference node, or by right-clicking and selecting Collapse All and Expand All from the contextual menu.



Schematic view *A.* **Collapsed node** *B.* **Expanded node**

Collapsing hierarchies in the Schematic view does not affect how your scene appears in any of the camera views. However, if you want to hide assets in the camera view when you are in the Schematic view, select them and press Shift-H.

See also:

- Schematic view on page 392
- Parenting and hierarchies on page 400
- Creating parent-child relationships on page 403

Creating parent-child relationships

To create parent-child relationships between objects in your scene, you can use either the Schematic view in the Viewer window, or you can use the Scene browser.

In the Scene browser:

1. *Alt*-drag the object to be parented and drop it on top of another object.
2. Select Parent from the contextual menu that appears.

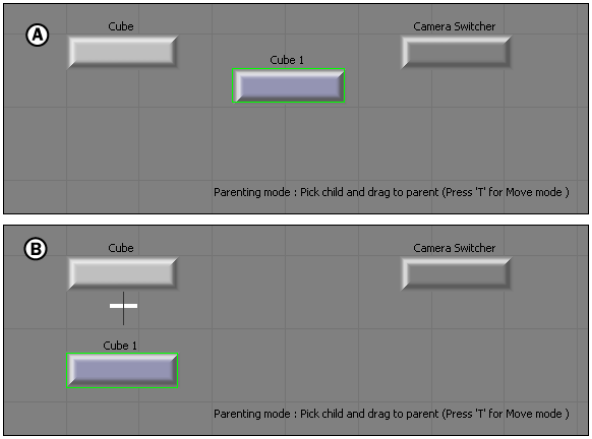
To add additional objects to the selection. *Ctrl*-click them, then drag the selection to the parent object.

In the Viewer window:

1. Switch to Schematic view (*Ctrl-W*).
2. Press P to activate Parent mode.
3. Double-click the node representing the object you want to select as a child. To add additional objects to the selection, *Ctrl*-click the corresponding nodes.
4. Drag the selection to the parent object's node.

   A dotted line joins a parent and its selected child objects, and the parent object is highlighted. The parent is connected to the selected children, and the objects are rearranged in a hierarchy.

   For example, the following figure illustrates two cubes before and after parenting in the Schematic view.



A. **Before parenting** *B.* **After parenting, Cube 1 is the child of Cube.**

NOTE You can create more complex parent-child relationships with constraints. See Parent-child constraint on page 1107.

See also:

- Parenting and hierarchies on page 400
- Disconnecting parent-child objects on page 404
- Parenting contextual menu on page 405

Disconnecting parent-child objects

You can unparent child objects using the Viewer window, Scene browser, or Schematic view.

To disconnect parent-child objects in the Scene browser or Viewer window:

1. Right-click the child object of any parent.
2. Select Unparent > Confirm from the contextual menu.

To disconnect parent-child objects in the Schematic view:

1. In the Viewer window, switch to the Schematic view (*Ctrl-W*).

2 Click in the Schematic view, then press P to activate Parenting mode.

3 Select the node representing the child object you want to disconnect. *Ctrl*-click additional children to add them to the selection.

4 Drag the selection to the parent object's node and release the mouse button when the parent is highlighted.

   Releasing the mouse button over an object other than the parent disconnects the selected children from their parent, and connects them to the selected object.

See also:

- Parenting and hierarchies on page 400
- Nodes on page 391
- Creating parent-child relationships on page 403
- Parenting contextual menu on page 405

Parenting contextual menu

If you *Alt*-drag an object onto another object in the Viewer window, a parenting contextual menu appears with different options depending on the objects involved.

The following are some of the common options available in the Parenting contextual menu.

Parent

Creates a parent-child relationship between the object dragged and the target object(s).

Align

Applies the translation/rotation, translation (X, Y, Z), rotation, and scaling values of the dragged object and the target object(s).

Attributes

Applies the properties of the dragged object to the target object(s).

See also:

- Parenting and hierarchies on page 400
- Nodes on page 391
- Creating parent-child relationships on page 403

Groups

24

One way to keep track of associated assets in MotionBuilder is to organize them into a group. Grouping assets together can keep large scenes well-organized, letting you easily select and view the related assets you need. Once stored in a group, you can manipulate the assets collectively, instead of manipulating each individual item.

For example, if you add all the nodes from a skeleton's arm to a group, you can then scale, rotate, or translate the entire arm at the same time. When you manipulate a group, the proportions and positions of its objects are constrained.

Groups are very similar to sets. However, groups are different in that you can have a single object appear in multiple groups. Sets are exclusive, meaning any object can occur in only one set.

The Groups window gives you a way to quickly transform and select a collection of objects, as well as toggle their visibility.

- Creating a group on page 407
- Viewing the contents of a group on page 409
- Groups window on page 410

Creating a group

You can create groups of objects and assets in your scene. You can store any type of object in a group. For example, you can create groups of lights, cameras, models, and so on. You can also create a group that contains the entire hierarchy of a Control rig. To change the timing of the animation, select the group, then make changes in the FCurves window.

To create a group:

1. Select an object in the Scene browser or the Viewer window. Ctrl-click to select multiple objects.
2. Click Create in the Groups window.

   The new group is listed in the Groups list. If no objects are selected, an empty group is created.

When creating groups you can also select objects in the Scene browser or the Viewer window, right-click and select Create Group from Selected Item(s) in the contextual menu. The new group is automatically named “group”.

■ Adding and removing group objects on page 409

Selecting groups

You can select grouped objects/assets in the Viewer window.

To select a group in the Viewer window:

➤ In the Viewer window, G-click an object belonging to the group you want to select.

NOTE You can also click groups in the Scene browser groups folder.

To select multiple groups:

1. In the Viewer window, G-click an object belonging to the group you want to select.
2. Press Ctrl-G and select multiple groups.

If an object is part of more than one group, all groups to which the object is connected are selected.

NOTE This selection function is not available with sets.

■ Creating a group on page 407

■ Adding and removing sub-groups on page 410

Viewing the contents of a group

Expand the Groups root folder in the Scene browser, then expand the group you want to view.

- Groups on page 407
- Creating a group on page 407

Adding and removing group objects

You can add objects to existing groups, which will help you keep your scene organized.

To add an object to a group:

1. Select a group in the Groups list.
2. Select the objects you want to add to that set from the Viewer window.
3. Click Update to save the new objects to the group.

To remove a single object from a group:

1. Select the object to be disassociated from its group in the Groups folder of the Scene browser.
2. Right-click the object and select Detach x From y Group in the contextual menu, where *x* is the name of the object and *y* is the name of the group to which it belongs.

   The object is no longer associated with the group.

To remove multiple objects from a group:

1. Select a group in the Groups list.

   The objects in the group are selected in the Viewer window.
2. Deselect (Ctrl-click) the objects you want to remove in the Viewer window.
3. Click Update in the Groups window to save the changes to your group.

- Creating a group on page 407
- Adding and removing sub-groups on page 410

Adding and removing sub-groups

You can store groups within each other to create sub-groups. This can be useful when you want to organize less important scene elements or actions within another heading.

To create a group:

1. Select an existing group in the Scene browser.
2. Drag it on top of a second group.
3. Select Move to Group from the contextual menu.

The first group becomes a sub-group of the second.

You can also copy a group to another folder by selecting Duplicate to this Group from the contextual menu. This leaves the group where it is and adds it to another group at the same time.

To remove a sub-group:

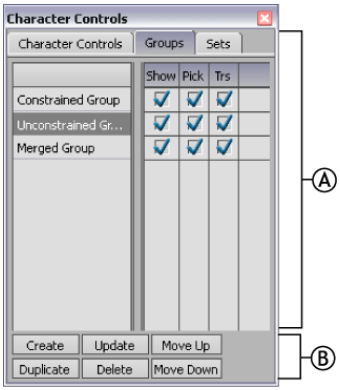
1. Select a sub-group in the Scene browser.
2. Drag the sub-group on top of the Groups root folder.

   The sub-group then displays under the root folder as a regular group again.

- Groups on page 407
- Creating a group on page 407

Groups window

The Groups window lets you take any kind of asset or object and associate them. You can create Groups including models, elements, sensors, lights, materials, shaders, markers, nodes, textures, constraints, and even other groups.



Groups window *A.* **Column area** *B.* **Options area**

To display the Groups window, select it from the Window menu in the MotionBuilder menu bar.

Column Area

The column area is where you find commands for controlling the groups. The following table shows the available commands:

Command	Function
Groups List	The Groups List shows all the groups created for use in the current take.
Show	The Show option lets you display or hide components of a group in the Viewer window. When the Show option is activated, all components of the group display in the Viewer window. When disabled, the components of the group are hidden.
Pick	When the Pick option is disabled next to a group, you cannot select objects in that group.
Transform	When the Transform (Trs) option is disabled next to a group, the contents of the group are “locked” and you cannot transform them, although you can still select them.

Options Area

The Groups option area, below the Groups column is where you find options for creating, copying, deleting, and reorganizing your groups. The following table shows which options are available from the Groups options area.

Option	Function
Create	The Create button lets you add a new group to the Groups column.
Update	The Update button lets you add or remove the contents of the currently selected group.
Move Up	You can rearrange the order of groups in the Groups list. This is useful for quick access when you work with multiple groups. Use the Move Up button to advance a selected group higher in the Groups list.
Duplicate	The Duplicate button copies a selected group from the Groups column. To duplicate a group, select it in the Groups list, then click Duplicate.
Delete	The Delete button removes a selected group from the Groups list. Using the Delete button only disassociates objects from each other, it does not remove the objects contained within the group from the scene. To delete a group, select it in the Group list, then click Delete.
Move Down	You can rearrange the order of groups in the Groups list. This is useful for quick access when you work with multiple groups. Use the Move Down button to move your group lower down in the Groups list.

- Groups on page 407
- Creating a group on page 407
- Adding and removing group objects on page 409

Sets

25

By organizing related assets into sets, you can effectively manage complex scenes that have a large number of assets involved.

Like groups, sets are used for the selection and organization of items in a scene. Unlike groups, the visibility of sets can be animated, and the animation stored in sets can be cached.

Using sets, you can select a pre-defined collection of several objects every time you want to work with them. Once stored in a set, you can manipulate the whole set instead of each individual object.

For example, if you add all the nodes from a skeleton's arm to a set, you can then scale, rotate, or translate the entire arm at the same time. When you manipulate a set, the proportions and positions of its objects are constrained.

Despite their similarities, the fundamental difference between groups and sets is that unlike groups, sets are exclusive. This means that while the same asset can appear in many groups, it can only occur once in one set. You cannot copy an asset or object from a set, you can only move it from one set to another.

The Sets window gives you a way to quickly transform and select a collection of objects, as well as toggle their visibility.

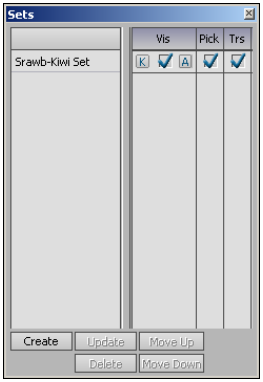
- Creating a set on page 414
- Viewing the contents of a set on page 414
- Adding and removing set objects on page 415
- Creating and removing sub-sets on page 415
- Sets window on page 416

Creating a set

1 Select an object in the Scene browser or the Viewer window. *Ctrl*-click to select multiple objects.

2 Click Create in the Sets window.

The new set is listed in the Sets list. If no objects are selected, an empty set is created.



A set is added to the Sets list.

See also:

- Sets on page 413
- Adding and removing set objects on page 415
- Creating and removing sub-sets on page 415

Viewing the contents of a set

Expand the Sets root folder in the Scene browser, then expand the set you want to view.

See also:

- Sets on page 413

Adding and removing set objects

To add an object to a set:

1. In the Sets window, select a set in the Sets list.
2. Select the objects you want to add from the Viewer window.
3. Click Update to save the new objects to the set.

To remove a single object from a set:

1. Select the object to be disassociated from its set in the Sets folder of the Scene browser.
2. Right-click the object and select Detach x From y Set in the contextual menu, where *x* is the name of the object and *y* is the name of the set to which it belongs.

   The object is no longer associated with the set.

To remove multiple objects from a set:

1. Select a set in the Sets list.

   The objects in the set are selected in the Viewer window.
2. Deselect (*Ctrl*-click) the objects you want to remove in the Viewer window.
3. Click Update in the Sets window to save the changes to your set.

See also:

- Sets on page 413
- Creating a set on page 414
- Sets window on page 416

Creating and removing sub-sets

You can store sets within each other to create sub-sets. This can be useful when you want to organize less important scene elements or actions within another heading.

To create a sub-set:

1. Create a new set containing the objects you want in the subset.
2. Select the set in the Scene browser.
3. Drag it on top of a second set.
4. Select Move to Set from the contextual menu.

The new set becomes a sub-set of the second set.

NOTE You cannot copy a set to another set, you can only move a set from one set to another. There is no duplication of sets.

To remove a sub-set:

1. Select a sub-set in the Scene browser.
2. Drag the sub-set on top of the Sets root folder.

The sub-set displays under the root folder as a regular set again.

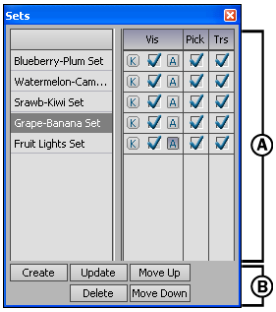
See also:

- Creating a set on page 414
- Sets on page 413
- Creating and removing sub-sets on page 415

Sets window

The Sets window lets you take any kind of asset or object and associate them. You can create sets including models, elements, sensors, lights, materials, shaders, markers, nodes, textures, constraints, and even other sets.

To display the Sets window, select it from the Window menu in the MotionBuilder menu bar.



Sets window *A.* **Column area** *B.* **Options area**

Column Area

The Column Area of the Sets window lists all of the sets you have created and gives you options for controlling the sets.

The following table shows the options available in the Column area:

Option	Function
Sets List	The Sets List shows all the sets created for use in the current take. Any type of object can be stored in a set. For example, you can create sets of lights, cameras, models, and so on. You can also create a set that contains the entire hierarchy of a Control rig. To change the timing of the animation, select the set, then make changes in the FCurves window.
Visibility	The Visibility (Vis) option lets you display or hide components of a set in the Viewer window. When the Visibility option is activated, all components of the set display in the Viewer window. When disabled, the components of the set are hidden.
Animating and Keying	With sets, you can set keyframes and animate the visibility of sets using the Key and Animate buttons next to the Visibility option. See Keyframe (K) and Animate (A) buttons.Note: The Animating and Keying visibility functions are not available within a group.
Pick	When the Pick option is disabled next to a set, you cannot select objects in that set.

Option	Function
Transform	When the Transform (Trs) option is disabled next to a set, the contents of the set are “locked” and you cannot transform them, although you can still select them.

Options Area

The Sets option area, below the Sets column is where you find options for creating, copying, deleting, and reorganizing your sets.

The following table shows the options available in the Sets option area:

Option	Function
Create	The Create button lets you add a new set to the Set column.
Update	The Update button lets you add or remove the contents of the currently selected set.
Move Up	You can rearrange the order of sets in the Sets list. This is useful for quick access when you work with multiple sets. Use the Move Up button to advance a selected set higher in the Sets list.
Delete	The Delete button removes a selected set from the Sets list. Using the Delete button only disassociates objects from each other, it does not remove the objects contained within the set from the scene. To delete a set, select it in the Sets list, then click Delete.
Move Down	You can rearrange the order of sets in the Sets list. This is useful for quick access when you work with multiple sets. Use the Move Down button to move your set lower down in the Sets list.

■ Sets on page 413

Part 1: Cameras

When you look at your 3D scene through the MotionBuilder Viewer window, you are using a camera view. The camera represents your vantage point, framing your view of the objects inside the MotionBuilder 3D world.

In fact, when many people describe a scene in the Viewer window, they often are describing what they see happening in the Viewer window's camera view.

MotionBuilder lets you use many camera views, some of which you can alter and some that contain preset angles.

Following are the topics included in this chapter.

- Adding Cameras to your scene on page 419
- Making a camera current on page 420
- Creating multiple camera views on page 421
- Producer cameras on page 425
- Custom cameras on page 431
- Camera settings on page 439
- Camera switcher on page 483

Adding Cameras to your scene

You can use the default Producer cameras to view your scene or you can create a custom camera. See Selecting a Producer camera on page 430, and Creating a custom camera on page 432.

To use a Producer camera in your scene:

1 In the Viewer window, click View.

2 From the View menu select either Perspective > Producer. If you want a fixed camera view, select View > Orthographic and choose a preset orthographic camera view, such as Producer Left.

TIP There are keyboard shortcuts for each Producer camera view so you can switch between views quickly.

The Producer camera view is automatically created as the current camera and the Viewer window switches to the new view as soon as a new Producer camera is selected.

To add a custom camera in your scene:

1 Drag a Camera asset into the Viewer window from the Asset browser.

The camera is added to the Scene browser's list of Custom cameras, beneath the Camera switcher.

2 Rename the custom camera by right-clicking it in the Scene browser's Cameras folder or the Viewer window, then selecting Rename from the contextual menu.

TIP You can add multiple custom cameras if you double-click the Camera asset in the Asset browser and then click anywhere within the Viewer window to place a camera at that point. Press Escape to cancel the operation or Enter to accept it.

3 To view through the new custom camera, make it the current camera. See Making a camera current on page 420.

Making a camera current

To make the Viewer window display a specific camera view:

1 Select a camera in the scene.

2 Right-click it and select Make Camera Current from the contextual menu. You can also right-click any camera in the Camera folder, and select Make Current from the contextual menu.

3 When you select Make Current, the view in the Viewer window switches to show the view from the selected camera.

NOTE You can only select custom cameras in the Viewer window, or the Scene browser. Make Producer cameras current by selecting them from the Viewer window View menu, or right-clicking them in the Scene browser and selecting Make Current.

You can also right-click anywhere in a scene and choose Select Current Camera from the contextual menu, to select the current camera, its interest, and Up Vector (if applicable).

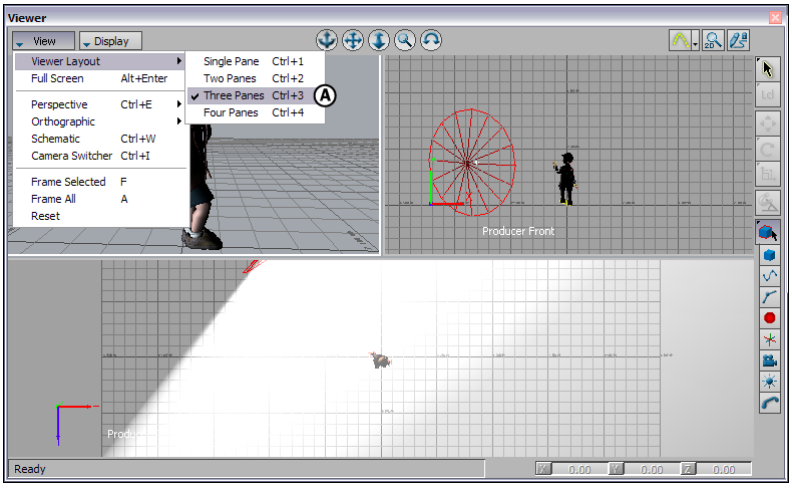
Creating multiple camera views

You can split the viewer window into multiple camera views, as shown in the following figure. This provides you with up to four different angles on your scene and makes it easier to position cameras in your scene.

To split the Viewer window into multiple panes (camera views):

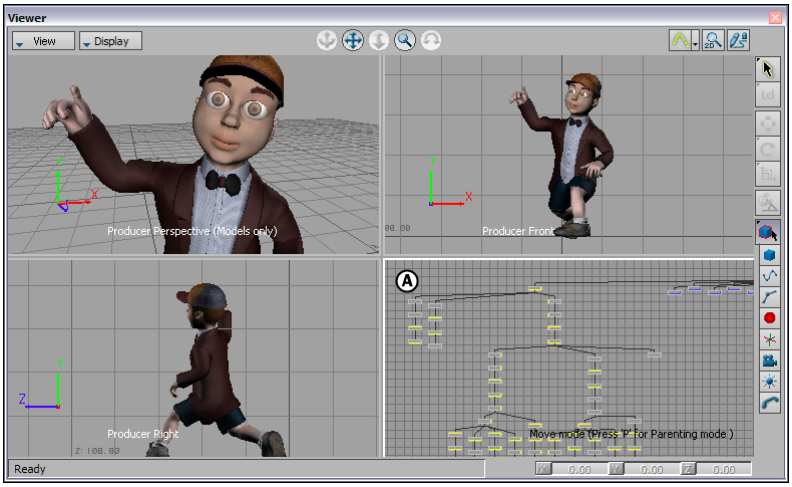
1. Select View > Viewer Layout from the Viewer window View menu.
2. Choose one of the four Viewer pane layouts as shown in the following figure (A).

NOTE ou can also click in the Viewer window and press *Ctrl-1*, *Ctrl-2*, *Ctrl-3*, or *Ctrl-4*.



Viewer window *A*. Three-pane Viewer window layout displaying three camera views

Each pane can use a different camera view, so you can see your scene from different perspectives at the same time. You can also show the Schematic view in any of the Viewer window panes as shown in the following figure.



Viewer window divided into four panes *A*. Active Viewer window pane showing the Schematic view

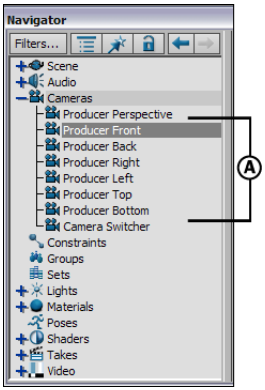
To make changes within a Viewer window pane, click within the pane.

The Viewer window pane displays a white outline indicating it is the currently active pane. An active Viewer window pane enables you to carry out actions such as changing the camera view.

Producer cameras

26

The Producer cameras are the first seven cameras in the Scene browser's Cameras folder. Producer cameras are provided as default cameras with preset views that you can use to place models and elements in a scene.



Scene browser *A.* **Producer cameras.**

You cannot see a Producer camera in a scene, nor can you select its camera interest or rename it. As well, certain camera settings do not apply, for example showing the near and far clipping planes, and adjusting the horizontal and vertical aperture.

Each Producer camera provides a different view of the scene. The following are descriptions of each Producer camera:

- Custom cameras on page 431

Producer camera types

The first seven cameras in the Scene browser's Cameras folder are Producer cameras. Producer cameras are default cameras that you can use to place models and elements in a scene.

You cannot select the camera interest of a Producer camera, and certain camera settings do not apply, such as showing the near and far clipping planes, and adjusting the horizontal and vertical aperture.

Each Producer camera provides a different view of the scene. The following are descriptions of each Producer camera:

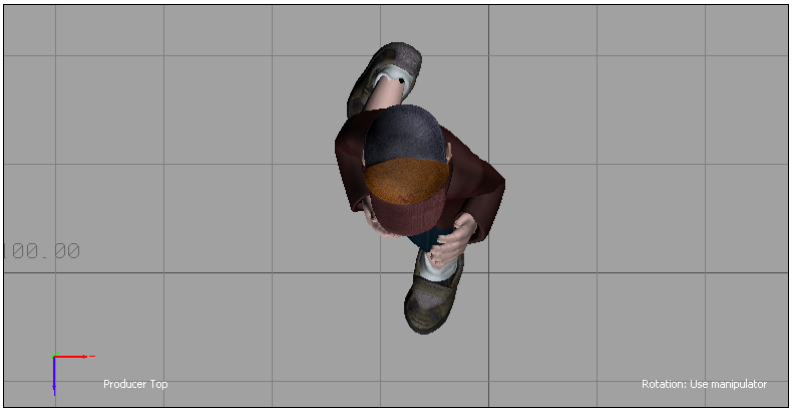
Producer Perspective

Shows the scene with the XZ plane defining the horizon . The Z-axis faces the camera, and continues towards the horizon, the X-axis is left to right, and the Y-axis is up and down. This camera view lets you translate an object on all three planes, and lets you zoom, pan, and orbit.

Producer Camera View: Producer Perspective

Producer Top

Shows the scene with the XZ plane defining the grid . The X-axis is left and right, and the Z-axis is up and down. The Y-axis points toward the camera. This camera view only lets you translate an object along the X and Z planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Top

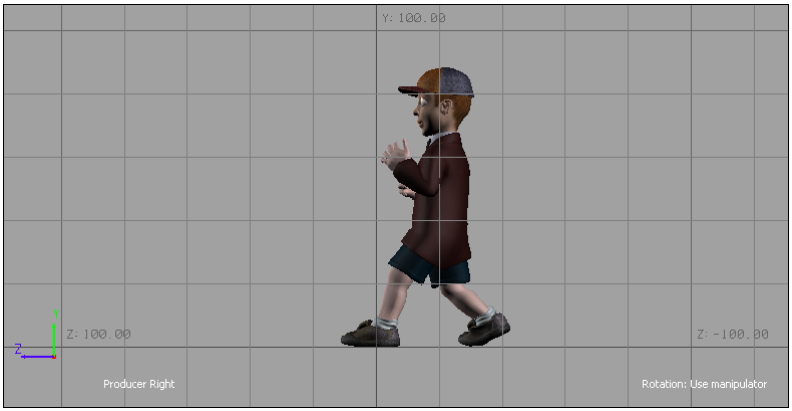
Producer Front

Shows the scene with the XY plane defining the grid . The X-axis is left and right, and the Y-axis is up and down. The Z-axis points toward the camera. This camera view lets you translate an object along the X and Y planes only. You can zoom and pan, but you cannot orbit.

Producer Camera View: Producer Front

Producer Right

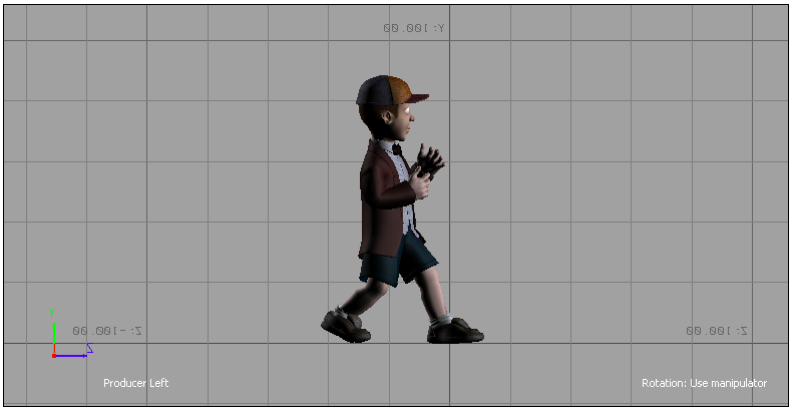
Shows the scene with the YZ plane defining the grid . The Z-axis is left and right, and the Y-axis is up and down. The X-axis points toward the camera. This camera view only lets you move an object along the Z and Y planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Right

Producer Left

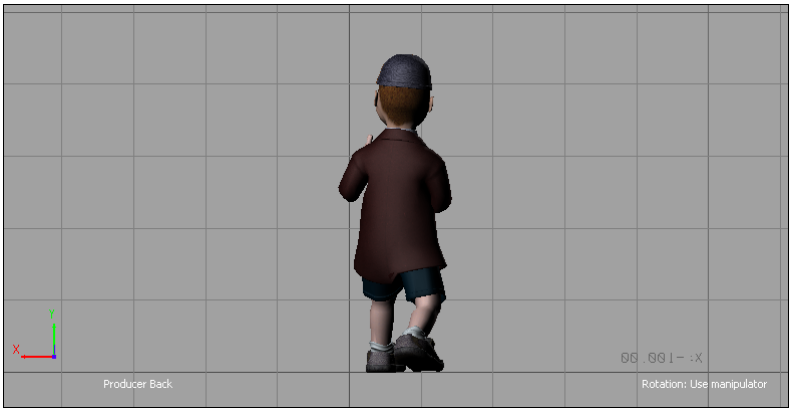
Shows the scene with the YZ plane defining the grid . The Z-axis is left and right, and the Y-axis is up and down. The X-axis points toward the camera. This camera view only lets you move an object along the Z and Y planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Left

Producer Back

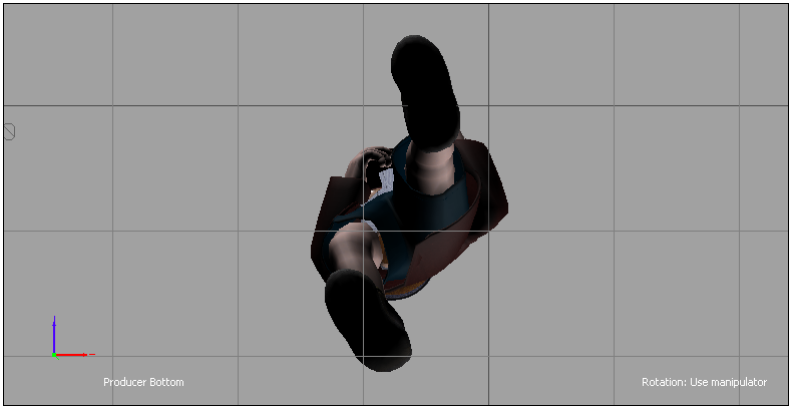
Shows the scene with the XY plane defining the grid . The X-axis is left and right, and the Y-axis is up and down. The Z-axis points away from the camera. This camera view only lets you move an object along the X and Y planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Back

Producer Bottom

Shows the scene with the XZ plane defining the grid . The X-axis is left and right, and the Z-axis is up and down. The Y-axis points away from the camera. This camera view only lets you move an object along the X and Z planes. You can zoom and pan, but you cannot orbit.



Producer Camera View: Producer Bottom

- Customizing the camera's view on page 440

Selecting a Producer camera

As Producer camera do not appear in the Viewer window, you cannot click a wireframe model to select it, as you would with a Custom camera.

There are two ways you can select a Producer camera: in the Scene browser, or in the Viewer window View menu.

Scene browser

➤ Expand the cameras folder in the Scene browser.

- Double-click any of the seven Producer cameras to display its camera settings in the Navigator and Properties windows.
- Right-click any of the seven Producer cameras and select Make Camera Current from the contextual menu.

View menu

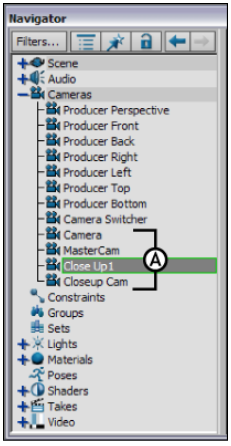
1. Expand the View menu in the upper corner of the Viewer window.
2. Expand the Orthographic menu and select the Producer camera you want to use.

Custom cameras

27

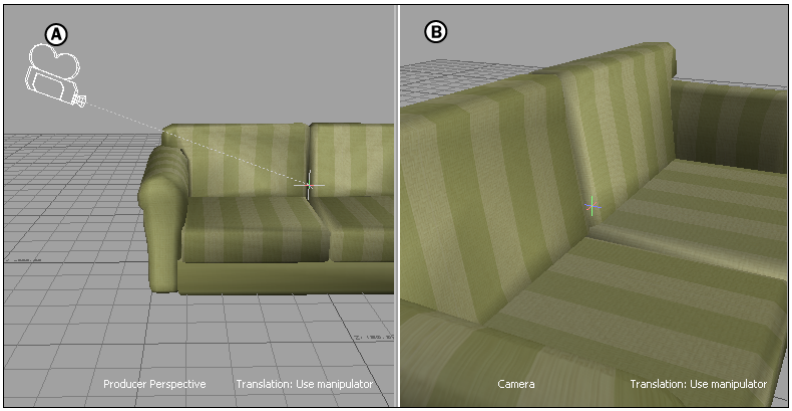
When you look at your 3D scene through the Viewer window, you are seeing it through a camera view. The camera represents your vantage point, framing your view of the objects inside the MotionBuilder 3D world. In fact, when many people describe a scene in the Viewer window, they are describing what they see happening in the Viewer window's current camera view.

You can add an unlimited amount of cameras, by dragging a camera asset into the Viewer window. These Custom cameras can be manipulated, constrained and animated; they let you alter the settings to mimic real-world camera and film aspects. Once you add Custom cameras to a scene, they are listed below the Camera switcher in the Cameras folder.



Scene browser *A.*
Custom cameras

Custom cameras are shown in the Viewer window as white wireframe movie cameras . You can view your scene through these cameras, which can be translated, rotated, scaled, and animated.



Camera views *A.* **A custom camera viewed through the Producer Perspective** *B.* **The custom camera view.**

In certain viewing modes, as in the previous figure, you can see a dotted line that ends with a "+" (cross) symbol coming from the camera. The "+" (cross) symbol is the camera interest, or focal point, and the dotted line shows the camera view's path.

You can also animate the camera interest or constrain it to an animated object to create a follow-cam. You can also use the Camera switcher to view a take through many custom cameras.

You can create scenes where the action is filmed through multiple cameras with the Camera switcher. For more on the Camera switcher, see Camera switcher on page 483.

- Creating a custom camera on page 432
- Producer cameras on page 425

Creating a custom camera

1. Drag a Camera asset into the Viewer window from the Asset browser. The new camera is added to the Scene browser's list of Custom cameras, beneath the Camera switcher.
2. Rename a custom camera by right-clicking it in the Scene browser's Cameras folder, or the Viewer window, then selecting Rename from the contextual menu.

To add multiple cameras:

1. Double-click the Camera asset in the Asset browser. The cursor becomes a cross hair.
2. Click anywhere within the Viewer window to place a camera at that point.
3. Press Escape to cancel the operation or Enter to accept it.

Showing the camera Near/Far plane

Activate the Camera Near/Far Plane option in the Camera View area to show or hide both the Near and Far clipping planes for the selected camera.

NOTE You can see a dotted outline of the camera's Near/Far pane when looking at it through another camera view.

The position of the Near and Far clipping planes are set using the Camera Format options.

Camera view area *A.* **Camera Interest option***B.* **Camera Near/Far Plane option***C.* **Camera Label option** *D.* **Grid option** *E.* **Axis option***F.* **Time Code option** *G.* **Center option***H.* **Safe Area option** *I.* **Safe area menu**

Setting up a tracking camera

Use the Focal Length slider in the Camera settings' Advanced pane to recalculate the Field of View. The Focal Length is expressed in millimeters, which is the same as a traditional camera.

1. Shift the camera's X-axis orientation to its interest by adjusting the Optical Center X values. You can animate this setting when the Aperture Mode is set to Horizontal and Vertical.

   The Optical Center X setting is disabled when the Aperture mode is set to Vertical.

2. Shift the camera's orientation to its interest with the Optical Center Y settings. You can animate this setting when the Aperture Mode is set to Horizontal and Vertical.

   This setting is disabled when the Aperture mode is set to Horizontal.

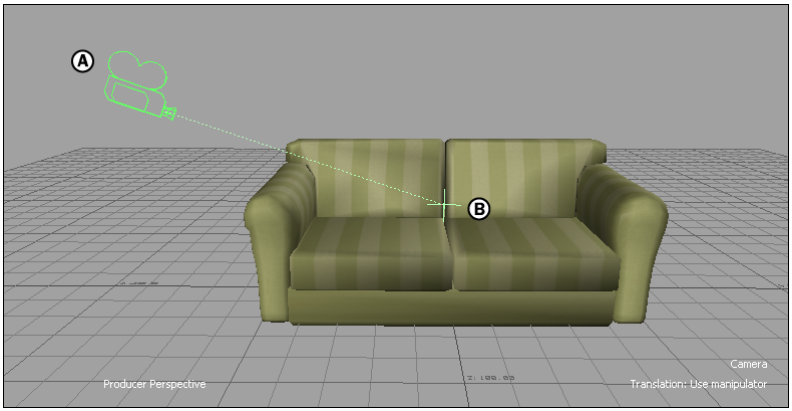
- Advanced Settings pane

Camera interest

The camera interest is the null element created when a custom camera is added. This is also known as a "Look At" point. When you add a custom camera, you actually add two elements: a camera element for the camera itself, and a special Null element for the camera interest.

When a camera is added, it is placed off-center of the scene and the camera interest is always placed at the center. The focal point of a camera is always the camera interest. When you move the camera, the subject of the camera interest never changes.

In certain viewing modes, as in the following figure, you can see a dotted line that ends with a "+" symbol coming from the camera. The "+" symbol is the camera interest, or focal point, and the dotted line shows the camera view's path.



A. **A custom camera** *B.* **camera interest**

You can animate a custom camera's interest separately from the camera to create camera moves. The Properties window shows the attributes for the selected camera interest. You can only change where the camera points by moving the camera interest.

NOTE Changing the camera interest of the same camera can be disorienting; select a Producer camera to view the interest while changing the camera interest.

- Showing the camera interest on page 435
- Selecting the camera interest on page 437
- Camera interest on page 434

Showing the camera interest

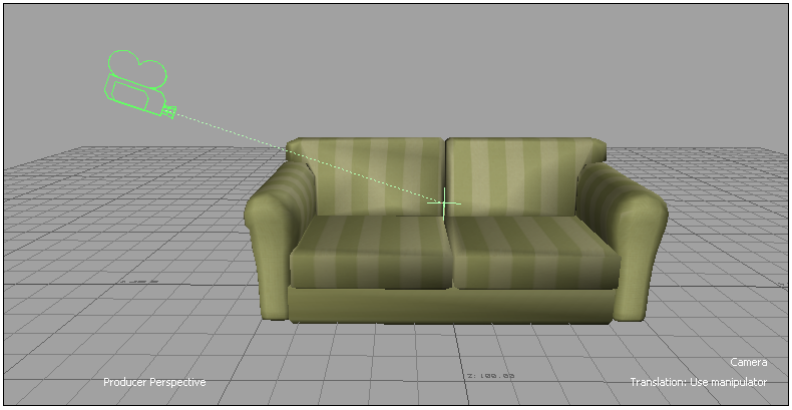
1. Activate the Camera Interest option in Camera settings View area the to show or hide the camera interest that is represented by a separate object in the scene.
2. Switch the view mode to Normal or X-Ray mode by pressing Ctrl-A.

   The camera interest is always placed at the center of the scene. The camera is shown with a dotted line that ends with a "+" (Cross) symbol.

   The "+" (Cross) symbol is the camera interest, or focal point, and the dotted line shows the camera view's path.

NOTE The Properties window shows the attributes for the selected camera interest.

3 You can select the Camera interest from the Schematic view or Viewer window.

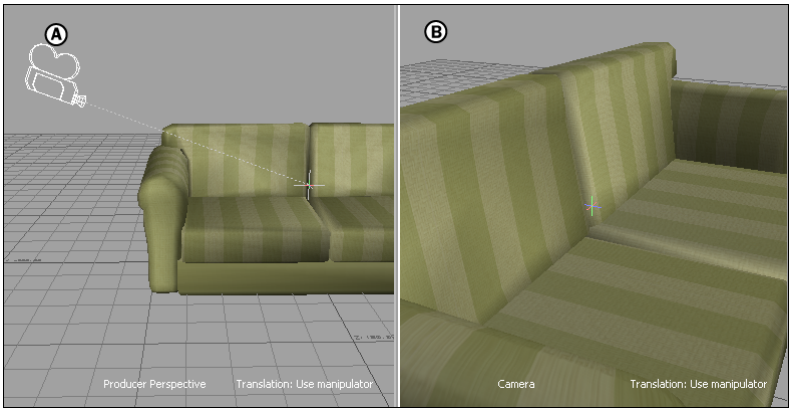


A Camera with its interest

4 Switch the view mode to Normal or X-Ray mode by pressing Ctrl-A.

The camera interest is always placed at the center of the scene. The camera is shown with a dotted line that ends with a “+” (Cross) symbol.

The “+” (Cross) symbol is the camera interest, or focal point, and the dotted line shows the camera view’s path.

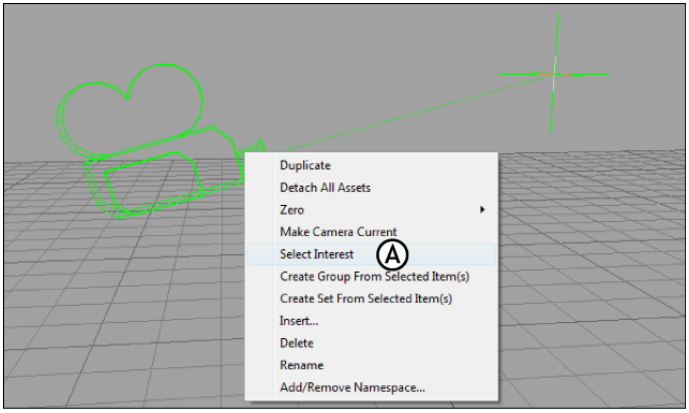


Camera views *A.* **A custom camera viewed through the Producer Perspective** *B.* **The custom camera view.**

- Camera interest on page 434
- Selecting the camera interest on page 437

Selecting the camera interest

Select the camera interest by right-clicking its camera in a scene and selecting Select Interest from the contextual menu .



Viewer window *A.* **Camera contextual menu**

You can also select the camera interest in the Schematic view in the Viewer window.

TIP Changing the camera interest of the same camera can be disorienting. Instead, select a Producer camera so you can see the camera interest while you adjust it.

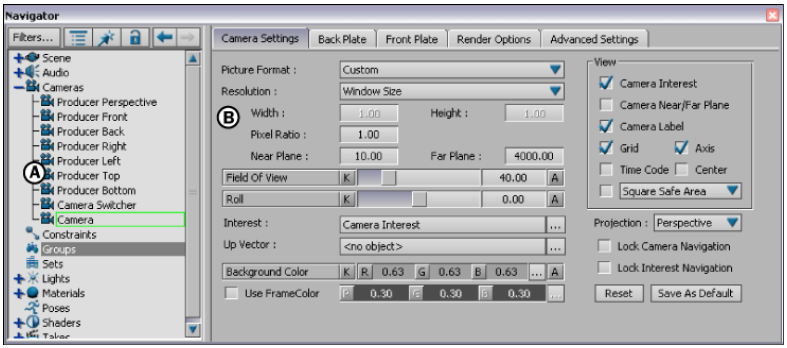
Camera settings

28

The Camera settings pane is where you modify settings for Producer and Custom cameras to view your scene.

This sub-section covers the various properties contained within the Camera Settings and how you can use them to create specific camera views.

To access the Camera settings, open the Cameras folder in the Scene browser, and double-click a camera to display its settings. These settings also display if you select a camera in the Viewer window.



Camera settings *A.* **Cameras folder** *B.* **Camera Settings**

The Camera settings consist of four panes:

Camera Settings pane

The Camera Settings pane contains the settings for configuring the selected camera's view areas.

Back Plate pane

The Back Plate pane lets you select a background image, or video clip to be displayed in the selected camera's background plane.

Render Options pane

The Render Options pane lets you set the Anti-aliasing, depth of field, and other options related to rendering for the selected camera.

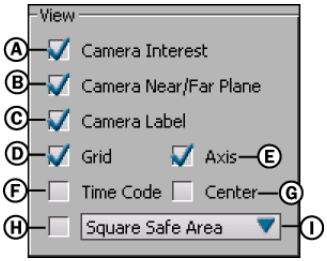
Advanced Settings pane

The Advanced Settings pane contains specialized camera settings and camera attributes that you can animate. These settings let you set the options for the aperture, lens, and film size of the selected camera.

- Camera Settings pane on page 450
- Back Plate pane on page 439
- Render Options pane on page 466
- Advanced Settings pane on page 472
- Creating a custom camera on page 432

Customizing the camera's view

You can show and hide elements that are displayed in a camera's view, such as the camera interest, Viewer window grid, time codes, and so on using the Camera settings View options in the Properties and Navigator windows.



Camera view area *A.* **Camera Interest option** *B.* **Camera Near/Far Plane option** *C.* **Camera Label option** *D.* **Grid option** *E.* **Axis option** *F.* **Time Code option** *G.* **Center option** *H.* **Safe Area option** *I.* **Safe area menu**

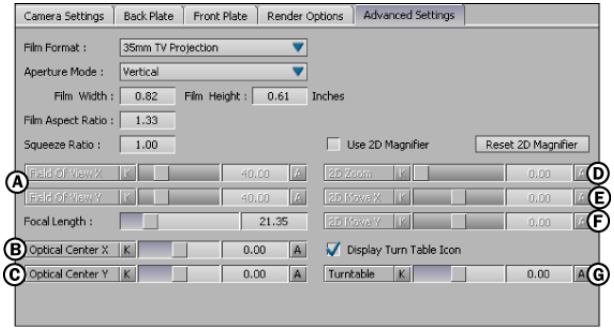
NOTE The Camera Interest and Camera Near/Far Plane options are only for Custom cameras. See Showing the camera interest on page 435 and Showing the camera Near/Far plane on page 433 for more information on using these settings.

See also:

- Showing the camera label on page 442
- Showing the Viewer window grid on page 443
- Showing the camera axis on page 444
- Showing the camera time code on page 444
- Showing the camera center point on page 445
- Showing the camera Safe area on page 445

Animating Camera settings

You can keyframe and animate any camera setting that has a Keyframe (K) and Animate (A) button beside it.



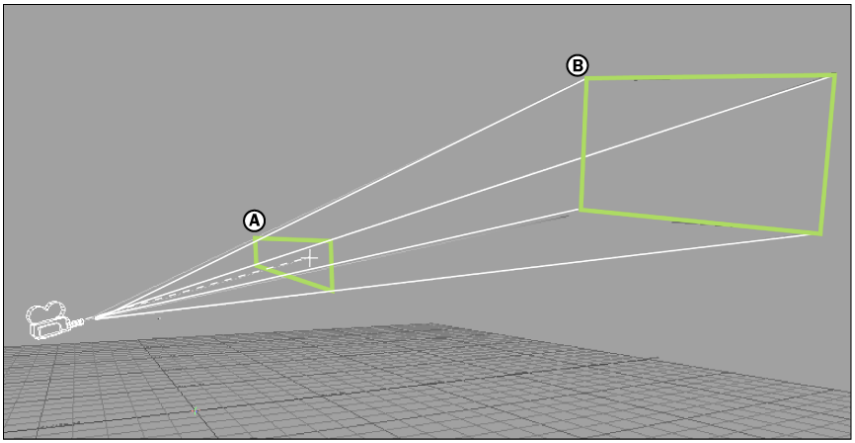
Camera Advanced Settings pane: you can animate settings A, B, C, D, E, F, and G.

For example, you can change the Field of View and Background Color of a camera in a scene so that over the length of the current take the look of the scene changes. See Setting keyframes on page 819.

NOTE The Focal Length or Field of View settings affect each other. If you animate the Focal Length, the Field of View settings are disabled and vice versa.

Showing the camera Near/Far plane

The Camera Near/Far plane option lets you view the viewing limit closest and furthest from the camera.



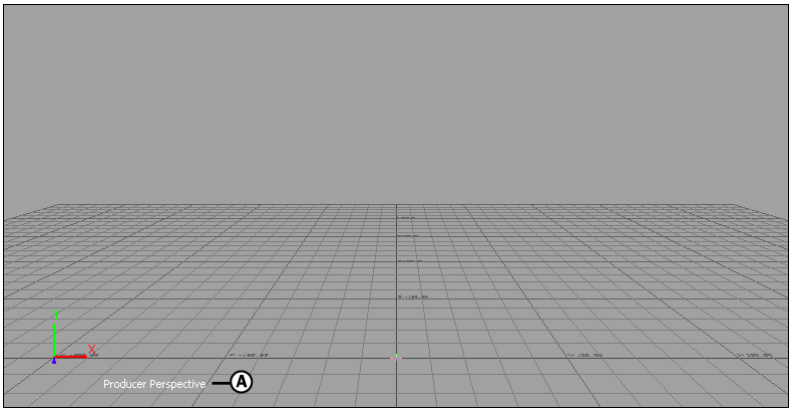
A. **Near plane** *B.* **Far plane**

To show the camera Near/Far plane:

1. Right-click a camera in the Scene browser or Viewer window and select make Current from the contextual menu.
2. In the Navigator window, activate the Camera Near/Far plane option in the Camera Settings View area.

Showing the camera label

The Camera Label option in the Camera settings View area lets you show or hide the text in the bottom left corner of the Viewer window, which indicates the name of the current camera.



Viewer window *A.* **Camera label**

To show the camera label:

1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.

2 In the Navigator window, activate the Camera Label option in the Camera Settings View area.

Showing the Viewer window grid

The Grid option in the Camera settings View area lets you show or hide the grid located at coordinate 0 of the Y plane.

NOTE The grid shows in all camera views by default.

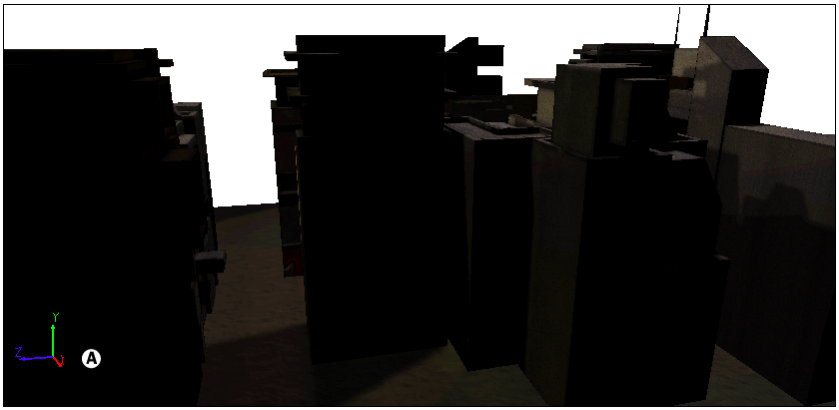
To show the Viewer window grid:

1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.

2 In the Navigator window, activate the Grid option in the Camera Settings View area.

Showing the camera axis

The Axis option in the Camera settings View area lets you show or hide the axis arrows that shows the scene's orientation.



Scene *A.* **Axis**

NOTE The axis shows in all camera views by default.

To show the camera's axis:

1. Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.
2. In the Navigator window, activate the Axis option in the Camera Settings View area.

Showing the camera time code

The Time Code option in the Camera settings View area lets you show or hide the local timecode in the Viewer window.

You may want to hide the time code when you are not playing animation.

To show the camera's local time code:

1. Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.

2 In the Navigator window, activate the Time Code option in the Camera Settings View area.

Showing the camera center point

The camera center point option lets you show or hide the center cross hair that marks the central point in the camera view.

A. **Camera center point**

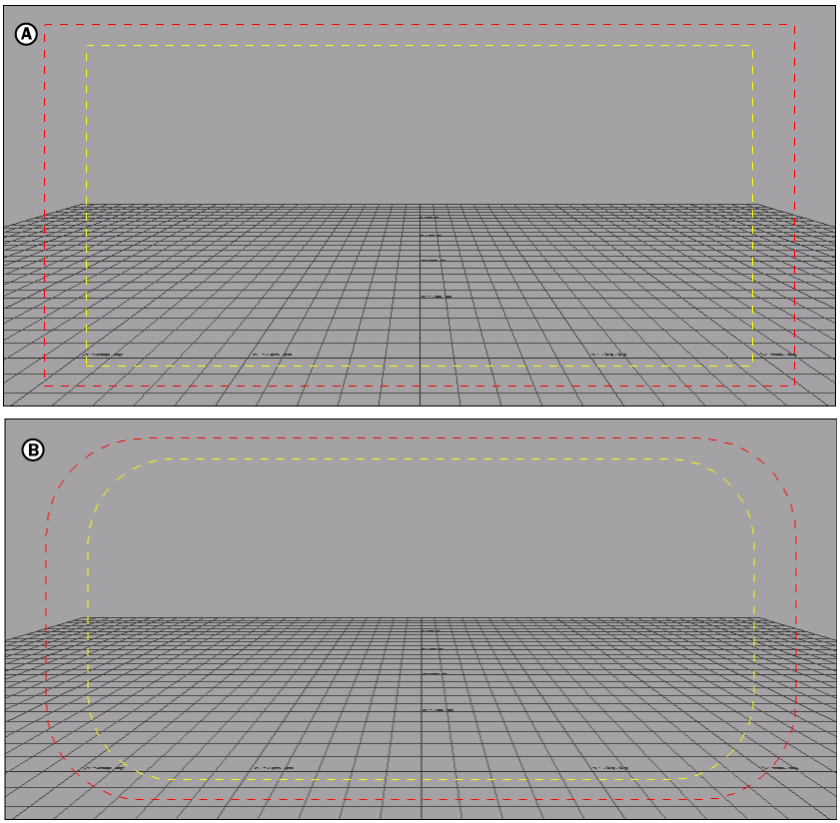
To show the camera's center point:

1 Right-click a camera in the Scene browser or Viewer window and select make Current from the Contextual menu.

2 In the Navigator window, activate the Center option in the Camera Settings View area.

Showing the camera Safe area

The Safe Area option lets you show or hide a set of guides that mark the area in which titles or animation/motion should be placed. Anything that falls outside of these guides may be cropped when transferring to video.



A. **Square Safe guides** *B.* **Rounded Safe guides**

To show the camera safe area:

1. Activate the Safe Area option in the Camera settings View area.
2. Select Square or Round Safe Area from the Safe Area menu.
3. Activate the Safe Area option to show or hide the Safe area in the Viewer window.

NOTE If you do not observe Safe areas, titles and animation may be cropped when transferring to video.

Setting a camera Front or Back Plane

You can set a texture to be a foreground or backdrop for a selected Camera:

- From the Asset browser
- From the Scene browser
- From the Camera settings

NOTE For information on how to use camera back planes as Storyboard images, see Creating a storyboard on page 1736.

To add a new texture from the Asset browser:

1. Drag a Texture asset from the Shading Elements folder in the Asset browser and drop it onto a camera in the Viewer. You can also drop it onto the camera listed in the Scene browser.
2. In the menu that appears, select either Selected Camera(s) Foreground or Selected Camera(s) Background.

   A new texture is added to the scene.
3. In the Scene browser, expand the Textures folder and double-click the new texture to display its settings.
4. In the Texture settings, select New Media from the Media menu to open a file browser which lets you select the image to be used as the camera's Front or Back plane.

   You can also use a video clip to project on the foreground/background plane. The new image or video clip is added to the Video folder in the Scene browser.
5. Select either the RGB or Alpha options to preview either the RGB or Alpha channels of the loaded image.

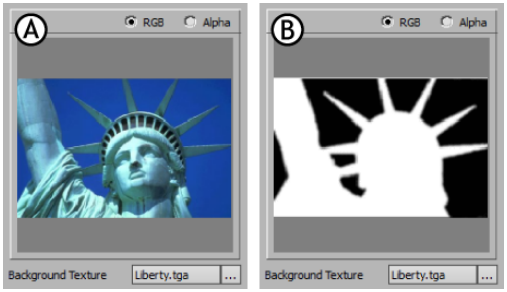


Image preview *A.* **RGB view** *B.* **Alpha view**

To attach a texture already in the scene:

1 Drag a texture from the Textures folder in the Scene browser and drop it onto a camera in the Viewer.

NOTE You can also drop it onto the camera listed in the Cameras folder in the Scene browser, or directly into the Background Texture field in the Camera settings.

---

2 In the menu that appears, select either Selected Camera(s) Foreground or Selected Camera(s) Background.

The texture is attached to the camera's Front or Back plane, depending on the option you select.

To detach a texture from the Camera settings:

1 In the Scene browser, expand the Cameras folder and double-click a camera to view its settings.

2 Select either the Back Plate or Front Plate tab, depending on where the image is placed.

3 Click on the Background Texture field, where the name of the texture appears.

4 In the list that appears, select the texture, then click Remove.

The texture is detached from the camera's Back Plate or Front Plate, but is not deleted from the scene.

Emulating real-world cameras

There are several settings for custom cameras that copy the attributes of real-world cameras so you can match MotionBuilder's output to that of actual camera footage.

NOTE The Film Format menu and Aperture mode settings apply to all custom cameras and the Producer Perspective camera.

1. Drag a custom camera into the Viewer window.
2. Right-click the camera in the Scene browser and select Make Camera Current.
3. Go to the Camera Setting's Advanced Settings pane and select the film format you are trying to emulate from the Film Format menu.
4. Adjust the Aperture mode based on the aperture setting of the camera lens you are trying to emulate.
5. Continue matching the settings in the Advanced settings pane until you are satisfied.

   NOTE If you change the Film Format setting for a custom camera in the Camera Settings Advanced pane, the Viewer window view does not change. This is because the new Film Format settings (for example the Focal Length or Optical Center) adjust to match the display of the current camera view in the Viewer window. This lets you use the Viewer window to set up shots more accurately. To change the current camera view in the Viewer window so it reflects the Film Format settings change, change the settings in the Advanced pane manually.

- Advanced Settings pane on page 472
- Camera Depth of Field settings on page 469
- Film Format menu on page 473

Applying Real-Time effects

Activate Enable Real-Time Effects to apply the Rendering options while interacting with MotionBuilder.

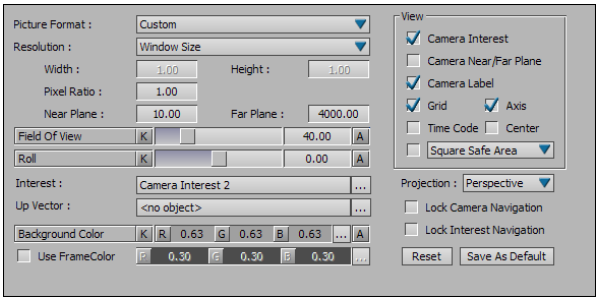
Disable Enable Real-Time Effects to apply the Rendering options only when rendering with the Render window.

For example, if Use Antialiasing is activated, and you disable Enable Real-Time Effects, Anti-aliasing is only applied when rendering to a file. Activating Enable Real-Time Effects can cause slower performance in some systems.

- Render window on page 307
- Using Anti-aliasing with cameras on page 471

Camera Settings pane

The Camera Settings pane contains the settings for configuring cameras and their view areas.



Camera Settings Pane

To configure cameras, right-click the camera that you want to change, and select Make Current from the contextual menu.

The Camera Settings pane consists of the following:

- Picture format area
- View area

Picture format area

The Picture Format area lets you select the camera's viewable area using a standard or custom frame size. You can also set the camera's near and far clipping planes in this area.

Depending on the way you configure the Aperture and Film settings, these two areas work together to determine the camera's viewable area.

Picture format menu

The following are the available Picture format options:

Picture Format type	Function
Custom	The format's width, height, or pixel ratio has been user-specified, and matches none of the other picture formats.
D1 NTSC	Standard format for D1 NTSC (720 by 486).
NTSC	NTSC standard for North American television broadcast (640 by 480).
PAL	PAL standard for European television broadcast (570 by 486).
D1 PAL	Standard format for D1 PAL (720 by 576).
640x480	Recommended computer screen format (640 by 480).
320x200	Recommended format for World Wide Web production.
320x240	Alternate World Wide Web format.
Full Screen	Full computer screen format (1280 by 1024 pixels).

Resolution

Use the Resolution menu to specify the camera's viewable area. To see the viewable area, activate the Use Frame Color option (see Use Frame Color on page 455).

The selection in the Picture Format field works with the Width, Height, Custom, and Pixel Ratio fields.

The following are the available frame size options:

Frame Size	Function
Window Size	Adjusts the viewable area to the size of the Viewer window used by the camera.

Frame Size	Function
Fixed Ratio	Lets you select between several fixed ratios. The viewing area adjusts to fit the size of the viewer, but respects the selected ratio (Width ratio).
Fixed Resolution	Lets you select between several fixed resolutions. When the viewing area is changed, the camera is fixed to the selected video standard (D1 NTSC, NTSC, and so on), or custom resolution.
Fixed Width Resolution	Fixes the width of the viewing area to the selected video standard or custom resolution, and lets you select a ratio for the height.
Fixed Height Resolution	Fixes the height of the viewing area to the selected video standard or custom resolution, and lets you select a ratio for the width.

Width and Height

The values in the Width and Height fields depend on the selection in the Picture Format field.

For example, when the Frame field is set to Fixed Width resolution, the Height field is shown as a ratio of the Width field, which is expressed in pixels.

Pixel Ratio

The Pixel Ratio field automatically sets the pixel ratio to the correct value for any selected Output format.

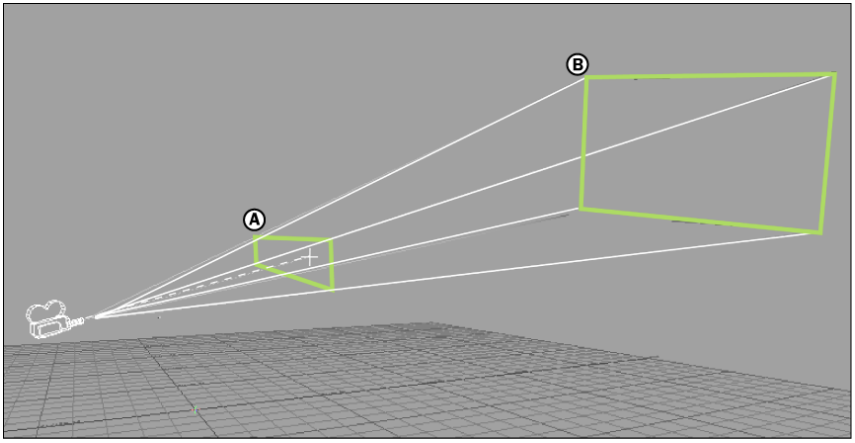
For example, on output to be viewed on television, the pixels are not square, so a small deformation is created in the Viewer window when rendering to compensate for output to that format.

When you choose from a standard picture format (NTSC, D1 NTSC,) the pixel ratio is recalculated to compensate.

If you change the pixel ratio when the Picture Format menu is set to a standard viewing area (D1 NTSC, NTSC, PAL, and so on), the Picture Format field is automatically set to Custom because the viewing area no longer matches the selected film standard.

Near Plane

The near plane is the viewing limit closest to the camera. Objects between this plane and the camera do not appear in the scene because they are out of the camera's viewing area.



A. **Near plane** *B.* **Far plane**

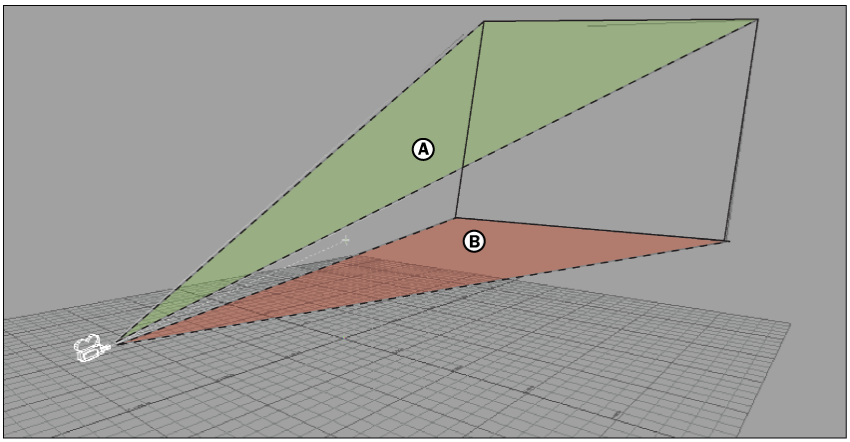
Far Plane

The far plane is the viewing limit furthest from the camera. Objects that move past this plane do not show in the scene because they are out of the camera's viewing range.

Use the Far plane field to set the distance in pixels of the far plane relative to the camera's position.

Field of View

The Field of View settings let you change the angle of the viewing area starting at the camera eye. When the Aperture mode is set to Vertical, the angle of view changes the angle between the top and bottom clipping plane, and so on.



A. **Top plane** *B.* **Bottom plane**

To view a camera's angle of view, activate the View Near/Far Plane option in the Camera View Options (see Showing the camera Near/Far plane on page 433). You can see the camera's top, left, right, and bottom clipping planes.

When the Aperture mode is set to Horizontal, the angle of view changes the angle between the left and right clipping planes.

The Field of View is expressed in degrees. You can animate this setting but the Focal Length setting is disabled.

Roll

The Roll setting lets you set a numerical value for the camera roll which rotates the camera's view. A negative value rotates the view clockwise, while a positive value rotates it counter clockwise.

The Roll setting is expressed in degrees.

Interest

The Interest setting lets you redefine the camera interest's Null element created when a custom camera is added.

Alt-drag any element from the Viewer window into the Interest field to define it as the interest of a given camera. Click the Interest field to select the camera's interest and press T on the keyboard to translate it.

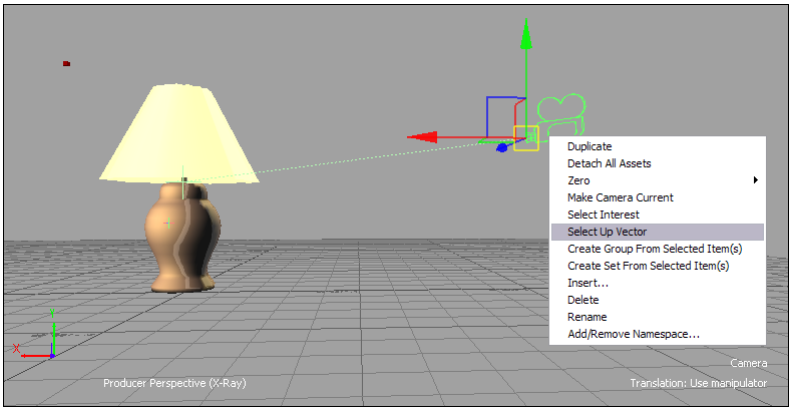
TIP Changing the camera interest of the current camera can be disorienting. Select a Producer camera to view the interest while translating it.

Up Vector

The Up Vector field lets you select an element to be used as the Up Vector of a selected camera. Alt-drag an object or marker from the Viewer window into the Up Vector field to assign an Up Vector to the current camera.

An Up Vector is an element that controls the Roll orientation of a given camera by constraining it to orient its Roll toward the Up Vector model's position. The top of the camera always pivots using the selected up vector element as a guide. This prevents the camera from flipping, and provides more realistic camera movement.

Click the Up Vector field to select the camera's Up Vector and then translate it. To select a camera's Up Vector, right-click the camera and choose Select Up Vector from the contextual menu.



Choose Select Up Vector in the contextual menu.

Background Color

The Background Color setting lets you change the background color for the selected camera. Click the Color button to open the Color window and select the background color. See Changing the background and grid colors on page 51.

Use Frame Color

Activate the Use Frame Color option to draw a border around the camera's viewable area. By default, Use Frame Color is disabled, which means no frame is used.

Use the three fields beside the Use Frame Color option to define the color of the border around the camera view.

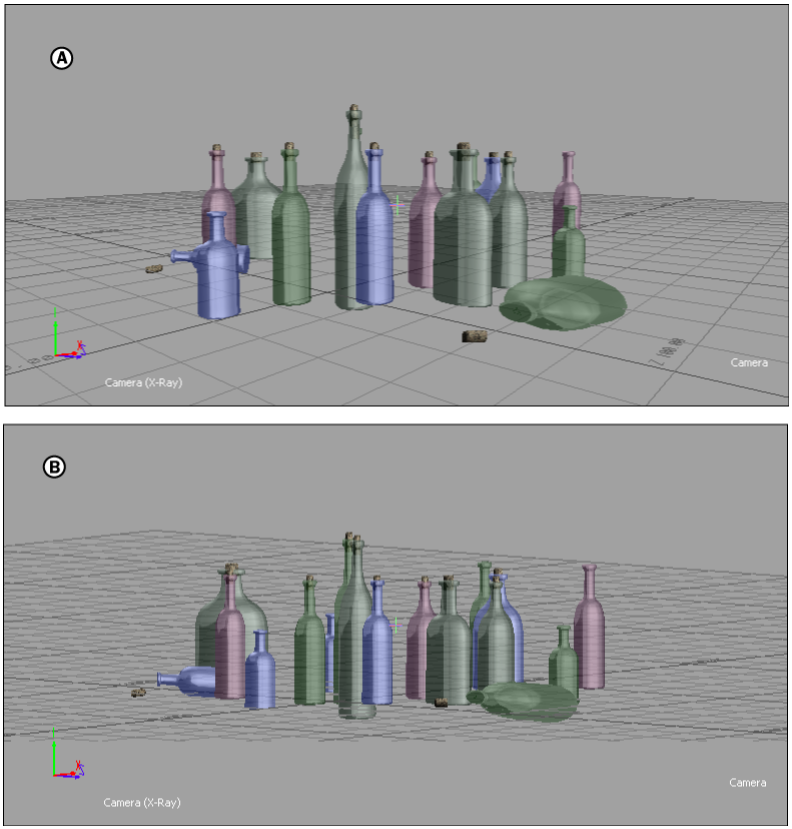
Click the Color button to open the Color window and select a specific frame color.

Key and Animate

You can keyframe and animate the Field of View, Roll, and Background Colors of cameras using the Keyframe (K) and the Animate (A) buttons beside the corresponding sliders.

Projection

Use the Projection menu to select the current camera's visualization options.



Camera Projection Types. *A.* **Perspective** *B.* **Orthographic**

Perspective	Select Perspective to set the current camera's view to show depth. This setting is the default.

Orthographic	Select Orthographic to set the current camera's view to show the environment without perspective.

Lock Camera Navigation

Activate the Lock Camera Navigation option to lock the current camera. When Lock Camera Navigation is active, you can no longer change the camera's view using the mouse and keyboard commands when the custom camera is made current.

Use Lock Camera Navigation after you position a custom camera that you do not want move accidentally as you select and translate models.

Lock Interest Navigation

The Lock Interest Navigation option lets you lock the position of the camera interest.

Reset

The Reset button lets you remove changes to the camera settings and restore the camera settings to the default, whether it is the MotionBuilder default or new custom defaults created with the Save as Default setting.

It also resets the camera position to X: 0, Y: 145, and Z: 300.

NOTE The reset button does not restore MotionBuilder default settings once the Save as Default has been activated.

See Setting a default camera on page 480.

Save as Default

Click Save as Default to retain the current custom values of the camera as a new default setting so that any new cameras use these values by default. Once you set a camera as a Default, every new camera you create uses this custom setting.

This is useful if you need several cameras with very specific custom settings. For example, you can save the picture format, background color, and View options for a camera, and then load these settings for every camera in your scene.

NOTE The Save as Default option overrides MotionBuilder defaults to your own custom setting. You cannot restore the MotionBuilder default.

The Save as Default function overwrites any previously saved defaults as only one default exist a time. See Setting a default camera on page 480.

View area

The View area contains settings for how the camera view is supposed to appear. You can use the View area to hide the grid, display a timecode, or set a safe area.

NOTE These changes affect the selected camera only.

Camera Interest

Activate Camera Interest to show or hide the Camera Interest that is represented by a separate object in the scene. You can select the Camera interest from the Schematic view or Viewer window.

Camera Near/Far Plane

Activate the Camera Near/Far Plane option to show or hide both the Near and Far clipping planes for the selected camera. The position of the Near and Far clipping planes are set using the Camera Format options. Showing the camera Near/Far plane on page 433.

Camera Label

Activate the Camera Label option to show or hide the text in the bottom left corner of the Viewer window, which indicates the name of the current camera.

Grid

Activate the Grid option to show or hide the grid located at coordinate 0 of the Y plane. By default, the grid is shown in all camera views.

Axis

Activate the Axis option to show or hide the XYZ axis in the left corner of the Viewer window. You may want to hide the axis to avoid confusion when your scene contains many Nulls that look similar to it.

Time Code

Activate the Time Code option to show or hide the local timecode in the Viewer window. You may want to hide the time code when you are not playing animation.

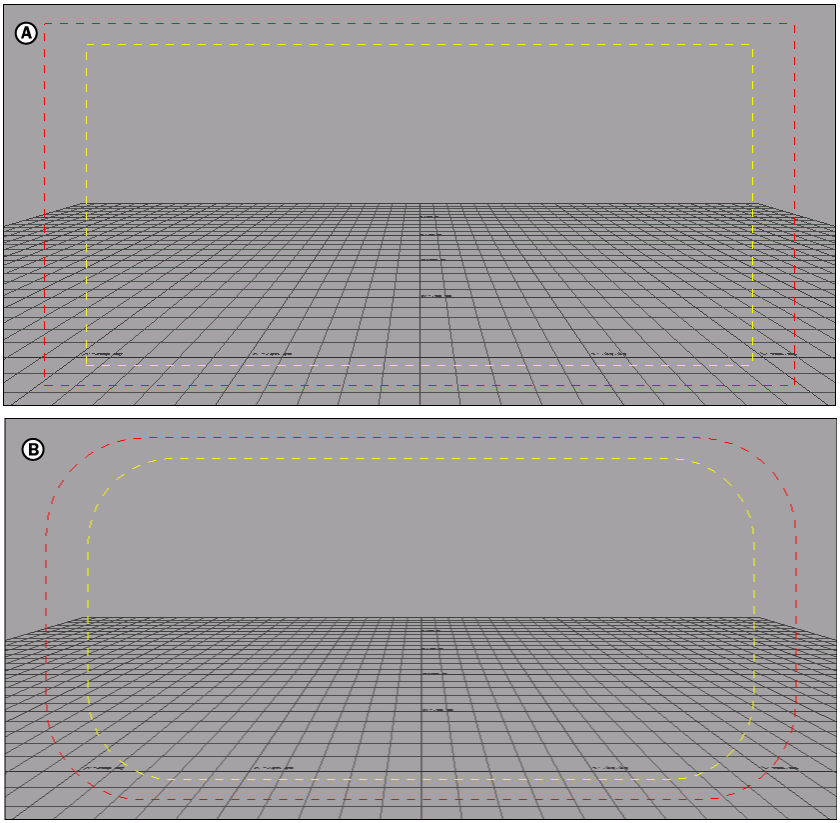
Center

Activate the Center option to show or hide the center cross hair that marks the central point in the camera view.

Safe Area

The Safe Area is a set of guides that mark the area in which titles or animation/motion should be placed. Anything that falls outside of these guides may be cropped when transferring to video.

Select Square or Round Safe Area from the Safe Area menu, then activate the Safe Area option to show or hide the Safe area in the Viewer window.



A. **Square Safe area** *B.* **Rounded Safe area**

NOTE If you do not observe Safe areas, titles and animation may be cropped when transferring to video.

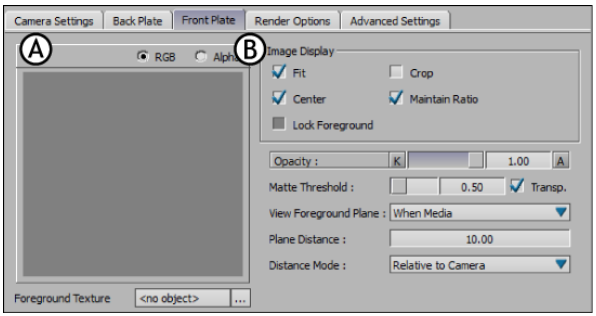
Front Plate pane

Similar to the Back Plate pane, the Front Plate pane lets you select a texture (containing either an image or video clip) to appear in the camera view, but for the camera's foreground plane.

The Front Plate plane is a separate plane used only for projecting images or video clips. The size of the plane matches the camera's viewing area and remains a part of the camera's view, even with the 2D magnifier, and the Turn Table options.

The Front Plate pane consists of two areas:

- Image Preview area on page 460
- Image Display area on page 465



Front Plate pane *A.* **Image Preview area** *B.* **Image Display settings**

Image Preview area

The Image Preview area of the Camera Settings Front Plate pane contains settings for loading a Front Plate picture, as well as lets you preview RGB or Alpha channels.

RGB - Alpha

Select either the RGB or Alpha options to preview either the RGB or Alpha channels of a loaded image.

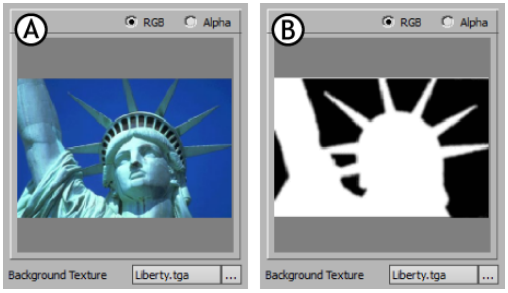


Image preview *A.* **RGB view** *B.* **Alpha view**

Background Texture

The Background Texture menu shows the name of the attached texture. For more information on loading an image on the camera back plate, see Showing the camera Near/Far plane on page 433 and Setting a camera Front or Back Plane on page 447.

Image Display area

The Image Display area lets you select how the specified texture is applied to the Front Plate plane.

NOTE The default Image Display settings are Center and Maintain Ratio.

Choose the following options from the Image Display area:

Option	Function
Fit	Scales the foreground texture to fit on the foreground plane.
Crop	Crops the foreground texture to fit on the foreground plane. If the texture is smaller than the plane, this option has no effect.
Center	Centers the foreground texture on the background plane.
Maintain Ratio	Keeps the aspect ratio of the foreground texture. Activate Maintain Ratio with the Fit option to scale the texture proportionately.

Matte Threshold slider

The Matte Threshold settings work with the Alpha channel of the selected background texture. Use the Matte Threshold slider to change the white threshold of the matte's gradient. Double-click the Matte Threshold field to enter a precise value.

Transp. option

Activate Transp to make the Alpha channel blend with the foreground image. When disabled, the Alpha channel is only used to determine how the pixels are drawn. To take advantage of this feature, the Alpha channel of your clip or image must have a gradient.

View Foreground plane menu

The View Foreground Plane menu lets you select when to show the foreground plane. This field works with the View Near/Far plane option in the Camera View Options.

The View Background Plane menu contains the following options:

Option	Function
Disabled	Disables the Background plane whether texture is being projected or not.
Always	Always shows the Background plane, even if no texture has been added.
When Media	Shows the Background plane only if a texture has been added.

Plane Distance field

The Plane Distance field lets you specify a distance where the foreground plane is to be placed.

- Image Preview area on page 460
- Showing the camera Near/Far plane on page 433

Distance Mode menu

The Distance Mode menu lets you select whether the foreground plane is placed in relation to the camera interest or the camera.

The Distance Mode menu contains the following options:

Option	Function
Relative to camera	Select to place the foreground plane relative to the camera. The foreground plane distance is measured in relation to the camera. This setting is the default.
Relative to Interest	Select to place the foreground plane relative to the camera interest. The foreground plane distance is measured in relation to the camera interest.
Absolute from Camera	Select to place the background plane relative to the camera. The foreground plane distance is measured in relation to the camera.

- Showing the camera Near/Far plane on page 433

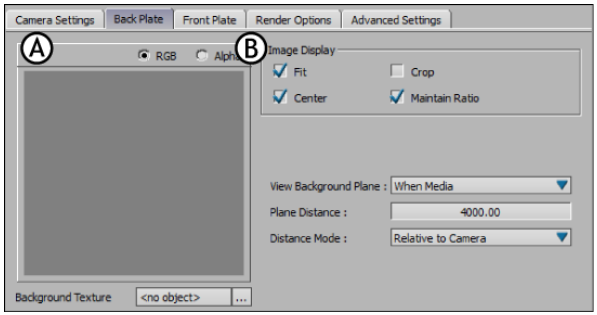
Back Plate pane

The Back Plate pane lets you select a background texture (containing an image or video clip) to be displayed on a camera's background plane.

The background plane is a separate plane used only for projecting images or video clips. The size of the background plane matches the camera's viewing area and remains a part of the camera's view, even with the 2D magnifier, and the Turn Table options.

The Back Plate pane consists of two areas:

- Image Preview area on page 464
- Image Display area on page 465



Back Plate pane *A.* **Image Preview area** *B.* **Image Display settings**

Image Preview area

The Image Preview area of the Camera Settings Back Plate pane contains settings for loading a Back Plate image or video texture, as well as lets you preview its RGB or Alpha channels.

Setting	Function
RGB - Alpha	Select either the RGB or Alpha options to preview either the RGB or Alpha channels of a loaded image.
Background Texture	The Background Texture menu shows the name of the loaded image. See Setting a camera Front or Back Plane on page 447.

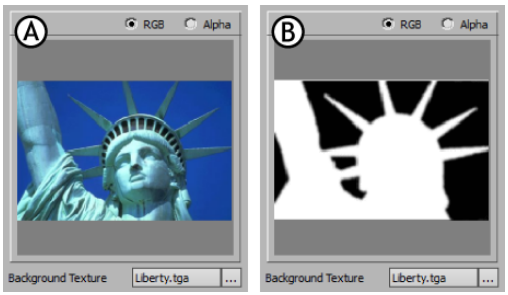


Image preview *A.* **RGB view** *B.* **Alpha view**

Image Display area

The Image Display area lets you select how the specified texture is applied to the Back Plate plane.

NOTE The default Image Display settings are Center and Maintain Ratio.

Choose the following options from the Image Display area:

Option	Function
Fit	Scales the background texture to fit on the background plane.
Crop	Crops the background texture to fit on the background plane. If the texture is smaller than the plane, this option has no effect.
Center	Centers the background texture on the background plane.
Maintain Ratio	Keeps the aspect ratio of the background texture. Activate Maintain Ratio with the Fit option to scale the texture proportionately.

View Background Plane

The View Background Plane menu lets you select when to show the background plane. This field works with the View Near/Far plane option in the Camera View Options.

The View Background Plane menu contains the following options:

Option	Function
Disabled	Disables the Background plane whether a texture is being projected or not.
Always	Always shows the Background plane, even if no texture has been added.
When Media	Shows the Background plane only if a texture has been added.

Plane Distance field

The Plane Distance field lets you specify a distance where the background plane is to be placed.

- Image Preview area on page 464
- Showing the camera Near/Far plane on page 433

Distance Mode menu

The Distance Mode menu lets you place the background plane in the camera's viewing area. The Distance Mode menu lets you select whether the background plane is placed in relation to the camera interest or the camera.

The Distance Mode menu contains the following options:

Option	Function
Relative to Interest	Select to place the background plane relative to the camera interest. The Background Plane distance field is measured in relation to the camera interest.
Absolute from Camera	Select to place the Background plane relative to the camera. The Background plane distance field is measured in relation to the camera.

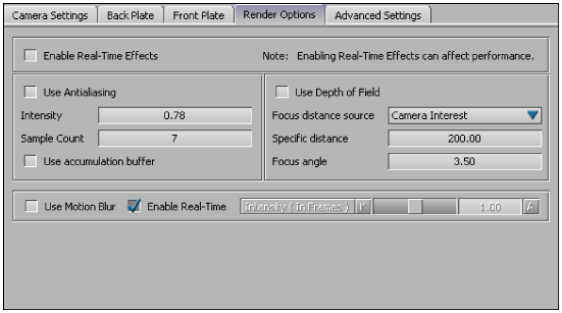
- Image Preview area on page 464
- Showing the camera Near/Far plane on page 433

Render Options pane

The Render Options pane lets you set the Anti-aliasing, depth of field, and other rendering related options for the selected camera.

The Render Options pane consists of the following:

- Enable Real-Time Effects option
- Anti-aliasing settings
- Camera Depth of Field settings



Render Options pane

Enable Real-Time Effects option

Activate Enable Real-Time Effects to apply the Rendering options. Disable Enable Real-Time Effects to apply the Rendering options only when rendering with the Render window.

For example, if Use Antialiasing is activated, and you disable Enable Real-Time Effects, Anti-aliasing is only applied when rendering to a file.

Anti-aliasing refers to a method of softening hard edges in a display that occurs as a result of sampling and over-sampling.

NOTE Activating Enable Real-Time Effects can cause slower performance in some systems.

Anti-aliasing settings

Use the Anti-aliasing settings in the Render Options pane to use and configure anti-aliasing when rendering the camera image.

You should remove the grid from your current camera when using anti-aliasing because anti-aliasing is applied to the grid as well as to models.

You should also hide objects such as Nulls, lights, cameras, and skeletons. These objects are also anti-aliased when anti-aliasing is activated, and slow the frame rate and rendering time of your scene.

Use Anti-aliasing option

Activate Use Anti-aliasing to blur the hard edges of your models in the display so they do not appear pixelated.

When this setting is activated, there is a brief pause as the scene is re-rendered. When this setting is disabled, anti-aliasing is not applied See Anti-aliasing and oversampling on page 481.

Intensity field

Double-click in the Intensity field to enter an Anti-aliasing value to increase or decrease the intensity of the anti-alias blur.

For best results, use a low intensity. The default setting is 0.7778.

Because anti-aliasing blurs the entire image, a high intensity may blur important details.

Method field

If you are using dedicated hardware anti-aliasing, use the Method field to view the anti-alias applied to the selected camera.

NOTE If you do not have dedicated hardware anti-aliasing, the default Use Software Oversampling option cannot be changed.

Use Software Over Sampling

Over-sampling refers to the process of sampling data at a higher rate than normal to obtain more accurate results or to make it easier to sample. Over-sampling is used to determine the color of each pixel viewed by the current camera.

Sample Count

This Anti-aliasing option concerns oversampling, which is a method used to determine the color of each pixel viewed by the current camera.

The resolution of the scene is not dependent on the number of pixels or scan lines. The unit of measurement is much smaller but must be adapted to pixels to be viewed by the current camera, and shown on the computer screen.

Use this field to enter the number of times each pixel is sampled to determine the pixel's color. The higher the number of samples the more accurate the pixel color, but the longer it takes to render.

Sampling Type

Along with Sample Count, this anti-aliasing option also affects oversampling, which is a method used to determine the color of each pixel viewed by the current camera.

There are two methods of sampling:

- The Uniform method samples each pixel at the same location. The pixel is divided into equal parts, and each part is sampled. The number of samples determines the number of times the pixel is divided.
- The Stochastic method randomly samples each pixel. This produces an accurate color using a small number of samples.

Use Accumulation Buffer option

Activate the Use Accumulation Buffer option if you are using a computer with a hardware accumulation buffer. If your computer is not equipped with a hardware accumulation buffer, a software emulation of the buffer is activated.

NOTE The software emulation of the accumulation buffer may decrease computer performance.

For more information on buffer settings, see the OpenGL pane preference settings in the OpenGL Viewer Info window on page 148.

Camera Depth of Field settings

The Camera Depth of Field settings let you configure the camera interest for the chosen camera.

The camera depth of field is the amount of space within lens view that maintains focus at given settings, such as camera speed, film speed, lens aperture, and so on. In MotionBuilder, it refers to a method of blurring the view depending on either the camera's focal point or a specific distance from the camera.

Use Depth of Field option

Activate the Use Depth of Field option to enable the Depth of Field options for the current camera.

The Depth of Field settings are a method of blurring the current camera view based on either the camera's focal point or a specified distance from the camera.

When disabled, Depth of field is not applied.

Focus Distance Source menu

Use the Focus Distance Source menu to select the focal point for the depth of field.

Focus distance is the distance between the camera and the object on which the camera is focused.

There are two possible sources:

Source	Function
Camera interest	Bases the depth of field on the camera interest. Models at the camera interest are in focus. As you move toward or away from the camera interest, models become increasingly blurred.
Specific Distance	Bases the depth of field on a point defined by a specific distance from the camera interest.

Specific Distance

Enter a value in the Specific Distance field to define an alternative point other than the camera interest.

NOTE This field is activated only when Specific Distance is selected as the Focus distance source.

Focus Angle field

Use the Focus Angle field to specify the angle of the focus or blur. Increasing the angle value decreases the depth of field, and increases the amount of blur.

Decreasing the focus angle increases the depth of field, and decreases the amount of blur.

Use Motion Blur option

Activate the Use Motion Blur option to create a motion blur effect for the selected camera.

Enable Real Time option

Activate the Enable Real Time option to view the Motion Blur effects in real time. If this option is disabled, the blur effect is visible only when rendered.

For better results, disable Enable Real Time, as the render time motion blur calculation is more precise.

Intensity (In Frames) slider

Use the Intensity slider to set a value for the duration, in frames, that the Motion blur effect lasts. Set a frame number for a stronger blur effect and a low frame value for a subtle blur.

- Customizing the camera's view on page 440
- Setting a default camera on page 480

Using Anti-aliasing with cameras

Anti-aliasing is used to blur the hard edges of your models in the display so they do not appear pixelated.

Remove the grid from your current camera when using anti-aliasing because MotionBuilder applies anti-aliasing to the grid as well as to models. See Showing the Viewer window grid on page 443 for more on how to disable the grid in the Viewer window.

1. Hide objects such as Nulls, lights, cameras, and skeletons as these objects are also antialiased when antialiasing is activated, and slow the frame rate and rendering time of your scene.
2. Activate Use Antialiasing in the Camera settings Render options pane.

   When this setting is activated, there is a brief pause as the scene is re-rendered. When this setting is disabled, anti-aliasing is not applied.
3. Double-click in the Intensity field to enter an anti-aliasing value to increase or decrease the intensity of the antialias blur.

   For best results, use a low intensity. The default setting is 0.7778.

NOTE Because anti-aliasing blurs the entire image, a high intensity value may blur important details.

4 Use the Sample Count field to enter the number of times each pixel is sampled to determine the pixel's color. The higher the number of samples the more accurate the pixel color, but the longer it takes to render.

5 Activate the Use Accumulation Buffer option if you are using a computer with a hardware accumulation buffer.

NOTE If your computer is not equipped with a hardware accumulation buffer, a software emulation of the buffer is activated.

The software emulation of the accumulation buffer may decrease computer performance. See Anti-aliasing settings on page 467.

About camera Depth of Field

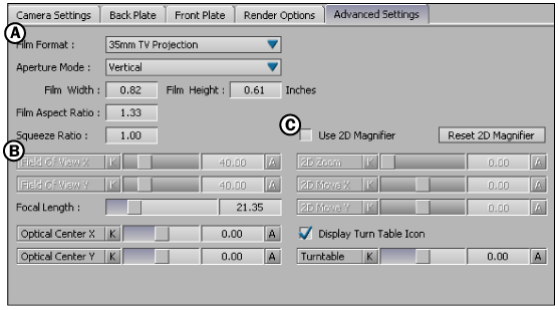
The Camera Depth of Field settings let you configure the camera interest for the chosen camera.

The camera depth of field is the amount of space within lens view that maintains focus at given settings, such as camera speed, film speed, lens aperture, and so on. In MotionBuilder, it refers to a method of blurring the view depending on either the camera's focal point or a specific distance from the camera.

■ Showing the camera interest on page 435

Advanced Settings pane

The Advanced Settings pane contains specialized camera settings, and camera attributes that you can animate. These settings let you set the options for the aperture of the camera, the lens, and the film size used by the camera.



Advanced Settings pane *A.* **Film Settings area** *B.* **Camera Tracking settings** *C.* **2D Magnifier settings**

These settings are useful when making a MotionBuilder camera emulate a real-world camera.

If you modify the Aperture and Film settings, you may cause the Viewing Area settings to be updated. Changing settings in the Advanced Settings pane may affect other camera settings. See Aperture Mode menu on page 475.

Film Settings area

The Film Settings area lets you change MotionBuilder camera settings to mimic those of real-world cameras. Use these settings to set the camera's film size, aperture size, and squeeze and aspect ratios.

Film Format menu

Use the Film Format menu to set the width, height, and pixel ratio of the camera's settings to one of the available standard camera types.

NOTE If you change the Film Format setting for a custom camera in the Camera Settings Advanced pane, the Viewer window view does not change. This is because the new Film Format settings (for example the Focal Length or Optical Center) adjust to match the display of the current camera view in the Viewer window. This lets you use the Viewer window to set up shots more accurately. To change the current camera view in the Viewer window so it reflects the Film Format settings change, change the settings in the Advanced pane manually.

If you want to use a film format setting and also see the changes in the Viewer window, change the settings in the Advanced settings pane using this table:

To simulate this film format:	Change the following settings:
16mm Theatrical	Film Size: 0.404, 0.295 inches. Film Aspect Ratio: 1.369.Field of View Y: 12.26.
Super 16mm	Film Size: 0.493, 0.292 inches. Film Aspect Ratio: 1.688.Field of View Y: 12.13.
35mm Academy	Film Size: 0.864, 0.630 inches.Film Aspect Ratio: 1.371.Field of View Y is set to 25.83.
35mm TV Projection	Film Size: 0.816, 0.612 inches. Film Aspect Ratio: 1.333.Field of View Y: 25.12.
35mm Full Aperture	Film Size: 0.980, 0.735 inches. Film Aspect Ratio: 1.333.Field of View Y: 29.95.
35mm 1.85 Projection	Film Size: 0.825, 0.446 inches. Film Aspect Ratio: 1.850.Field of View Y: 18.44.
35mm Anamorphic	Film Size: 0.864, 0.732 inches. Film Aspect Ratio:1.180.Field of View Y: 29.84.
70mm Projection	Film Size: 2.066, 0.906 inches. Film Aspect Ratio: 2.280.Field of View Y: 36.50.
VistaVision	Film Size: 1.485, 0.991 inches. Film Aspect Ratio: 1.498.Field of View Y: 39.67.
DynaVision	Film Size: 2.080, 1.480 inches. Film Aspect Ratio: 1.405.Field of View Y: 56.62.
IMAX	Film Size: 2.772, 2.072 inches. Film Aspect Ratio: 1.338.Field of View: 74.04.

NOTE The Film Format field is automatically set to Custom if the Film Size, Film Aspect Ratio, or Squeeze Ratio fields are changed from the settings used for the Viewer window's display.

Aperture Mode menu

Use the Aperture Mode menu to select the aperture of the camera lens. You can use these settings can to match a MotionBuilder camera with a real-world camera.

There are three possible aperture modes:

Aperture mode	Function
Horizontal and Vertical fields	Select to set the angle values for both the horizontal and vertical settings. This setting activates Field of View X, Field of View Y, Focal Length, Optical Center X, and Optical Center Y.
Horizontal	Select to use the aperture and film settings to set only the horizontal angle. This setting activates Film Width, Film Aspect Ratio, Squeeze Ratio, and Focal Length.
Vertical	Select to use the aperture and film settings to set only the vertical angle. This setting activates Film Height and Focal Length.

Film Width and Height fields

The values in the Width and Height fields depend on the selection in the Picture Format field. They automatically set the Field of View, Focal Length, and Film Size fields based on the selected film.

For example, when the Frame field is set to Fixed Width resolution, the Height field is shown as a ratio of the Width field, which is expressed in pixels.

NOTE Only the first field is active if you select Horizontal as your Aperture Mode setting.

Film Aspect Ratio field

The Film Aspect Ratio field gives the ratio between the horizontal and vertical Film Size. If you change either of the two Film Size fields, the Film Aspect Ratio is recalculated.

NOTE If you change the Film Aspect Ratio when the Film Format field is set to a supplied format (16mm Theatrical, Super 16mm, IMAX, and so on), the Film Format field is automatically set to Custom.

Squeeze Ratio field

The Squeeze Ratio represents the horizontal compression of the camera lens. The Squeeze Ratio only works when the Aperture mode is set to Horizontal.

NOTE Squeeze Ratio is active only if you select Horizontal as your Aperture Mode setting. Increasing the Squeeze Ratio affects the Field of View X settings.

See Aperture Mode menu on page 475.

Camera Tracking settings

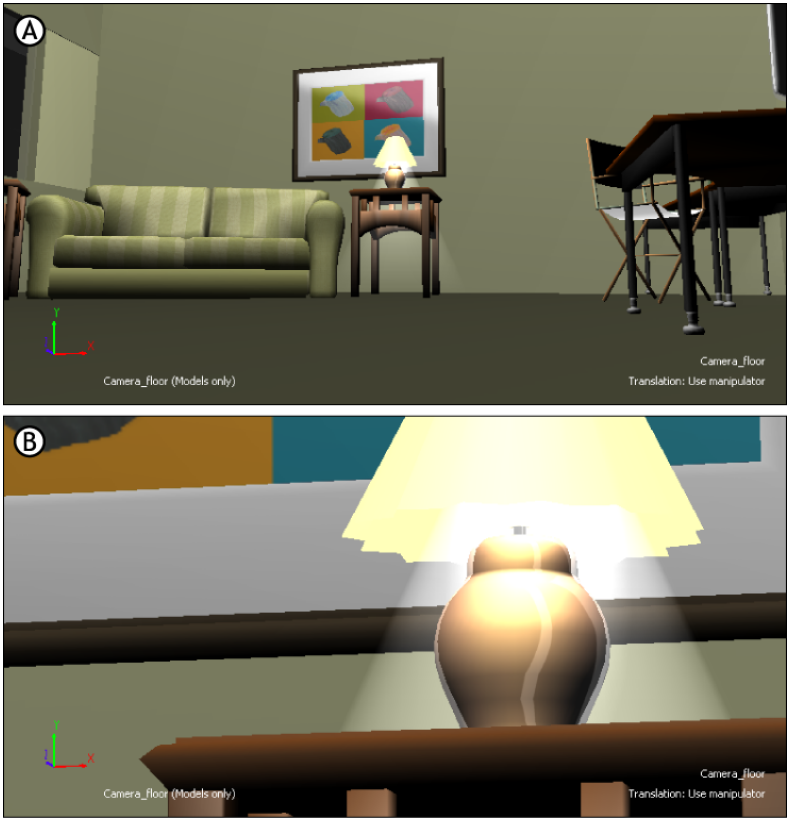
The following settings are used with the Camera Tracker to help synchronize MotionBuilder cameras with a real-world cameras. You can change Focal Length value to choose a lens, or shift the camera's X or Y-axis orientation to its interest.

Option	Description
Field of View X	Use the Field of View X values to set the camera aperture's width. The Field of View X setting is disabled when the "Aperture mode" is set to Vertical. You can animate this setting when the Aperture mode is set to Horizontal or when it is set to Horizontal and Vertical.
Field of View Y	Use the Field of View Y values to set the camera aperture's height. The Field of View Y setting is disabled when the Aperture mode is set to Horizontal. You can animate this setting when the Aperture mode is set to Vertical or when it is set to Horizontal and Vertical.
Focal Length	The Focal Length value changes the lens used to film the scene. When you change the Focal Length, the Field of View is recalculated to reflect the new focal length.You can animate this setting but it disables the Field of View settings.
Optical Center X	Use the Optical Center X values to shift the camera's X-axis orientation to its interest. The Optical Center X setting is disabled when the Aperture mode is set to Vertical.

Option	Description
Optical Center Y	Use the Optical Center Y values to shift the camera's orientation to its interest. The Optical Center Y setting is disabled when the Aperture mode is set to Horizontal.

2D Magnifier settings

These settings lets you use and set up the 2D Magnifier. The 2D Magnifier lets you perform a 2D enlargement of the scene using the current camera without changing any camera settings.



A. **Original scene seen through Camera_floor** *B.* **Camera_Floor view enlarged with the 2D Magnifier.**

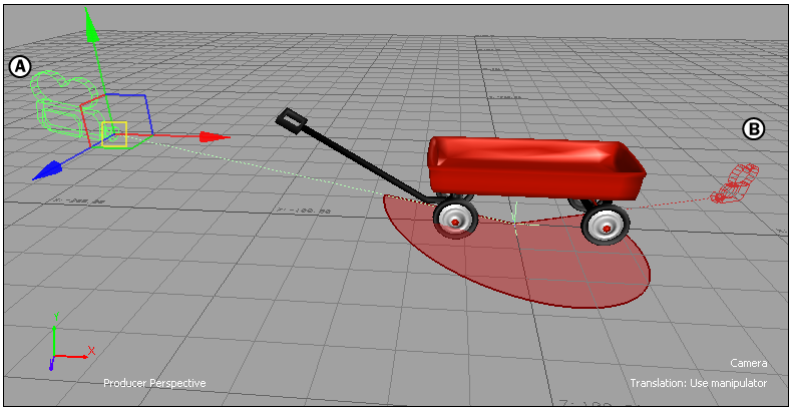
Use 2D Magnifier	The Use 2D Magnifier option lets you perform a 2D enlargement of the scene using the current camera without changing any camera settings. Use this option when you want to enlarge the scene to view small details but do not want to alter the camera's primary position. The Use 2D Magnifier setting lets you edit from the same angle as the current camera, but without using a perspective zoom. You cannot orbit the camera when the 2D magnifier is activated. When the 2D Magnifier is activated, you can only move the camera laterally (left, right, up, or down) and enlarge or shrink the prescribed 2D magnifier view, which is designated by a yellow dotted line.

Reset 2D Magnifier	Click Reset 2D Magnifier to center and deselect the selected camera view.
2D Zoom	Use the 2D Zoom slider to increase or decrease the enlargement of the 2D Magnifier. You can also enlarge or shrink the 2D Magnifier viewing area by Ctrl-clicking.
2D Move X	Use the 2D Move X slider to move the 2D Magnifier view left or right. You can also move the 2D Magnifier viewing area horizontally by Shift-right-clicking.
2D Move Y	Use the 2D Move Y slider to move the 2D Magnifier view up or down. You can also move the 2D Magnifier viewing area vertically by Shift-right-clicking.

Turn Table options

Use the Turn Table options to rotate a camera around its interest without changing the camera position or settings.

The Turn Table is useful if you want to rotate around the camera's interest but do not want to alter the camera's primary position. The Turn Table values maintain any Back Plate settings specific to the camera.



Camera Turn Table set to 216. *A.* **Camera in its original position** *B.* **Camera at 321 degrees**

Display Turn Table icon

Activate this option to show or hide the Turn Table icon that appears in the upper right corner of Viewer window when the Turn Table option is active for the current camera.

Turn table icon

Turn Table slider

The Turn Table lets you move a full 360 degrees around the interest while maintaining the camera's original position at 0.

- Customizing the camera's view on page 440
- Emulating real-world cameras on page 449
- Setting a default camera on page 480

Setting a default camera

You can save and reuse any changes you have made to a camera in the Camera settings with the Save as Default option.

1. Once you have established a camera setup that you like, click Save as Default in the Camera settings Picture Format area.

   Every camera you add to your scene now will use these default settings.

2. Experiment with the camera view.

3. If you want to recall your camera's custom default, click Reset.

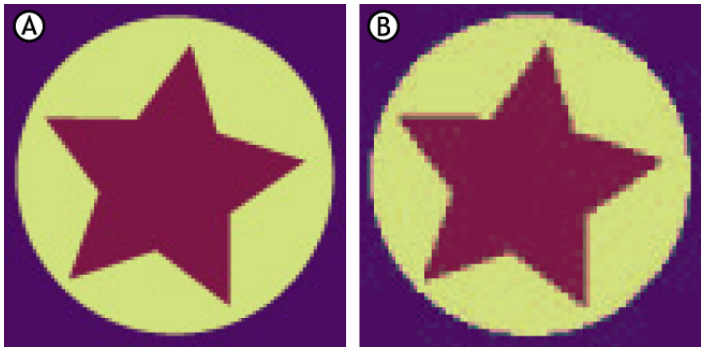
   This lets you experiment with your default camera views without losing the settings you originally defined.

   NOTE The Reset button does not restore MotionBuilder (or "factory") default camera settings.

- Customizing the camera's view on page 440

Anti-aliasing and oversampling

In the figure below, A is an illustration of a model's edge without depending on pixels or scan lines is shown. Because the smallest unit of measurement is a pixel, the model is adapted by splitting its image into pixels. This results in an aliased, or jagged edge. To smooth this edge, each pixel is sampled at different locations to determine its color.



A. **With antialiasing applied.** *B.* **Without antialiasing: the image is about to be over-sampled.**

See also:

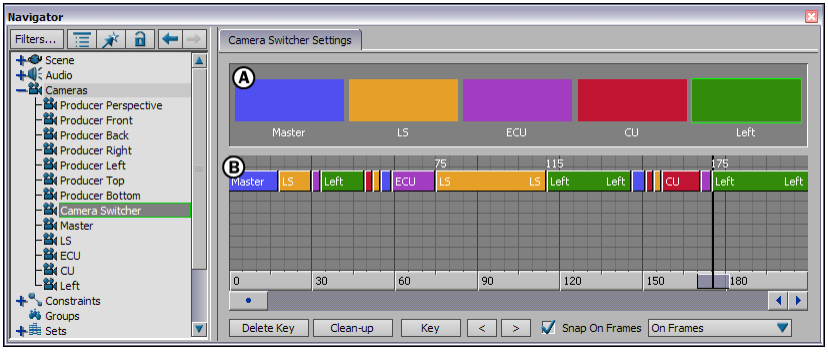
- Anti-aliasing settings on page 467

Camera switcher

29

The Camera switcher is a window that lets you switch between the custom cameras placed in your scene so you can create a take using multiple camera angles. It is found in the Scene browser's Cameras folder after the seven Producer cameras, and before any Custom cameras.

The Camera switcher contains the custom cameras you have created. If you have no custom cameras created in your scene, the Camera switcher is empty.



Camera switcher *A.* **Camera Colors** *B.* **Switcher timeline**

The Camera switcher is divided into two parts, the Camera Colors and the Switcher timeline.

- Camera Colors area on page 491
- Switcher timeline on page 489

Creating camera switches

1 Add more than one camera to your scene. (See Creating a custom camera on page 432 for more on how to add a camera to your scene.)

2 Expand the Cameras folder in the Scene browser and double-click Camera switcher.

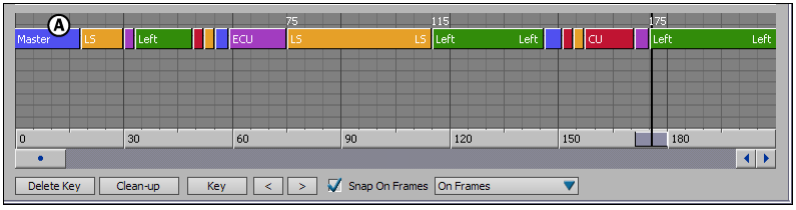
3 Right-click Camera switcher and select Make Current.

4 Select the camera color box that represents the camera you want to switch to in the Camera Colors area.

5 Move the Switcher timeline indicator to the point where you want a camera switch to occur, and click Key.

TIP You can also press K on the keyboard to set a camera switch.

This sets a keyframe, which creates a camera switch in the Camera switcher.



Camera Switches and Keyframes *A.* **Camera switches in the Camera switcher**

➤ Advance the timeline indicator to the position of the next key, select the appropriate Camera Color, and click Key again.

The new key is set from that position forward.

➤ To set the next switch, advance again, select a camera, and click Key, and so on.

Once you have added more than one camera switch to the Switcher timeline, you can refine the camera switching by playing the switches, changing the cameras, or removing the cameras altogether.

■ Selecting cameras in the Camera switcher on page 485

■ Navigating the Switcher timeline on page 491

Playing camera switches

After you have set a series of camera switches, you can play the camera switches like a current take.

1. Right-click the Camera switcher in the Scene browser and select Make Current from the contextual menu.

   This lets you view your camera switches along with the current take when you play them back.

2. Click Play in the Transport Controls window

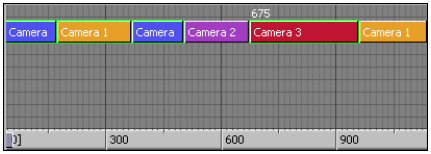
- Use the Play Backward button (<) to jump between camera switches in reverse of the order that they occur, that is, from right to left.
- Use the Play Forward button (>) to jump to the next camera switch in the order that they occur, that is, from left to right.
- Creating camera switches on page 483
- Swapping cameras on page 488
- Navigating the Switcher timeline on page 491

Selecting cameras in the Camera switcher

Select a camera by clicking its color box in the Camera Colors area. The selected box is highlighted with a green border. This makes the camera the current view in the Viewer window.

Selecting multiple camera switches

You can select multiple camera switches to change their assigned cameras. To do so, Ctrl-click the camera switches in the Switcher timeline, and then click the camera's color box in the Camera Colors area .



Multiple cut selection

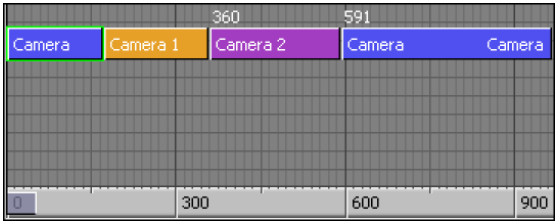
- Selecting cameras in the Camera switcher on page 485
- Selecting cameras in the Camera switcher on page 485

Editing camera switches

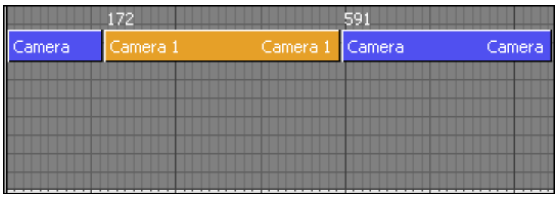
Once you have added your camera switches, you may want to delete, clean up, snap, resize, or have switches snap to exact frames.

Deleting switches

Click Delete Key to delete a camera switch. The Delete Key button removes a selected camera switch in the Switcher timeline and also removes the keyframe from the Transport Controls timeline.



Switcher timeline before the Camera 2 switch is deleted.

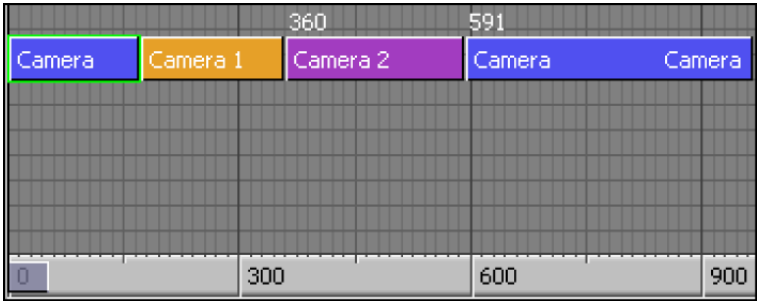


Switcher timeline after Camera 2 switch is deleted. Camera 1 fills the empty space.

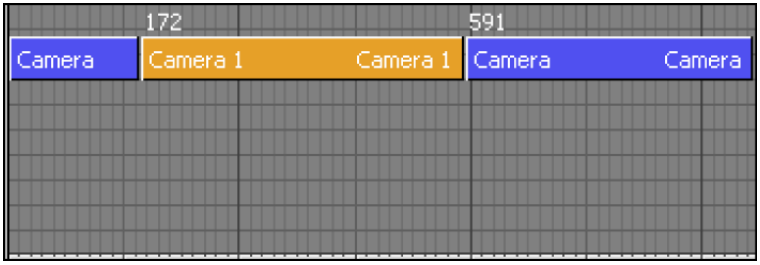
Removing redundant switches

Click Clean-up to remove any redundant camera switches that might reduce system performance.

For example, in the following figure, there are three Camera 3 switches. In the figure that follows that, the Clean up button is clicked, and the three switches become one Camera 3 switch that lasts the duration of the previous three.



Three Camera 3 switches in a row



After clicking Clean up, the three Camera 3 switches become one.

Resizing switches

You can resize the camera switch length by click-dragging the left or right side of a selected camera color's green highlight in the Switcher timeline.

You can also move camera switch keys added to the Transport Controls by dragging them to another time. The keys on the Switcher timeline update automatically.

Swapping cameras

You can change the order in which the cameras are used by selecting a camera in the Switcher timeline, then clicking a different camera in the Camera Color row.

The selected camera in the Switcher timeline becomes the new camera for that camera switch. This does not alter the location of camera switches.

Snapping switches to frames

1 Activate the Snap On Frames option to snap camera switches to the nearest frame after the camera switch.

   For example, if a switch occurs in the middle of two frames, the camera switch is bumped to the next frame.

   When you select either of the two snapping methods, a dialog box appears asking if you want to apply snapping to all switches or new switches .

Snap Camera Switch dialog box

2 Click “Yes” to snap all current camera switches or click “No, snap only new switches” to ignore the existing camera switches, and snap only new camera switches.

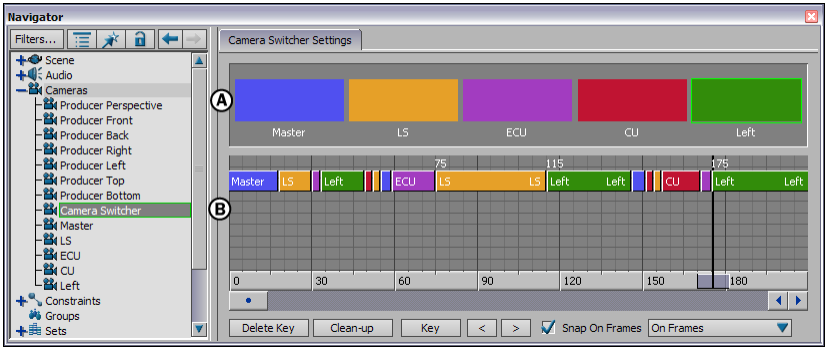
The menu to the right of the Snap On Frames button lets you choose two methods of snapping camera switches to frames:

Option	Description
On Frames	Select On Frames to have the Camera Switch snap to the frame rate of the timeline. For example, if your take is set to thirty frames per second, the camera switches are snapped to this frame rate. If you do not have a video clip associated with the camera, a dialog box appears to warn you that there is nothing on which to base the frame snapping.

Option	Description
On Back Plate Frame	Select On Back Plate Frame to have the Camera Switch snap on the frame rate you set as the Back Plate in your Camera view. This way, your camera switch is synchronized with any Back Plate video you might be using.

Switcher timeline

The Switcher timeline lets you create and manage each camera switch.



Camera switcher *A.* **Camera Colors** *B.* **Switcher timeline**

The Switcher timeline is managed using the following options:

Delete key button

The Delete key lets you delete camera switches.

Clean-up button

The Clean-up button lets you remove any redundant camera switches.

Key button

The Key button lets you set a camera switch.

When the Camera switcher is the active camera, the Property field in the Key Controls window displays “Camera switcher” to signify the keyframes on the Action timeline represent existing camera switches.

Play Backward (<) button

The Play Backward button lets you play through your switches in reverse.

Play Forward (>) button

The Play Forward button lets you play through your switches.

Snap On Frames option

The Snap On Frames option snaps camera switches to the nearest frame after the camera switch. For example, if a switch occurs in the middle of two frames, the camera switch is bumped to the next frame.

The menu to the right of the Snap On Frames button lets you choose two methods of snapping camera switches to frames:

Option	Description
On Frames	Select On Frames to have the Camera Switch snap to the frame rate of the timeline. For example, if your take is set to thirty frames per second, the camera switches are snapped to this frame rate. If you do not have a video clip associated with the camera, a dialog box appears to warn you that there is nothing on which to base the frame snapping.
On Back Plate Frame	Select On Back Plate Frame to have the Camera Switch snap on the frame rate you set as the Back Plate in your Camera view. This way, your camera switch is synchronized with any Back Plate video you might be using.

See also:

- Creating camera switches on page 483
- Navigating the Switcher timeline on page 491

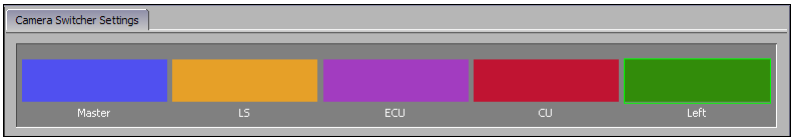
Navigating the Switcher timeline

Use the scroll bar located below the Switcher timeline to move it from left to right, or Shift-drag the timeline left and right. Ctrl-drag to zoom in and out of the Switcher timeline.

- Selecting cameras in the Camera switcher on page 485

Camera Colors area

The Camera Colors area show each custom camera represented by a colored rectangle. These rectangles are assigned different colors and are named for the camera they represent.



Camera Colors area.

If you rename the custom cameras in the Scene browser Cameras folder, the names in the Camera Colors rectangles are changed as well.

NOTE You cannot change the colors automatically assigned to each camera. They are assigned to the camera when it is created.

- Creating camera switches on page 483
- Resizing switches on page 487
- Editing camera switches on page 486

Camera switches in the Story window

Switches created in the Camera switcher can be converted for usage in the Story window's Edit Track list. See Edit track contextual menus on page 1862.

Part 2: Lighting

Lights are used to light your scene, and create special effects. They behave exactly like theatrical lights except that you can put them anywhere, even inside objects.

Aside from serving a practical purpose, MotionBuilder lights also can create a dramatic ambience that helps set your scene.

Lights adding drama to the scene

This chapter covers MotionBuilder lights, their settings, properties and how to use them to create lighting in your scene.

Following are the topics included in this chapter.

- Custom lights on page 495
- Global lights on page 521

See also:

- Selective Lighting shader settings on page 659

Custom lights

30

Lights are used to light your scene, and create special effects. They behave exactly like theatrical lights except that you can put them anywhere, even inside objects.

There are three Light types in the Light settings: Point lights, Infinite lights, and Spot lights. There is also a Global light, which provides default lighting, should your scene have no lights added. See Global lights on page 521.

These lights can be translated, rotated, scaled, colored, and animated.

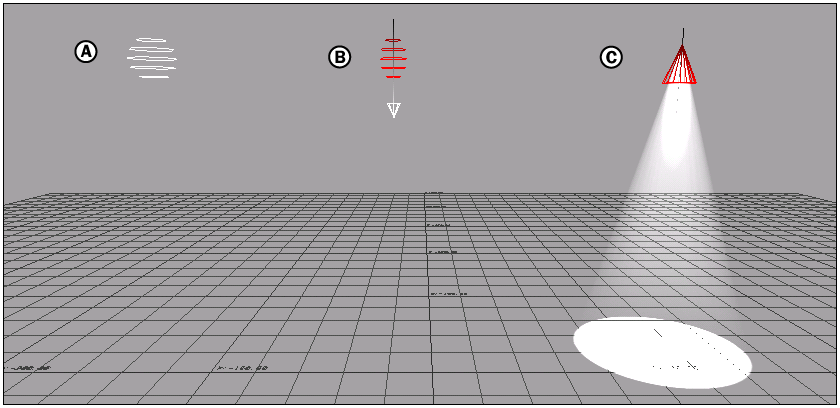
NOTE Settings are used for all light types unless otherwise noted. When properties cannot be used for the selected light type, their sliders are disabled.

- Adding and removing lights on page 498

Light types

In MotionBuilder, there are three Light types in the Light settings:

- Point light on page 496
- Infinite light on page 497
- Spot light on page 497

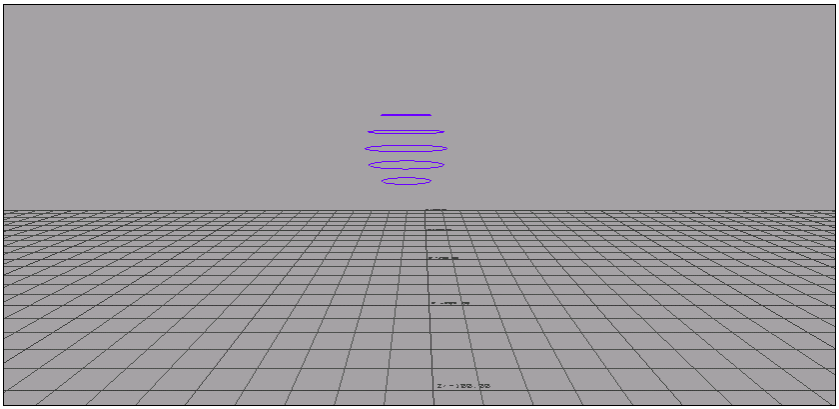


Light types *A.* **Point light** *B.* **Infinite light** *C.* **Spot light**

NOTE The Global light is present in every scene but cannot be selected from the Type menu. For more about the Global light, see Global lights on page 521.

Point light

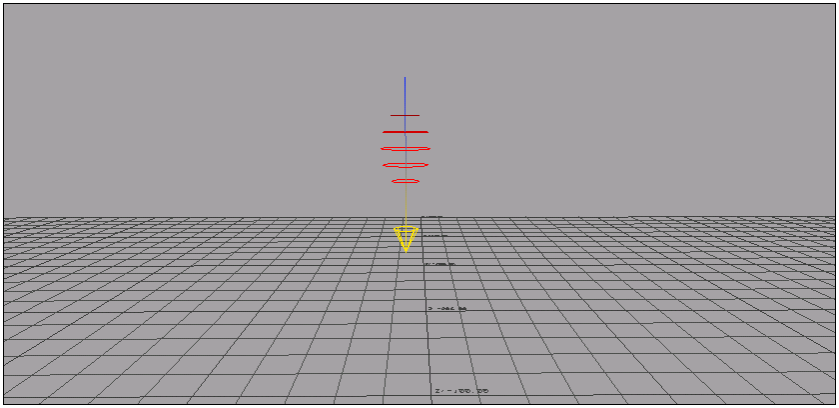
Radiates from the center of the light, illuminating all other models in the scene. The current color of the light is shown by the light. You cannot set the Cone Angle or Fog Intensity for Point lights.



Point light

Infinite light

Shines light in a specific direction. The position of the actual light is not important. The current color of the light is shown by a downward arrow. You cannot set the Cone Angle or Fog Intensity for Infinite lights.

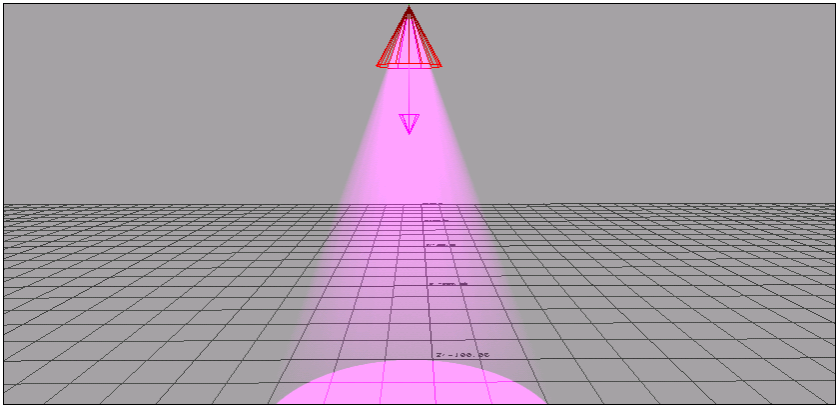


Infinite light

Spot light

Shines light in a specific direction from one position in your scene. The current color of the light is shown by the light ray, an arrow indicating the light's direction and the ground projection. The range of the light is defined using a Cone Angle.

Spot lights have the most settings available, and unlike other light types can show fog, project images and gobos, and have their cone angles animated. See Defining Spot lights on page 504 for more about the different Spot light options.



Spot light

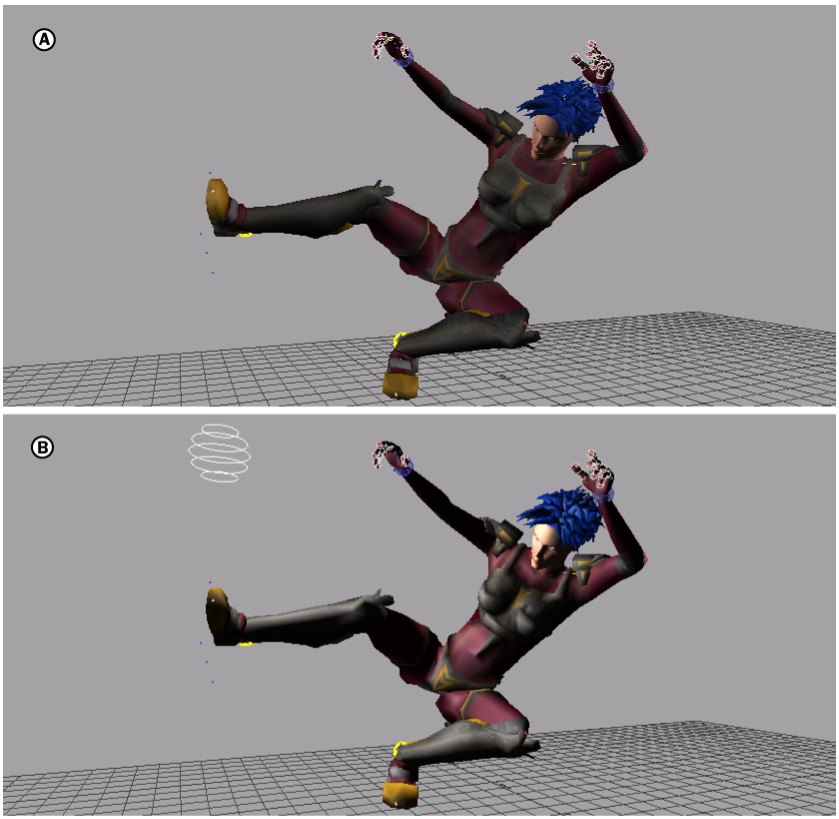
■ Adding and removing lights on page 498

Adding and removing lights

Lights are used to light your scene, and create special effects. They behave exactly like theatrical lights except that you can put them anywhere, even inside objects.

To add a light to a scene, drag a Light asset from the Asset browser Elements folder into the Viewer window. The new light is added to the Lights folder.

When you add a light, it is a Point light by default and the Global (ambient) light is extinguished. For example, the following figure shows the scene illuminated using the default Global light (A) and an added Point light (B).



Default and added lights *A.* **Global light** *B.* **Added Point light**

TIP Rename a light by right-clicking it in the Lights folder and selecting Rename from the contextual menu.

To remove a light from your scene, right-click the light in the Scene browser's Lights folder and select Delete from the contextual menu. You can also select the light in the Viewer window and press the Delete key.

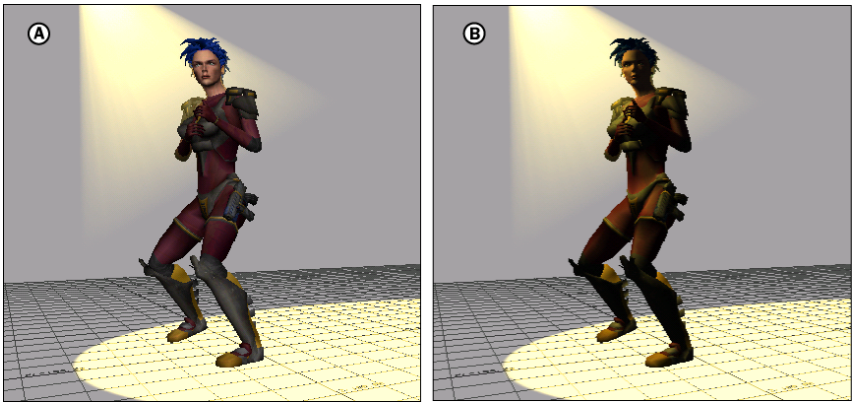
NOTE You can add an unlimited number of lights to a scene, however due to graphics card limitations, you can see only the effects of the first eight lights.

To add a light without lighting objects:

1. Select the light in the Viewer window or Scene browser.
2. In the Light Settings, disable Cast Light On Object.

This lets you use the light as an effect in the scene without illuminating objects.

For example, the following figure shows a model with Cast Light On Object disabled and activated.



Cast Light On Objects *A.* **Disabled** *B.* **Activated**

When the Cast Light On Object option is activated, objects are lit. When the setting is disabled, the light effect exists but does not affect the object. Disabling Cast Light On Object also speeds up the display time.

NOTE The Cast Light On Object option is activated by default.

This effect can also be provided by the Selective Lighting shader. For more information, see Selective Lighting shader settings on page 659.

- Adjusting light color on page 501
- Projecting images with lights on page 504

Intensifying a light

You can increase or decrease the brightness of any type of light using the Navigator or Property window's Light Intensity settings. The lower the intensity value, the softer the light.

- When set to 100, the Intensity mimics a hard light.
- At 0, the light is off.

Click the Animate (A) button beside the Intensity settings to activate this setting for animation.

Adjusting light color

You can adjust the color of any lights,

Use the Navigator or Property window's Color settings to adjust the color of the light. By default, the color of the light source is pure white.

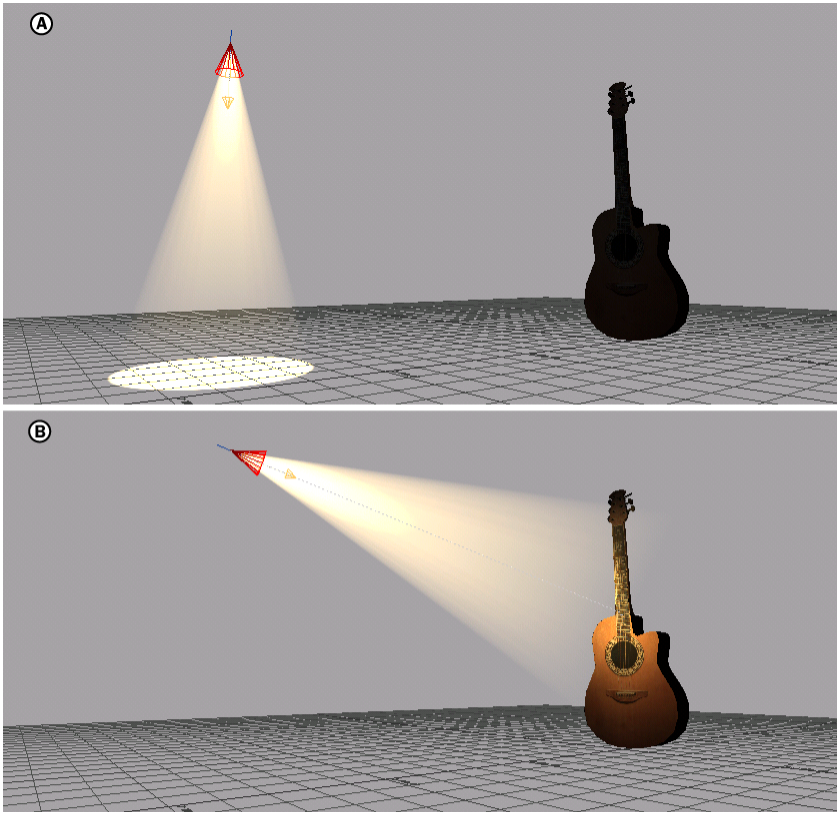
1. Select the light.
2. Enter a new value in the Color settings.
3. Click the Color button to open the Color window and change the selected light's color and mode. For more information on the Color window, see Using the Color window on page 6.
4. Click Animate (A) beside the Color settings to activate this setting for animation.

See Intensifying a light on page 500 for information on how to brighten or dim your lights.

Defining a light's Interest

You can assign an interest, or "look-at point" for any light.

1. Select the light in either the Scene browser or the Viewer window.
2. In the Light Settings, Alt-drag any element into the Interest field to define it as the interest of a given light.
3. If you translate the interest object, the light is constrained to it.



Spot light interest *A.* **Spot light with Interest not set.** *B.* **Spot light with Interest set on the guitar.**

Click the Interest field to select the element you selected to be the light's interest, and both the light and interest object are selected. When the light is translated, the light's interest follows it.

- Light types on page 495

Defining a light's Up vector

You can set an Up vector for any light.

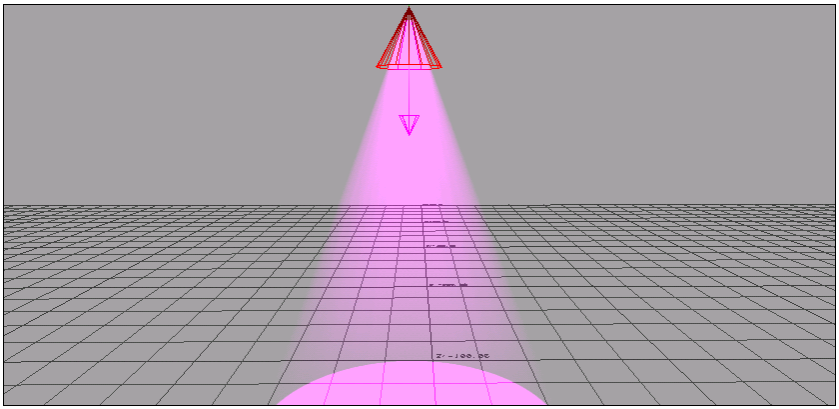
To define a light's up vector:

1. Select the light in either the Scene browser or the Viewer window.
2. Alt-drag an object or marker from the Viewer window into the Navigator or Property window's Light Settings Up Vector field to assign an Up Vector to the light.
3. Click the Up Vector field to select the light's Up Vector, and then translate it.

- Projecting images with lights on page 504
- Draw Ground Projection option on page 510

Spot Lights

Spot lights have the largest variety of configurable settings of any light, and unlike other light types they can show fog, project images and gobos, and have their cone angles animated. See Defining Spot lights on page 504 for more about the different Spot light options.



Spot light

- Adding and removing lights on page 498

Defining Spot lights

Spot lights have many different ways they can be customized. Use the following steps to customize the look and behavior of Spot lights in your scene.

- Drawing lights that face front on page 504
- Projecting images with lights on page 504
- Projecting light on the ground on page 505
- Attaching a gobo to a light on page 506
- Removing a gobo from a light on page 507
- Showing the light beam on page 507
- Adjusting fog in lights on page 508

Drawing lights that face front

1. Select the Spot light in either the Scene browser or the Viewer window.
2. Activate the Draw Front Facing Volumetric Light option in the Light settings to change the light stream of a Spot light to a realistic 3D cone shape.

Projecting images with lights

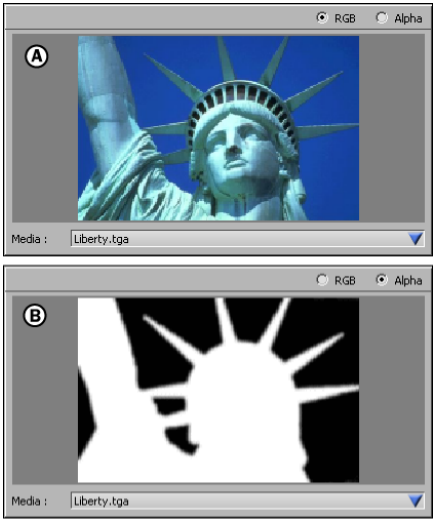
There are three methods you can use to project images with a selected Spot light:

- Select New Media to open a file browser where you can select *.avi*, *.bmp*, *.tiff*, *.jpg*, *.memory*, *.pic* or *.qtmot* files, or select None to use a standard Spot Light.
- Drag images and textures from the Asset or Scene browsers onto Spot lights to be projected. If you drag video onto a Spot light, only the current frame is projected.
- You can also select files previously used on Spot lights. The Media menu lists all the image files used as textures on lights from the current session in the Media menu.

Previewing Alpha channels of projected images

Select the light in either the Scene browser or the Viewer window, and select either the RGB or Alpha options in the Light preview area to preview either the RGB or Alpha channels of a loaded image.

Select RGB to display a full-color version of the image in the Image Preview area, and select Alpha to display the Alpha image.

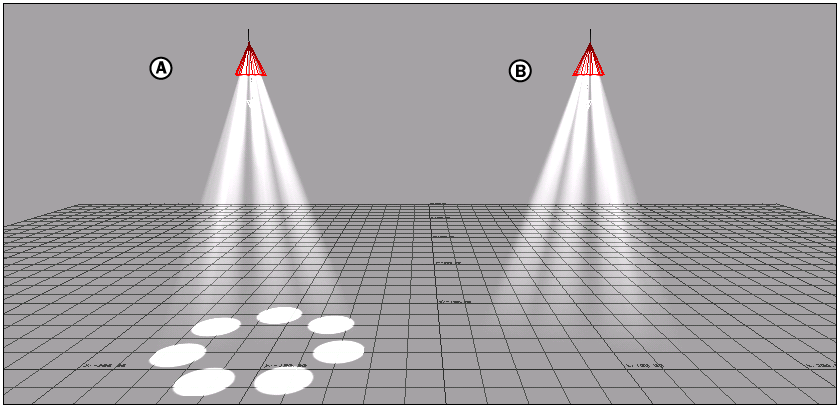


Light Texture preview *A.* **RGB view** *B.* **Alpha view**

The Alpha image displays the areas that are not projected in black, like a gobo, which is a filter placed over a light that projects light patterns.

Projecting light on the ground

1. Select the Spot light in either the Scene browser or the Viewer window.
2. Activate the Draw Ground Projection option in the Light settings to show the light projected on the ground.

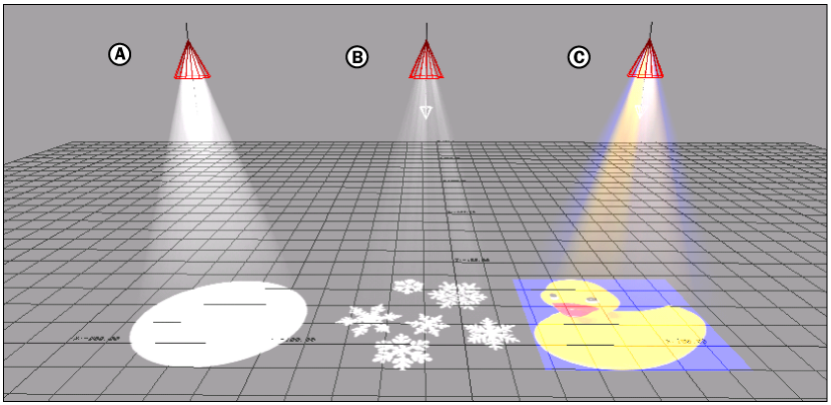


Draw Ground Projection *A.* **Activated** *B.* **Disabled**

Attaching a gobo to a light

You can use a gobo or an image to the projection of a Spot light.

- Drag a gobo or an image from the Asset browser on top of the light in the Viewer window.
- Drag a gobo or an image from the Asset browser on top of the Light settings Image preview. (The light must be selected in the Viewer window or Scene browser in order to do this.)
- Select Media > New Media from the Light Settings Media menu. A file browser opens for you to select a gobo or image to use as your projection. (The light must be selected in the Viewer window or the Scene browser in order to do this.)



Spotlight *A.* **Without Gobo** *B.* **With Gobo** *C.* **With projected image**

Removing a gobo from a light

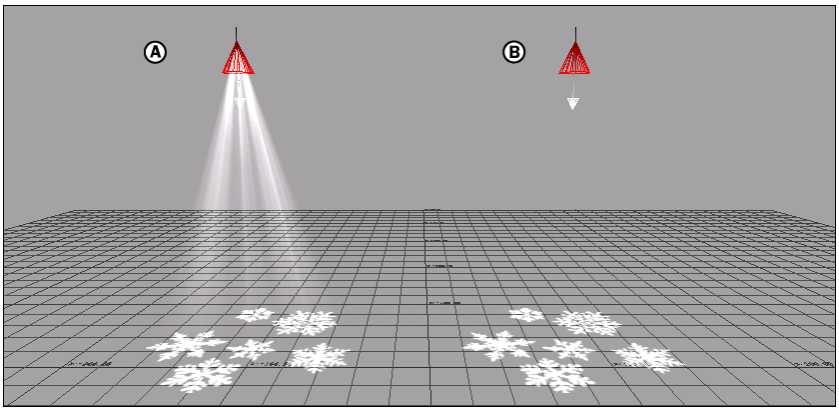
1. Select the Spot light, either in the Scene browser or the Viewer window.
2. In the Light Settings, select None in the Media menu.

- Projecting images with lights on page 504
- Adjusting fog in lights on page 508

Showing the light beam

1. Select the Spot light in either the Scene browser or the Viewer window.
2. In the Light Settings, disable the Draw Volumetric Light option if you want to project the image on the floor without drawing the light stream. When this option is disabled, the Fog Intensity field has no effect.

For example, the following figure shows two lights, one with Draw Volumetric Light activated and one with Draw Volumetric Light disabled. If you set Fog Intensity to 0, the Draw Volumetric Light settings have no effect.



Draw Volumetric Light *A.* **Activated** *B.* **Disabled**

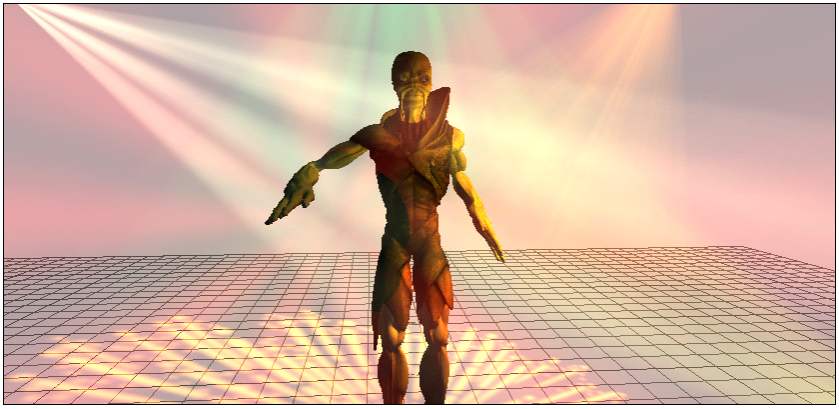
Adjusting fog in lights

Use the Navigator or Property window's Fog Intensity slider to increase or decrease the thickness of the fog shown in the selected Spot light's beam.

1. Select the light in the Scene browser of the Viewer window.
2. Use the Fog intensity slider in the Light Settings to increase or decrease the fog in a particular light's beam.

Spot light options

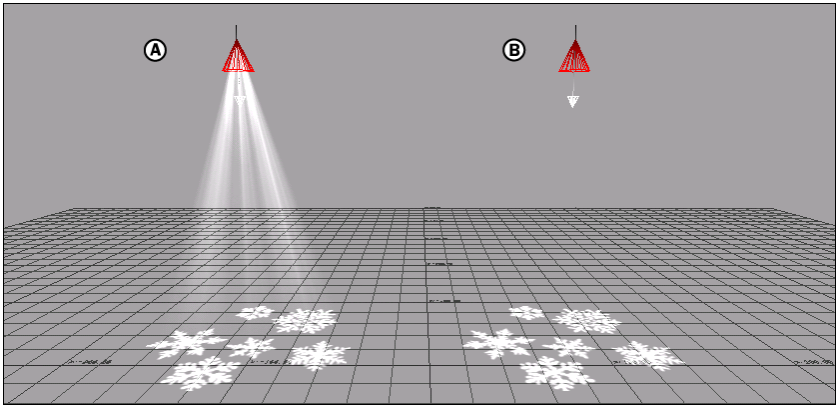
Spot lights are the most customizable of all the lights. You can use them to project images or gobos, widen their light beams, or have the light shine directly into the camera.



A model with various Spot light effects.

Draw Volumetric Light option

The Draw Volumetric Light option lets you create a volumetric lighting effect by making the light stream visible. The Fog Intensity field in the Light settings controls the strength of the volumetric lighting effect.



Volumetric light *A.* **Active** *B.* **Disabled.**

Cone Angle settings

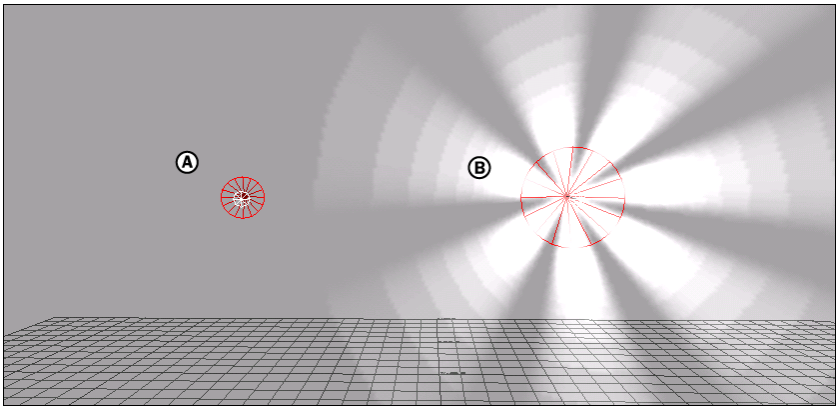
The Cone Angle setting in the Light Settings adjusts the spread or range of light. Use the Cone Angle slider or enter a new value in the Cone Angle field.

Click Animate (A) beside the Cone Angle settings to activate this setting for animation.

Draw Front Facing Volumetric Light option

Front facing light occurs when the camera view is looking down or up the light stream of a Spot light, which makes the light stream look three-dimensional.

For example, the following image shows two lights, one with Draw Front Facing Volumetric Light activated and one with Draw Front Facing Volumetric Light disabled.

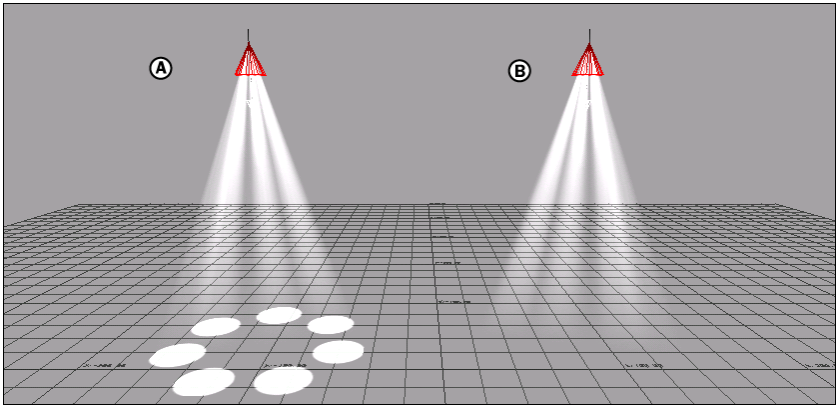


Draw Front Facing Volumetric Light *A.* **Disabled: No light beams appear when facing the camera.** *B.* **Activated: Light beam appears realistic when facing the camera.**

Draw Ground Projection option

The Draw Ground Projection option shows the light projected on the ground.

For example, the following figure shows two lights, one with Draw Ground Projection activated and one with Draw Ground Projection disabled.



Draw Ground Projection *A.* **Activated** *B.* **Disabled**

Light Preview area

The Light Preview shows the image applied to the selected Spot light. When no image is applied to the selected light, the Image Preview shows a white circle. For information on how to apply an image to a light, see Attaching a gobo to a light on page 506.

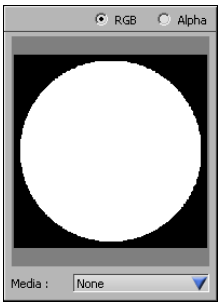


Image Preview default setting is None

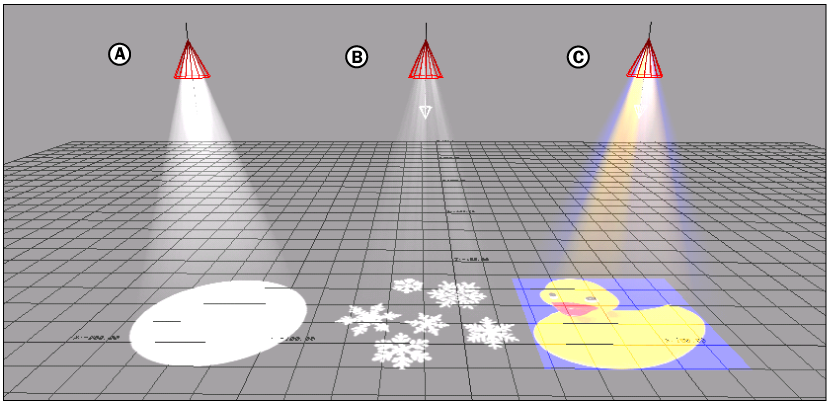
To view the Light Preview area, select a Spot light in the Lights folder, or select Spot Light from the Type menu.

NOTE The Light Preview area is only available with Spot lights. Point lights and Infinite lights cannot use projected light images.

- Adding and removing lights on page 498

Gobos in Spot lights

A gobo is a filter placed over a Spot light to project light patterns through fog on a surface. The Gobo folder in the Asset browser has gobos that you can attach to lights in your scene.



Spotlight *A.* **Without Gobo** *B.* **With Gobo** *C.* **With projected image**

You can also use an image file as a gobo, which cause the light to project an image, much like a projector. You can use an *.avi*, *.bmp*, *.tiff*, *.jpg*, *.memory*, *.pic* or *.qtmot* file.

Not all the gobos are installed by default when you install MotionBuilder. Additional gobos are available on the MotionBuilder Clip Art DVD and can be installed separately.

- Adding and removing lights on page 498
- Projecting light on the ground on page 505

Saving light settings as defaults

You can create a default light type so that every time you add a light to a scene, it has the same values, such as cone angle or color, and so on.

To create the current light settings as a default:

1. Select the light in the Scene browser of the Viewer window.

   Set up the light so that it has the settings you want all future lights to use as a default.

2 Click Save as Default in the Light Settings.

This retains your current custom light values as a new default setting so that any new light have these values as a preset.

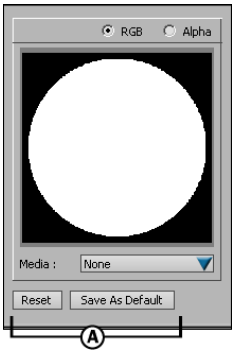


Image Preview area *A.* **Default light settings**

See Restoring the custom default light settings on page 513 for information on how to undo changes made to these lights.

Restoring the custom default light settings

Click Reset to recall your light's custom default, and restore it to your default settings. This lets you experiment with your custom default lighting without losing the settings you originally defined.

NOTE The Reset button does not restore default light settings. To do this, see Restoring original light settings on page 513.

Changes to the default light settings are global and affect every light added to the scene after you created the default. The lights already in the scene do not change, but all subsequent lights use the default, regardless of which file you are working on.

Restoring original light settings

If you want to remove all changes made to the default light settings and restore MotionBuilder's factory default lighting, the configuration file must be modified.

To restore original Light settings:

1 Close MotionBuilder.

2 Locate the MotionBuilder Config folder on your hard drive.

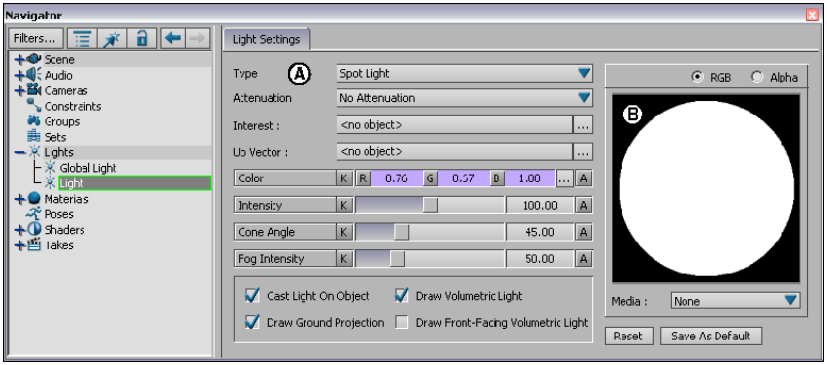
3 Delete the file *modeldefaultsetting.fbx*.

- Adding and removing lights on page 498
- Saving light settings as defaults on page 512

Light settings

When a light is selected, its settings display in the Light settings. The Global light is always in the Light settings by default. See Global lights on page 521 for more on Global lighting. To access the Light settings for other lights in your scene, select the light in either the Scene browser or the Viewer window.

The Light settings let you add and set lights in your scene to illuminate models and other objects.



Light settings *A.* **Light settings** *B.* **Light Preview area**

Light settings area

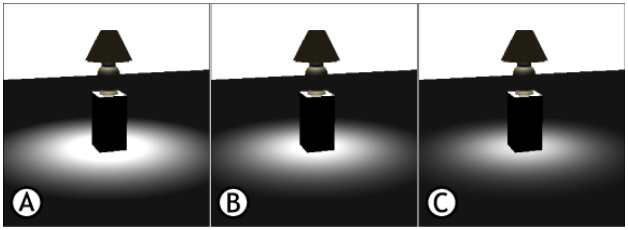
The light settings area contains options for customizing the look and behavior of your lights.

Light type menu

Lets you select one of three light types: Infinite, Point and Spot. For more information about these lights see Light types on page 495.

Attenuation

The Attenuation settings lets you specify how the intensity of a light drops off in relation to the distance from the source. Once you add a Dynamic lighting shader, use this setting to set how MotionBuilder calculates the light falloff. There are two options, Linear and Quadratic, that affect lighting falloff. No Attenuation disables the falloff effect.



Light attenuation setting: A. None B. Linear C. Quadratic. Compare the edges of the shadow.

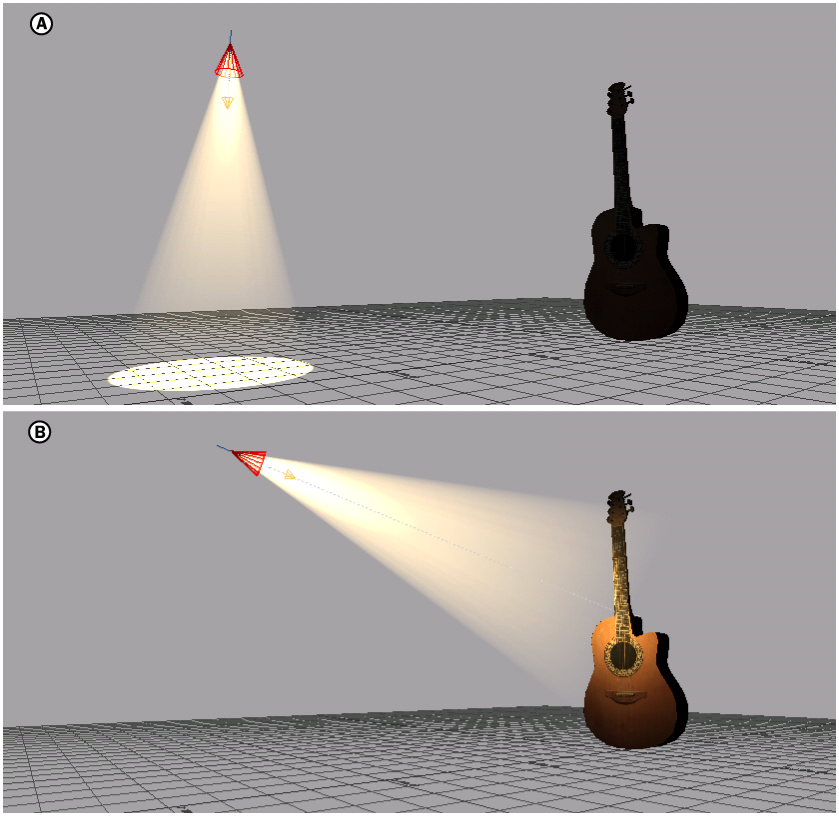
Do not change the attenuation setting if you do not want to the lighting influenced by its distance from the source.

NOTE You must apply a Dynamic Lighting shader to the scene to see attenuation effects. See Dynamic Lighting shader settings on page 671for more information.

Setting	Function
Linear	This setting produces an even falloff. The equation is (intensity/x). The light will drop off in an even fashion from the point it leaves the light until it illuminates an object.
Quadratic	This setting produces an uneven falloff. The equation is (intensity / x squared). The light will make a rapid drop off close to the object and the falloff will then slow the further it gets from an object.

Interest field

Lets you define a “look-at point” or target for the selected light. When the light is translated, the light’s interest follows it.



Spot light interest *A.* **Spot light with Interest not set.** *B.* **Spot light with Interest set on the guitar.**

See Defining a light’s Interest on page 501.

Up Vector field

Lets you add and use a model as the Up Vector of a selected light. An Up Vector is a model that controls the orientation of a given light.

This is done by constraining the light to orient its movement toward the Up Vector model's position and prevents the light from flipping, providing more realistic movement of an animated light’s projections. See Defining a light’s Up vector on page 502.

Color

Lets you specify the color of the selected light. By default, the color of the light source is pure white. You can animate this setting. See Adjusting light color on page 501.

Intensity

Lets you adjust the brightness of the selected light. You can animate this setting. See Intensifying a light on page 500.

Cone Angle

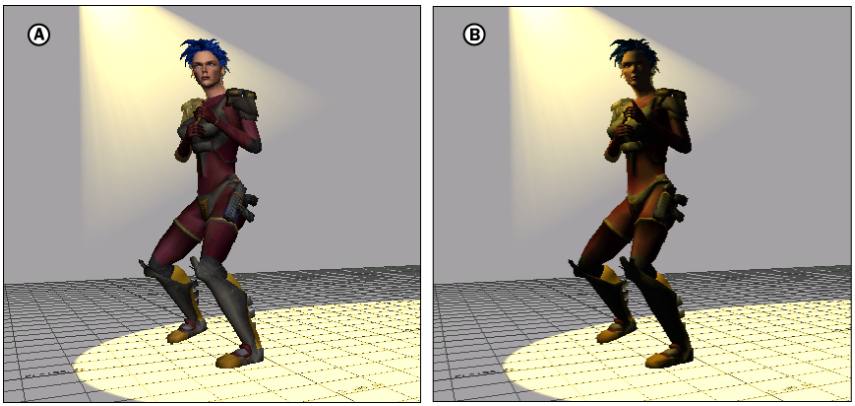
Active only for Spot lights, the Cone angle slider lets you adjust the spread or range of light from a Spot light. The smaller the cone angle, the smaller the area of the scene that is illuminated by the light. You can animate this setting. See Defining Spot lights on page 504.

Fog intensity

Active only for Spot lights, the Fog intensity slider lets you increase or decrease the amount of fog shown in the light's beam. You can animate this setting. See Defining Spot lights on page 504.

Cast Light on Object

Lets you use the light as an effect in the scene without illuminating objects. For example, the following figure shows a model with Cast Light On Object activated and disabled.



Cast Light On Objects *A.* **Disabled** *B.* **Activated**

When the Cast Light On Object option is activated, objects are lit. When the setting is disabled, the light effect exists but does not affect the object.

Disabling Cast Light On Object speeds up the display time. The Cast Light On Object option is activated by default. If you want only to have some objects affected by particular lights in your scene, see Selective Lighting shader settings on page 659.

Draw Ground Projection

Active only for Spot lights, this setting makes the beam of the Spot light shine on the ground. See Defining Spot lights on page 504.

Draw Volumetric Light

Active only for Spot lights, this setting lets you see the actual beam that the Spot light emits and is often used with Fog effects. See Defining Spot lights on page 504.

Draw Front-Facing Volumetric light

Active only for Spot lights, this setting lets you see the effect of the light when it is facing directly into the camera. See Defining Spot lights on page 504.

Light Preview area

Used only with Spot lights when they project images or gobos, the Light preview area shows you what the shape of the projection looks like.

Setting	Description
RGB/Alpha options	Lets you view either the full image or the alpha channel of any image projected by the Spot light.
Light Preview	When no image is selected, the light preview shows a white circle. If an image is select in the media menu, it is shown here.
Media menu	Use the Media menu to select an image to be projected by the Spot light, depending on whether you have activated the Draw Ground Projection option, or the Draw Volumetric Light options. For example, if you have only selected Draw Ground Pro-

Setting	Description
	jection, the selected image is shown on the ground. If you have selected Draw Volumetric Light only, the light beams are shown. See Projecting images with lights on page 504 for more on how to use lights to display images.
Reset/Save as default	The Reset and Save as Default buttons let you save modifications you have made to a light's settings to create a new default light. Once a default is set, every new light added uses this custom setting.For example, you can save a Spot light's intensity, cone angle, and fog options as a default, and then all lights that you add to the scene use these settings.You cannot save Interest, Up Vector, or Media settings as defaults.Saving default settings is useful if you need several lights to use specific custom settings. See Saving light settings as defaults on page 512 for more about creating a new default light setting.

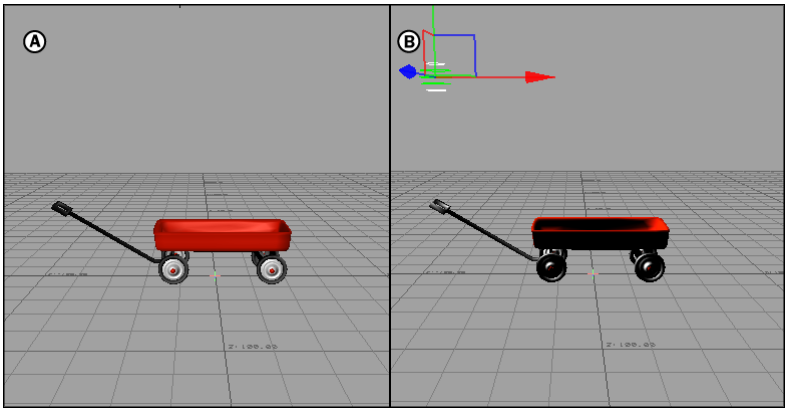
Global lights

31

When you first bring an object into MotionBuilder, no lights are in the scene, and yet you can see the object in the Viewer window. This is because of a generic lighting effect created by the *Global light*.

The Global light is the default light that illuminates your scene before you have added any lights. The Global Light is not considered a light because it is simply an ambient “work light” that illuminates your models in a steady, ambient light. You cannot select it, or make it brighter.

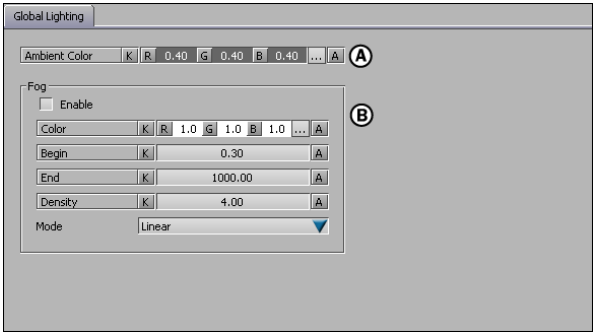
When a custom light is dragged into the scene, the Global Light is turned off as shown in the following figure (B).



Global Light versus custom light (A) Global light in scene (B) Custom light added to scene

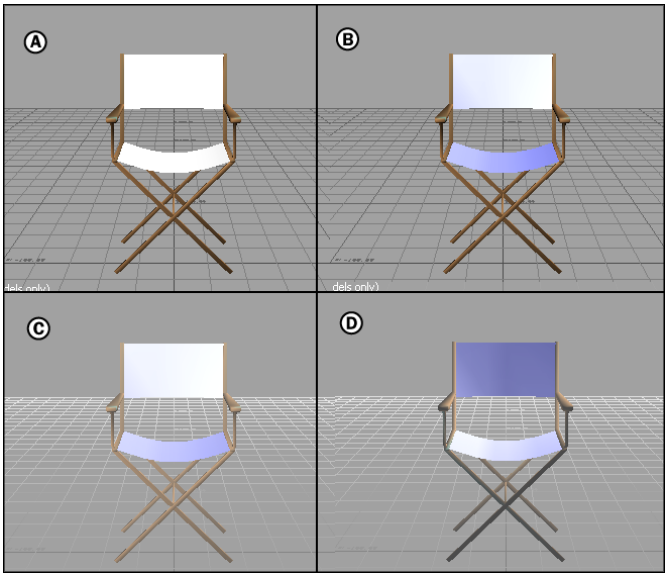
The global light is useful as a general light while you work, but provides a characterless ambience for your scenes. The Global light cannot display shaders or be animated, nor can you adjust the Global light’s position or intensity.

If the Global light is selected, the Global Lighting settings display, which let you change the general color and brightness of the scene.



Global Light settings *A.* **Ambient Color settings** *B.* **Fog settings**

The Global Light settings are used to adjust the global lighting parameters, such as the overall ambient lighting effects and fog settings.



Global lighting examples *A.* **Global lighting** *B.* **Ambient color changed** *C.* **Ambient color changed and Fog added** *D.* **Ambient color changed, fog added, two custom lights added**

- Adding and removing lights on page 498
- Changing a scene's ambient color on page 523
- Global lights on page 521

Changing a scene's ambient color

1. Expand the Lights root folder in the Scene browser and double-click Global light.
2. Use the Ambient Color settings to adjust the color of the ambient light. By default, the color of the light source is pure white.
   - Enter a new value in the RGB fields, or click the Color button to open the Color window to change the selected light's color and mode.
   - Click Animate (A) beside the Ambient Color settings to activate this setting for animation.

   NOTE There must be objects in the scene to see the effect of a change in ambient lighting.

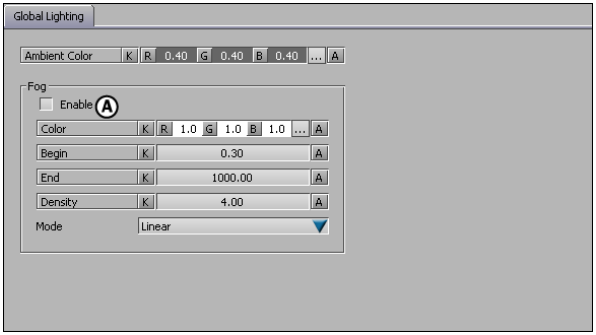
- Adding fog to scenes on page 523
- Color window on page 2

Adding fog to scenes

You can add fog to globally affect entire scenes.

To set the ambient fog for the entire scene:

1. In the Asset browser light settings, select Global Light.
2. Activate the Enable Fog option.



Global Light settings *A.* **Fog option enabled**

3 Enter a new value in the Color settings or click the Color button to open the Color window and change the fog's color.

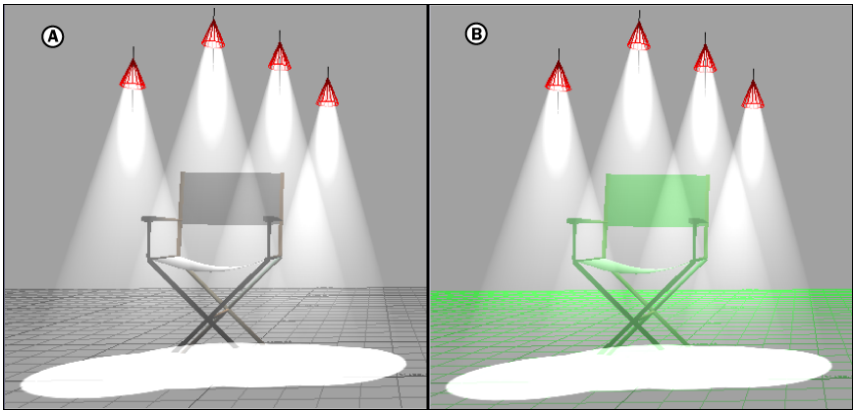
4 Click the Animate (A) button beside the Color settings to activate this setting for animation.

- Adding and removing lights on page 498
- Changing a scene's ambient color on page 523

Setting fog color

1 Type a new color value in the Color settings in the Global lighting window to adjust the color of the fog.

By default, the color of the fog is pure white.



A. **Fog settings disabled** *B.* **Fog settings activated and fog color set to green**

2 Use the Mode menu to select the type of fog generation. For more on the different Fog modes, see Mode menu on page 527.

3 Control the thickness of the Fog in your scene by adjusting the Begin and End fields in the Global Lighting window when Linear is the selected Fog Mode.

   Begin and End are measured relative to the current camera. At Begin, objects are slightly obscured by fog. At End, objects are fully obscured by fog.

4 Adjust the Density value to control the thickness of the fog when Exponential or Square Exponential mode is selected.

For more information on color, see Color window on page 2.

Global Lighting settings

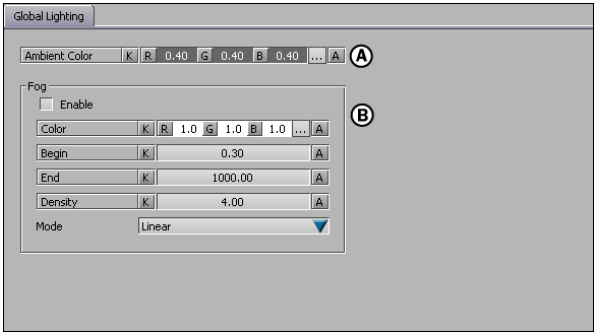
The Global Lighting settings are divided into two areas: The Ambient color and the Fog settings.

Ambient Color values

The Global lighting Ambient color values let you adjust the overall color in your scene. See Changing a scene's ambient color on page 523 for more on how to change the overall color of your scene.

Fog settings

The Global Lighting Fog settings let you create fog to add dramatic lighting effects to your scenes. See Adding fog to scenes on page 523 for more on how to add fog atmosphere to your scene.



Global Light settings *A.* **Ambient Color settings** *B.* **Fog settings**

Enable option

Activate the Enable option to use fog in your scene. Fog works best in a fully modelled scene with floors, walls, and props such as desks, stairs, and so on.

Color values

Use the Color settings to adjust the color of the fog. By default, the color of the fog is pure white.

Enter a new value in the Color settings or click the Color button to open the Color window and change the fog's color.

Click the Animate (A) button beside the Color settings to activate this setting for animation.

Fog Begin and End fields

Adjust the Begin and End fields to control the density of the fog when Linear is the selected Fog Mode.

Begin and End are measured relative to the current camera. At Begin, objects are slightly obscured by fog. At End, objects are fully obscured by fog.

Density option

This option controls the density of the fog when Exponential or Square Exponential mode is selected.

Mode menu

Use the Mode menu to select the type of fog generation.

There are three fog modes:

Fog mode	Function
Linear	Generates fog that gradually increases from the Begin value to the End value.
Exponential	Generates fog that increases exponentially according to Density.
Sqr Exponential	Similar to Exponential except the fog's density increases more rapidly, resulting in a clear fog close to the camera and a heavy fog the further you move from the camera.

NOTE Settings are used for all light types unless otherwise noted. When properties cannot be used for the selected light type, their sliders are disabled.

- Adding fog to scenes on page 523
- Color window on page 2

Part 3: Surfaces

A model's surface appearance simulates the substance from which it is made, such as skin, cloth, wood, or metal. Light and shadow, and how these interact with models, also add a dimension of realism to the scene.

Applying materials, textures, and shaders to a model lets you modify its surface appearance using identifiable properties like color, pattern, and shine. They also let you create static shadows, cartoon outlines, and other special effects.

In most cases, you can see the results of materials, textures, and shaders in real time, without the need to render. In certain cases, the real-time result you see depends on which shaders and material settings you use.

NOTE Terminology may differ slightly from software to software. For information on what these terms mean in MotionBuilder, see material on page 2007, texture on page 2021, and shader on page 2018.

This section covers the following topics:

- Materials on page 531
- Textures on page 549
- Texture settings on page 575

See also Shaders on page 585.

Materials

32

Materials are the most basic way to create surface effects on models. Material assets let you change a model's color, use textures, and create life effects such as transparency and reflections. Use materials with textures and shaders to give your models realism and style. View the results in real-time, without the need for rendering.

Add a material to a scene by dragging the Material asset from the Shading Elements folder in the Asset browser into an empty space in the Viewer. To automatically apply a material to a model, drop the asset onto the model in the Viewer.

When you add a material, you can define its properties in the Material settings that appear in the Navigator window.

- About materials on page 531
- Applying a material to a model on page 537
- Applying a material to a region on page 537
- Adjusting material color on page 539
- Material settings on page 540

About materials

Material assets let you change a model's color and simulate how the model's surface reacts to light.

The way materials affect a model's surface can be approached into two ways:

- Material color and lighting on page 532
- Materials and surface consistency on page 533

To simulate how a model's surface reacts to light and color, the Material settings let you change the color and intensity of properties such as Diffuse and Specularity.

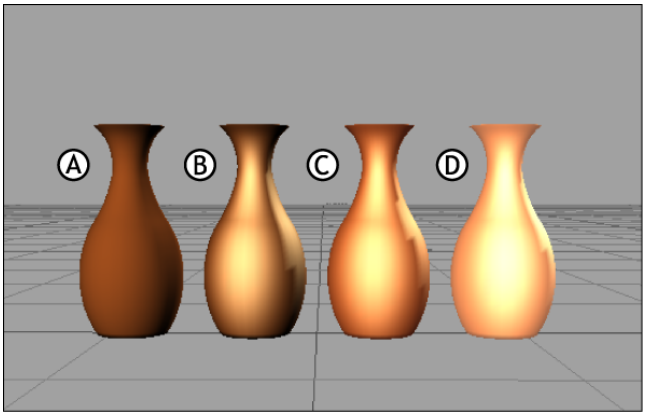
To simulate surface consistency, additional settings let you create more advanced effects, such as reflectivity, transparency, and relief. To create these effects using a Material asset, you must also apply the corresponding shader.

Material color and lighting

Materials govern an object's own internal lighting attributes, such as Emissive, Ambient, and Diffuse color. These attributes simulate how the object's surface reacts to light and reflects color.

These effects are created by changing the colors on the object, but they can create effects that go beyond simply coloring the object.

The following image shows a progression of changes to the basic Material settings to create an effective color and lighting result. See Adjusting material color on page 539.



Material settings results *A.* **Diffuse color alone** *B.* **Specular color with Diffuse** *C.* **Ambient color added to Diffuse and Specular** *D.* **Emissive color added to the result**

Diffuse

Diffuse refers to the actual color of the object. In the figure above, the vase is orange.

Specularity

Specularity refers to the color of the highlight that appears on the object. Depending on the intensity and spread of the specular highlight, a brighter, lighter color gives a sharp, shiny effect.

Ambient

Ambient refers to the color that shadows are filled with on the object, to simulate color that bounces off of a nearby object. For example, a white sphere next to a red wall would have at least a bit of red as an ambient color.

The Ambient color is dark gray by default, but few shadows are truly gray. By changing the Ambient color, you can simulate various lighting effects.

For example, when objects are placed close together, light bounces between them, causing the color of one object to affect the color of the other, depending on the substance of the object. To choose the most realistic shadow color possible for your model, look at the color of the other models in the scene to see what would make sense.

Also, always keep in mind the substance you are trying to simulate; a rough or matte surface takes on less color from other objects than a smoother or more reflective surface.

Emissive

Emissive refers to the color of the light that radiates from the object. For example, choosing a bright color with high intensity gives the effect of a radioactive glow.

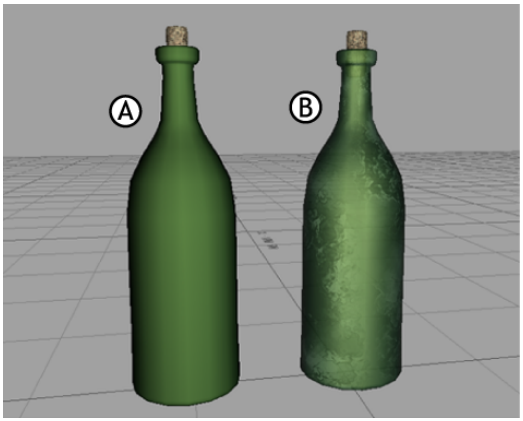
See also:

- Shading preferences on page 159
- Materials working with shaders and textures on page 534
- Applying a material to a model on page 537
- Adjusting material color on page 539

Materials and surface consistency

Materials change the model's surface "feel", meaning that they provide the illusion of various external properties for models, such as roughness, transparency, reflectivity, and shine.

These external properties simulate the model's substance and determine how we perceive an object.



A. **Material used for color** *B.* **Material used for color and detail**

In the image above, two copies of the same bottle model are shown. The first bottle has a material applied simply to provide color, and the second bottle material has had the Bump Map settings changed to simulate detail, as well as color.

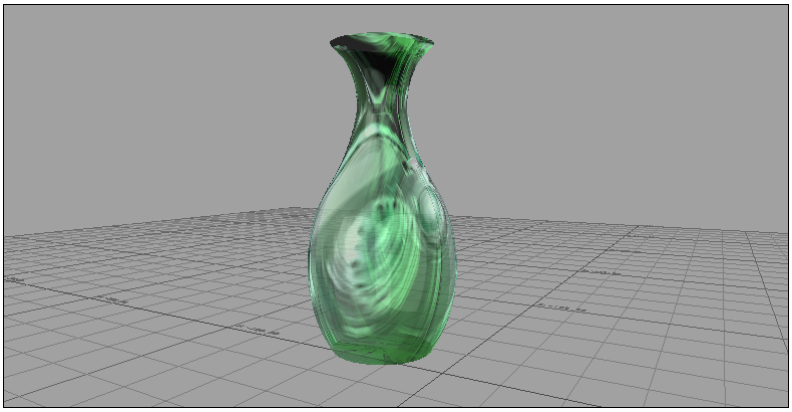
Note how changing the settings changes the appearance of the bottle from a smooth ceramic or plastic to a shinier, dirty glass. The geometry of the model has not been changed, only the material, shaders, and textures applied to it.

See also:

- Shading preferences on page 159
- Applying a material to a model on page 537

Materials working with shaders and textures

Some of the effects of materials, such as detail and reflectivity, can be also achieved with shaders or textures. Used together these can give simple grey models surfaces which resemble glass, metal, skin, and so on.



Vase with materials, textures, and shaders added

A model's material properties may be used by the texture settings when applying textures, and by the shader settings when applying certain shaders.

Materials and textures

Attach textures or Layered textures to a Material's properties. For example, you can attach a texture to the Material's Diffuse property to add color and detail to the model's surface. See Adding a texture to a material on page 561 and Detaching textures on page 565.

For other Material properties, the attached texture can only display in the Viewer when a type of shader is applied to the model. For example, to see the texture attached to the Normal Map property, apply a Bump Map shader and add a light to the scene.

Materials and shaders

The results of some material settings applied to a model may not display in the Viewer window. You must use shaders with advanced Material settings to see the results in the Viewer window. The advanced settings that need shaders are as follows:

Material settings	Shader	See
Transparency	Flat, Light, and Dynamic Light	Making an object transparent on page 602
Reflectivity	Reflection	Reflection effects on page 633

Material settings	Shader	See
Bump Map and Normal Map	Bump Map	Creating a Bump Map on page 640
Displacement	Custom shaders	Displacement settings on page 547
Texture attached to a Material property. Only the Diffuse property does not need a shader.	Custom shaders	Textures on page 549

See also:

- Applying a material to a model on page 537
- Shader basics on page 587

Material regions

A model may have more than one material applied to it when you import it from a 3D modeling software, such as Autodesk Maya® or Autodesk 3ds max®. In MotionBuilder, these materials are listed in the Scene browser and are attached to the model.

The different materials were assigned to different regions of polygons, instead of to the entire model. These regions are set in the 3D modeling software and cannot be altered using MotionBuilder.

NOTE In Autodesk 3ds max, these polygon regions are called material IDs, and the material that uses them is called the Multi/Sub-Object material.

MotionBuilder includes all the materials imported with the model, and assumes that material has a corresponding polygon region on the model. The model may in fact have more or less regions than the number of materials attached to it suggest. For example, if a model of a soccer ball has two regions, one for a black material and one for a white material, the model can be imported with more than two materials attached to it. In this case, where there are more materials than polygon regions, the first materials listed in the Scene browser are used, and the rest are ignored.

You can modify, replace, or delete materials applied to model regions. See Applying a material to a region on page 537.

Applying a material to a model

Change the surface appearance of a model by applying a material to it.

To apply a material to a model:

1. Open the Shading Elements folder in the Asset browser.
2. Drag a Material asset onto a model in the Viewer window.

   NOTE If a menu with a list of regions appears, see Applying a material to a region on page 537 instead.

   The new material appears in the Materials folder in the Scene browser and is named "Material" by default. The Material settings display in the Navigator window.
3. Adjust the color, specularity, and shininess of the material in the Material settings. See Adjusting material color on page 539.
4. Attach textures to material properties. See Adding a texture to a material on page 561.
5. Create more realistic effects with the advanced material settings, such as Transparency, Reflectivity, and Bump Map.

   NOTE To see results for advanced material settings you must apply the corresponding shader. See Materials working with shaders and textures on page 534 and Advanced material settings on page 546.

Applying a material to a region

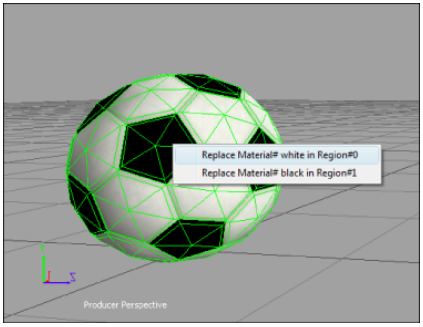
When you are using a model that can support multiple materials, you can replace materials by assigning new materials to each region. See Material regions on page 536.

To replace a material for a multi-region model:

1. Open the Shading Elements folder in the Asset browser.

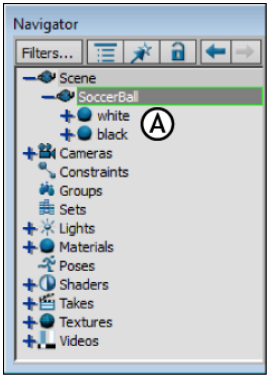
2 Drag a Material asset onto the model in the Viewer window.

3 In the menu that appears, select the region whose material you want to replace.



Material regions menu

The old material is detached from the model but remains in the scene. The new material is attached to the model and displays on the model if the region you selected corresponds to one of the model's polygon regions. Materials attached to the model are listed below the model's name in the Scene browser (A).



Scene browser *A*. Materials attached to the model.

Adjusting material color

Follow the steps of this example to learn how to use the basic Material color and intensity settings effectively. Adjusting the settings in a specific order can help you reach the result you are looking for more easily. Depending on the effect you want to achieve, some of the following steps are optional.

To adjust material colors:

1. Apply a Material asset to the model. See Applying a material to a model on page 537.

   The Material settings display in the Navigator window.

2. Use the Diffuse RGB settings to choose the main color of the object. You can also click the Color button to open then Color window (See Color button on page 542).

3. Use the Specularity RGB settings to choose the color of the highlight.

4. Adjust the intensity of the highlight by changing the Specularity factor value.

   NOTE When you want to hide the effects of a Material setting, you can turn it off by setting its intensity to 0.

5. Adjust the spread of the highlight using the Shininess settings.

6. Use the Ambient RGB settings to change the shadow color.

   The Ambient color is dark gray by default, but few shadows are truly gray. By changing the Ambient color, you can simulate various lighting effects, such as color reflecting from other objects or light passing through the object. See Ambient on page 533.

7. Adjust the intensity of the shadow color by changing the Ambient factor value.

8. If your model must glow or emit light, use the Emissive settings. Change the Emissive color, then adjust its intensity.

See also:

- Adding a texture to a material on page 561
- Materials working with shaders and textures on page 534
- Shading preferences on page 159

Material settings

The Material settings let you do the following:

- Change the color of a model and simulate various lighting effects.
- Create different effects such as transparency, reflectivity, shine, and bump maps for models in your scene.

Use a model's material properties with texture settings when applying textures, and by shader settings when applying certain shaders. These different types of settings often interact to create the final result.

NOTE Some material settings and textures applied to a model may not display in the Viewer window. This usually means that a specific type of shader is required to create a result in MotionBuilder. See Materials working with shaders and textures on page 534.

To add a new material to your scene and open the Material settings, expand the Shading Elements folder in the Asset browser, then drag a Material asset into the Viewer window and onto a model.

The new material appears in the Materials folder in the Scene browser and is named "Material" by default. The Material settings display in the Navigator window.

Material settings

The Material settings consist of the following:

- Material Proxy on page 541
- Material Properties area on page 541

See also:

- Making objects reflective on page 635
- Creating transparent objects on page 639
- Using the Color window on page 6

Material Proxy

The Material proxy is a sphere on which the material's texture, color, transparency, reflectivity, and specularity display as you change them. Use this proxy when composing or modifying the material for your model.

When a texture is attached to the material and displays on the sphere, drag in the Material proxy area to rotate the sphere and see the texture from all sides.

Material settings *A.* **Material proxy** *B.* **Preview Texture option**

Preview Texture option

When the Preview Texture option is active, the texture attached to the material's Diffuse property displays on the sphere.

Disable the Preview Texture option when you want to preview the material without its Diffuse texture. Disabling this option does not detach the textures attached to the material.

Material Properties area

The Material Properties area contains settings with which you can modify the material attributes.

Drag the material onto a model in the scene to see the results in the Viewer. Any color and level adjustments you make in the Material properties update in real time. See Applying a material to a model on page 537.

Material Settings *A.* **Material Properties area** *B.* **Advanced Mode option** *C.* **Color button** *D.* **Intensity field** *E.* **Texture list and button**

Advanced Mode option

The Advanced Mode option lets you switch between the basic material settings and the advanced material settings. Use the advanced settings when working with shaders. Shaders let you see the results of the advanced settings in the Viewer window. See Advanced material settings on page 546. The basic material settings are those you can use without also applying a shader. See Basic material settings on page 543.

Color button

The Color button opens the Color window which lets you modify the material properties' color. You can adjust the color for Emissive, Ambient, Diffuse, and Specularity properties without the need to apply a shader. The remaining material properties with RGB settings need to interact with a shader to have any effect in the Viewer.

See Adjusting material color on page 539 and Color window on page 2.

Intensity field

Each property has a value which lets you control its intensity. For example, an intensity value of 1.00 for Ambient may be too strong, depending on the Ambient color, while an intensity value of 0.50 may keep the Ambient color from overshadowing the Diffuse color.

NOTE The intensity values may also be referred to as the property's "factor", such as the Diffuse factor property found in the Properties window.

Texture list and button

The Texture list and button let you attach a texture to a material property. You can also use these settings to detach a texture from a material property.

The Texture list displays the texture you have attached to the material. You can select the texture in this list and click the Remove button to detach a texture from the material. To detach a texture, you can also right-click on either the list or the button and select Detach from the menu.

The Texture button displays a list of textures in the scene. This Texture list lets you select a texture to attach to a material property.

Which textures display depends on the types of shaders that are applied to the model. For example, a texture attached to the Diffuse property displays on the model without the need for a shader, while a texture attached to the Bump Map property needs a Bump Map shader applied to the model and at least one light in the scene. See Materials working with shaders and textures on page 534 and Adding a texture to a material on page 561.

Basic material settings

The basic material settings let you see results in the Viewer window without applying shaders. When you disable the Advanced Mode option in the Material settings, the settings that are still active are the basic ones that do not require shaders. The results of these basic material settings always display on the model to which the material is applied.

NOTE You can attach a texture to the Diffuse property and see the results on the model in the Viewer without needing to apply shaders. To see the results of textures attached to the other basic material properties, apply a corresponding shader. See Materials working with shaders and textures on page 534.

To use the basic material settings effectively, see Adjusting material color on page 539 and Adding a texture to a material on page 561.

Emissive settings

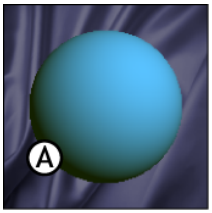
The Emissive settings let you define the RGB color and intensity for the glow of a material. The Emissive color of an object is constant and uniform.

Material proxy *A.* **Emissive color set to a bright yellow-green**

Ambient settings

The Ambient settings let you define the RGB color and intensity of the light reflected by a material. Ambient color is the general brightness of the material and comprises the dark range of color in a material's contrast.

The Ambient color of an object depends on the lighting in your scene.



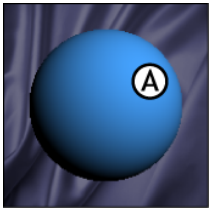
Material proxy *A.* **Ambient color set to a dark green**

Diffuse settings

The Diffuse settings let you define the base RGB color and intensity of a material. Diffuse color comprises the light range of color in a material's contrast.

The Diffuse color of an object is uniform and constant. It relies on the position and color of the lights in your scene and is not affected if you change the current camera view.

The Diffuse color settings define the main color of the model. The Diffuse color settings interact with any texture attached to the Diffuse property.



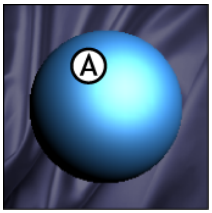
Material proxy *A*. Diffuse color set to a shade of blue

Specularity settings

The Specularity settings let you define the RGB color and intensity of a model's specular highlights, or "shiny" areas.

The specular color of an object depends on the shine of an object, the position of your light sources, and the current camera view.

NOTE Use the Shininess slider to change the spread of the specular highlight.

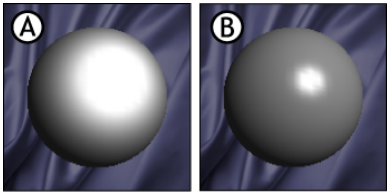


Material proxy *A*. Specular highlight set to a light blue

Shininess slider

The Shininess slider lets you define the level of light reflected on a material. Adjust this slider to control the distribution of an object's specular highlight.

Low values result in a large, soft glow, and high values define a smaller, sharper highlight. For the best results when adjusting the Shininess value, also play with the color and intensity of the Specularity settings.



Material proxy *A.* **Material with low Shininess value** *B.* **Material with a high Shininess value**

Advanced material settings

The advanced material settings are those that require a shader to display results in the Viewer window. When you disable the Advanced Mode option in the Material settings, the settings that become grayed are the advanced ones that require shaders. Activate the Advanced Mode option to access these settings. To see the results of these settings in the Viewer window, you must also apply the shaders with corresponding settings.

NOTE Shaders do not necessarily let you see the result of every setting for a property. For example, the Flat shader lets you set the level of the model's transparency but does not take the Transparency RGB settings into account. For complete results, use custom shaders.

Shader	Advanced Material settings
Flat, Light, and Dynamic Lighting	Transparency
Reflection	Reflectivity
Bump Map or Dynamic Lighting	Bump Map and Normal Map
Dynamic Lighting or Custom shaders	Displacement
Custom shaders	Texture attached to a Material property. Only the Diffuse property does not need a shader.

NOTE Custom shaders are created using the Open Reality® SDK.

Transparency settings

The Transparency slider lets you define the level of opacity for a material. Adjust this slider to increase or decrease the transparency of an object.

This slider can only be used with the Flat, Lighted, or Dynamic Lighting shaders. These shaders also have Transparency settings. Use the Transparency sliders in the Shader and Material settings together to achieve the result transparency on the model. The Transparency values in the Shader and Material settings work independently to give you more flexibility when, for example, a shader is attached to multiple models. See Making an object transparent on page 602.

Material proxy: Transparency settings

Reflectivity settings

The Reflectivity slider lets you define the amount of light that bounces off a model to create reflection effects. This slider only has an effect in the Viewer when a shader is applied. See Reflection effects on page 633.

Displacement settings

The Displacement settings let you use and adjust displacement maps.

NOTE Use custom shaders to see the results of the Displacement settings in the Viewer window. Custom shaders are created using the Open Reality® SDK.

Bump Map settings

The Bump Map settings let you apply a bump map to a model. To see its effect in the Viewer window, apply the Bump Map shader or Dynamic Lighting shader to the model and add at least one light to the scene. When you use the Bump Map shader, you can adjust the relief effect in the Bump Map shader settings. See Creating a Bump Map on page 640 and Normal Map shader on page 672.

Normal Map settings

The Normal Map settings let you apply a normal map to a model. To see its effect in the Viewer window, apply the Bump Map shader or Dynamic Lighting to the model and add at least one light to the scene. When you use the Bump Map shader, you can adjust the relief effect in the Bump Map shader settings. See Creating a Bump Map on page 640 and Normal Map shader on page 672.

Textures

33

Textures add realistic surface detail to models without the need for complex geometric transformations.

A texture uses an image or video clip. You can have many textures based on the same image with different texture settings.

The Texture settings let you do the following:

- Apply images, or video clips to selected models, planes, or cameras
- Add depth, color, and patterns to objects in your scene
- Adjust or animate the placement of textures on your model
- Change the texture type for use with shaders

About textures

When a model uses textures with its materials, it is useful to know how to adjust the texture so that it displays properly on the model. The following sections introduce you to the various texturing concepts.

Using a texture map lets you control the appearance of a model's surface on a pixel-by-pixel basis, rather than by assigning a single overall value. This is most commonly achieved by applying a color bitmap image to the surface.

Various types of textures used with shaders and materials can be used to produce various effects. Textures are most commonly used to simulate detail that is not part of the model's geometry, or to add static shadows and reflections.

Mapped textures

Mapped textures use graphic files (such as *.tga* and *.jpg* files) or video clips (such as *.avi*) applied to the 3D object. These can be drawn quickly, but use some of the computer's memory (RAM) to store the image.

Mapped textures are preferred by animators over procedural textures because procedural textures take too much memory to compute and slow down the animation. See Choosing a mapping method on page 567.

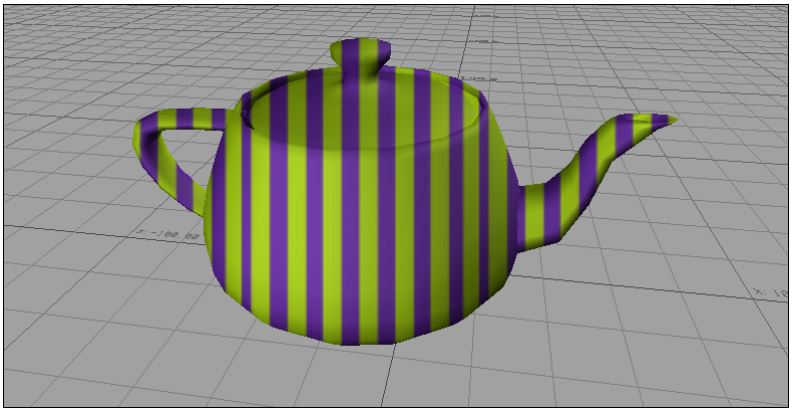
Projective textures

Projective textures project an image onto an object's surface as if it was a slide. You can use projective textures to create shadows and spot light effects, among other things.

Projective textures do not require specific UV mapping coordinates, unlike textures intended to fit the shape of the model.

Projective textures cause strange effects when used on three-dimensional objects, as they do not recognize the object's shape so much as project directly onto the front of it.

In the following figure, note how the striped texture does not recognize the curve of the teapot's lid, bowl, spout, or handle.



Teapot model with Projective texture

- Adding a texture to a material on page 561
- Testing shaders, textures, and materials on page 566

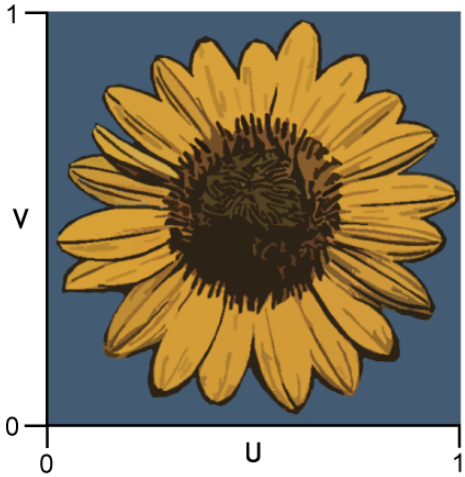
Procedural textures

Procedural textures are algorithm-generated textures, which require no storage of graphics files. Unlike mapped textures that use image and video files, the computations needed to portray the texture are performed by the computer's processor. This lets you create textures that do not use a lot of memory.

While this seems efficient because it uses less disk space, there is a trade-off. Procedural textures can take more time for a computer to process because it needs to compute complex texture algorithms.

UVW coordinates

UVW coordinates, also called mapping coordinates, are the values that tell the engine where to position textures on mesh. The engine uses three texture coordinates, commonly called U, V, and W. U is the width of the texture, V is the height, and W is used for depth if you are using a 3D procedural texture.



A texture's U and V values range from 0 to 1.

The coordinates are measured in a scale of 0.0 to 1.0, with 0.0 and 1.0 at opposite sides of the texture. When a texture is set to Repeat (for tiling) instead of Clamp, numbers higher than 1.0 make the texture tile, and negative numbers mirror the texture.

NOTE You cannot define a model's texture coordinates (also known as **unwrapping**) in MotionBuilder. However, you can adjust and tile the texture on the model.

With most 3D modeling software, these numbers are usually hidden from the artist, replaced by helpful visual representations of how the textures are projected. Planes, cylinders and spheres help the artist align the textures in a visual way, but it helps to know that engines see only the UVW values that these shapes create for the polygons.

Texture tiling

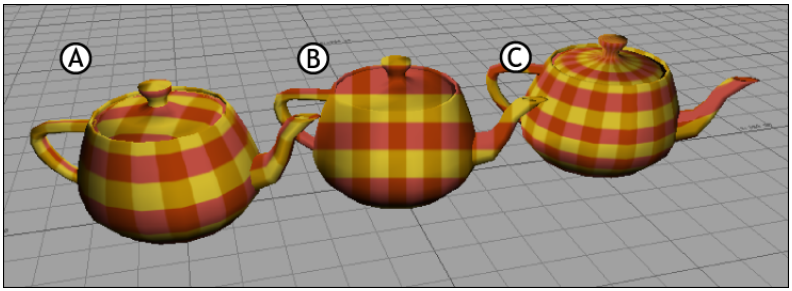
Tiling is the method of repeating a texture more than once across the surface of a model. A tiled texture looks best if its edges seamlessly match up with each other, top to bottom and left to right.

Tiling is a common method of using the smallest texture possible to cover a large area, like a small texture of a few bricks tiling across a large surface, creating a big brick wall.

Mapping method types

Map your texture on a model according to its UV coordinates, using a designated wrap option (XY, YZ, XZ, Spherical or Cylindrical), or by projecting it (Projection or Environment).

You can specify the mapping settings for your texture using the Mapping Method menu. See Choosing a mapping method on page 567 and Mapping Method on page 579.



Texture mapping methods *A.* **UV map** *B.* **Projection map** *C.* **Spherical map**

UV option

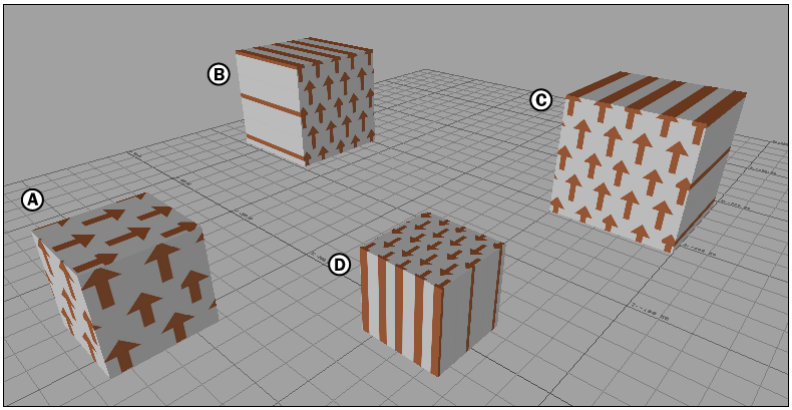
This option uses the model's UV coordinates that are assigned to the vertices of your model and is most useful when the model was unwrapped.

A model can have different sets of UV coordinates, which are referred to as *UV sets* or *Map channels*. To select a different UV set, see UV Set on page 580.

XY, YZ, and XZ options

Use the XY, YZ, or XZ options to map a selected texture to a specific face (XY, YZ or XZ) of the model's bounding box, and then project the face onto your model.

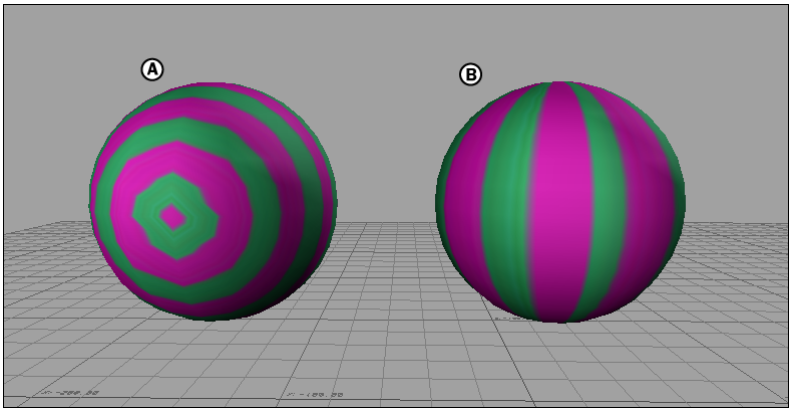
An example of each mapping style is shown below.



Texture mapping methods *A.* **UV mapping** *B.* **YZ mapping** *C.* **XY mapping** *D.* **XZ mapping**

Spherical and Cylindrical mapping options

Use the Spherical or Cylindrical mapping options to wrap your texture around a model that has a shape similar to a sphere or cylinder. Each method distorts the image in different ways and introduces a different seam. In the following image, a simple striped texture is mapped to two spheres, one using Spherical wrapping and one using Cylindrical mapping.



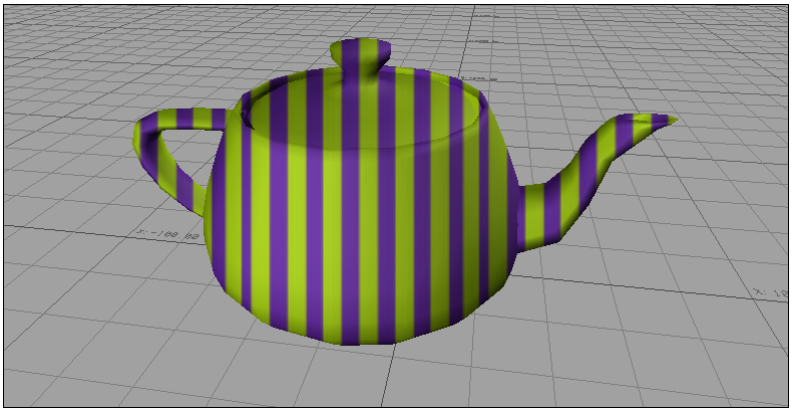
A. **Spherical mapping** *B.* **Cylindrical mapping**

When you wrap a texture around a model, there is always an area where the sides of the image meet. This area is called the seam. The visibility of the seam depends not only on the selected mapping type (Spherical or Cylindrical), but also on the model and the image.

It is recommended that you use an image that can be tiled to reduce the size of the seam. An image you can tile has opposite sides that match each other. You can easily create a tiling image with most common commercial paint programs.

Projection mapping

Projection mapping projects the image straight onto the object, like a slide projector, creating a two-dimensional image that does not "wrap" around the object. The following figure shows the result of Projection textures that do not work well with curved objects.



Projection textures on curved object

The image is always projected from the current camera's viewpoint.

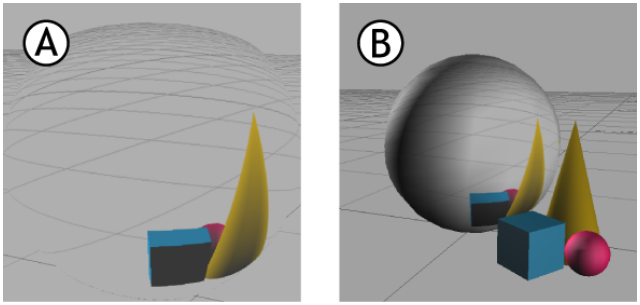
- Adding a texture to a material on page 561
- Applying a video texture on page 562
- Choosing a mapping method on page 567

Environment mapping

Use the Environment mapping option to project spheroid textures. You can use this mapping method to create special effects such as skyscapes, or to simulate reflections on objects.

Environment mapping is best suited for situations when you are filming a model or scene from a single point of view. This mapping method sacrifices realism that may be noticeable from many different angles or when filming the model using a moving camera.

For example, the following figure shows a spheroid image applied to a sphere. The Environment mapping method adds extra curvature to the image. Also, when the camera or object moves, Environment mapping allows the texture to move with the model, without the need to adjust the texture further. To obtain the most realistic results, the camera or object should only be moved slightly if moved at all.



A. **Original spheroid image** *B.* **Applied to sphere using Environment mapping method**

TIP You can create an image that reflects your scene using the Reflection shader. See Reflection effects on page 633.

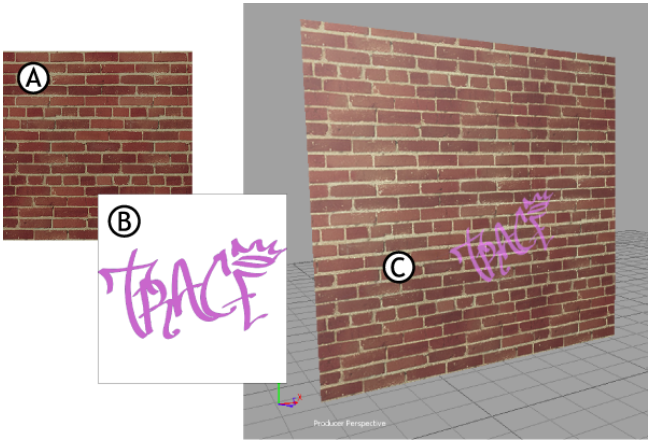
Mipmapping

Mipmapping is a way of compensating for small imperfections created by the computer's graphics card that can appear when you use detailed textures on a small object. Mipmapping re-samples the original texture and creates a stack of smaller images.

This solves the problem of textures with small objects "flickering" created by the filtering process as the object gets further away. By using many "mipmaps" of the larger texture, the filtering happens on a much smaller level, which improves its overall appearance. See Use MipMaps on page 579.

Layered texture

A Layered Texture asset lets you adjust and blend multiple images and videos, then add them to a material or model as if they were a single media.



Blending textures *A.* **Tiling brick texture** *B.* **Graffiti texture with alpha channel** *C.* **Both textures combined on one model using a Layered texture**

You can set different Blend modes for each texture layer, and adjust and animate each texture individually to create interesting results. For example, layer 1 can be a tiled texture while the texture for layer 2 is not tiled. However, a Layered texture imposes the same mapping method (such as UV or Projection) to all its texture layers.

NOTE To use a texture's alpha channels, apply a shader with a Transparency setting, such as the Lighted shader, to the model.

See Blending multiple textures on page 563.

Choosing texture types

When you open the Shading Elements folder in the Asset browser, you have different types of textures from which to choose. The type of texture you choose depends on its purpose in the scene.

There is one category of textures you add to materials, and another category that you apply directly to the model for use with shaders. Additionally, in each category you have the option of creating a Layered texture or a standard single-layered texture.

Texture types for materials

Use a Texture asset or a Layered Texture asset to attach images or videos to a material. These assets are available in the Asset browser when you select the Shading Elements folder.

A Texture asset lets you add an individual image or video to a material. Its most common purpose is to add detail and color to a material. See Adding a texture to a material on page 561.

A Layered Texture asset lets you blend multiple images and videos, then add them to a material as if they were a single media. See Blending multiple textures on page 563.

See also Materials on page 531.

Texture types for shaders

Some shaders require a Global Lighting-Based texture in order to work. These types of textures are available in the Asset browser when you open Shading Elements > Global Lighting-Based Textures.

Each type of Global Lighting-Base texture is available as a standard single-layered texture or as a Layered texture. A Layered texture lets you blend multiple images and videos, then apply them to a model as if they were a single media. See Blending multiple textures on page 563.

Global Lighting-Based textures must be applied directly to a model and used with the appropriate shader, as described in the following table:

Type	Purpose
Light Map	Use with a Shadow Map shader, when the shader is set to the Light Map type in the shader settings. See Shadows and lighting effects on page 657.
Layered Light Map	Same as the Light Map texture, but also lets you blend multiple images or videos, then apply them to the model as if they were a single media. See Blending multiple textures on page 563.
Shadow Map	Use with a Shadow Map shader, when the shader is set to Shadow Map type. See Shadows and lighting effects on page 657.
Layered Shadow Map	Same as the Shadow Map texture, but also lets you blend multiple images or videos, then apply them to the model

Type	Purpose
	as if they were a single media. See Blending multiple textures on page 563.
Spherical Reflection Map	Use with a Reflection shader, when the shader is set to Spherical Map type. See Reflection effects on page 633.
Layered Spherical Reflection Map	Same as the Spherical Reflection Map texture, but also lets you blend multiple images or videos, then apply them to the model as if they were a single media. See Blending multiple textures on page 563.
Sphere Map	Use with a Reflection shader, when the shader is set to Sphere Map type. See Reflection effects on page 633.
Layered Sphere Map	Same as the Sphere Map texture, but also lets you blend multiple images or videos, then apply them to the model as if they were a single media. See Blending multiple textures on page 563.

NOTE When you generate a map using the Reflection or Shadow Map shaders, a texture of the relevant type is automatically created and you can access its Texture settings in the Navigator.

Adding a texture to the scene

When you drag a Texture or Layered Texture asset into an empty space in the Viewer, you can choose to add an unattached texture to the scene, or choose to automatically attach the texture to the current camera or to a material and a plane. The menu that appears offers four options, as described in the following table.

Option	Function
Current Camera Foreground	Adds a texture to the scene and automatically sets it as the current camera's Front Plate media. See Setting a camera Front or Back Plane on page 447.
Current Camera Background	Adds a texture to the scene and automatically sets it as the current camera's Back Plate media. See Setting a camera Front or Back Plane on page 447.

Option	Function
Video Plane	Adds a texture, a material, and a plane to the scene. The texture is automatically attached to the material's Diffuse property, and the material is applied to the plane. The plane is perpendicular to the floor.
Add To Scene	Adds a texture to the scene. It appears in the Textures folder in the Scene browser, and is not attached to other assets.

To add a texture to the scene

1. Open the Shading Elements folder in the Asset browser.
2. Drag a Texture asset or Layered Texture asset into an empty area in the Viewer window.
3. In the menu that appears, select one of the options:
   - Current Camera Foreground
   - Current Camera Background
   - Video Plane
   - Add To Scene

   A texture is added to the scene and is listed in the Scene browser. If you selected Video Plane, a material and a plane model are also added to the scene. If you selected Current Camera Foreground or Current Camera Background, the texture is also attached to the current camera's Front Plate or Back Plate.
4. Expand the Textures folder in the Scene browser.
5. Double-click the texture to display the Texture settings.

   If you created a Layered texture, the Texture settings include the Layer Settings pane. See Blending multiple textures on page 563 to add textures to the Layered texture.

   If you created a standard texture, continue with the following steps.
6. Select New Media in the Texture settings' Media menu. A file browser opens.
7. Browse for a texture file and click Open.

   The texture displays in the Texture settings. If you selected Current Camera Background or Current Camera Foreground, the texture displays

in the Viewer window. If you selected Video Plane, the texture displays on the plane model in the scene. If you selected Add To Scene, the texture remains unattached.

Adding a texture to a material

To see a texture on a model, attach a texture to a material property such as the Diffuse property. You can use Texture and Layered Texture assets with a material. For information on using Layered Texture assets, see Blending multiple textures on page 563.

For information on using the other types of textures, see Choosing texture types on page 557.

The following steps describe attaching a texture to a material's Diffuse property.

When you attach a texture to the Diffuse property, you see the result of the texture on the model in the Viewer window. For all other material properties, a corresponding shader must also be applied to the model to see the result of the texture in the Viewer window. For example, to see the results of the Bump Map texture, apply a Bump Map shader to the model. For the remaining properties, a custom shader is needed. See Materials working with shaders and textures on page 534 and Advanced material settings on page 546.

To add a texture to a material

1. Select the Shading Elements folder in the Asset browser.
2. Drag a Texture asset onto a model in the Viewer window.

   NOTE If a material is already applied to the model, you can also drag the texture onto the material in the Scene browser.

3. In the menu that appears, select Attach Texture to Material > Diffuse. A texture is added to the scene.

   The texture is attached to the material's Diffuse property. If the model had no material applied to it, a new material is also added to the scene; the material is automatically applied to the model and the texture is attached to the material's Diffuse property.

4. Expand the Textures folder in the Scene browser.
5. Double-click the texture to display the Texture settings.

6 Select New Media in the Texture setting's Media menu. A file browser opens.

7 Browse for an image file, such as a .tga or .jpg, and click Open.

The texture displays in the Texture settings. The texture may also display on the model, depending on how your model's UVs are mapped.

8 If you added a Texture or Layered Texture asset and the texture does not display on the model, you may need to adjust the position of the texture on the model. See Choosing a mapping method on page 567, Tiling your texture on page 568, and Rotating your texture on page 571.

Applying a video texture

You can select a video file as a texture's media, then access its information in the Video settings.

The following steps describe attaching a texture to a materials Diffuse property. For attaching textures to other material properties and seeing a result in the Viewer window, see Materials working with shaders and textures on page 534 and Advanced material settings on page 546.

To apply a video texture

1 Open the Shading Elements folder in the Asset browser.

2 Drag a Texture asset onto a model in the Viewer window.

3 In the menu that appears, select Attach Texture to Material > Diffuse. A texture is added to the scene.

The texture is attached to the material's Diffuse property. If the model had no material applied to it, a new material is also added to the scene; it is automatically applied to the model and the texture is attached to its Diffuse property.

TIP To set up a video plane quickly, drag the Texture into an empty space in the Viewer window, then select Video Plane from the menu that appears. A plane is added to the scene with the texture automatically attached.

4 Expand the Textures folder in the Scene browser and double-click the texture to display the Texture settings.

5 Select New Media in the Texture setting's Media menu. A file browser opens.

6 Browse for a video file and click Open.

NOTE MotionBuilder supports .avi files.

The texture displays in the Texture settings.

7 Expand the Video folder in the Scene browser and double-click on the video.

8 The Video settings appear in the Navigator window. For more information about configuring the Video settings, see Video settings on page 347.

Blending multiple textures

Blend multiple textures using Layered textures, then attach them to a material or model as if they were a single media. You can set different Blend modes for each texture layer, and adjust and animate each texture individually to create interesting results.

NOTE To use a texture's alpha channels, apply a shader with a Transparency setting, such as the Lighted shader, to the model.

There is a type of Layered texture you can use with a material, and there are types of Layered textures you apply directly to a model for use with a shader. See Choosing texture types on page 557.

The following steps describe using a Layered Texture asset for use with a material.

To create a Layered texture for a material

1 Open the Shading Elements folder in the Asset browser.

2 From the Asset browser, drag a Layered Texture asset onto a model in the Viewer window.

3 In the menu that appears, select Attach Texture to Material > Diffuse.

A Layered texture is added to the scene and appears in the Scene browser's Textures folder. If the model had no material applied to it, a new material is added to the scene; the material is automatically applied to the model and the Layered texture is attached to the material's Diffuse property.

4 In the Scene browser, expand the Textures folder and double-click the Layered texture.

The Layered Texture settings appear in the Navigator window.

5 Click the Layer Settings tab to access the Layer Editor.

6 To add a new texture to a Layered texture, click the Add button in the Layer Editor. A new texture is added to the scene and attached to the Layered texture.

NOTE You can also add a texture that is already in the scene. Drag the texture from the scene browser and drop it either into the Layer Editor or onto the name of the Layered texture in the Scene browser.

7 Double-click the new texture in the Scene browser.

NOTE The new texture displays twice in the Textures folder; by itself and attached to the Layered Texture.

8 Select New Media in the Texture setting's Media menu. A file browser opens.

9 Browse for a media file and click Open.

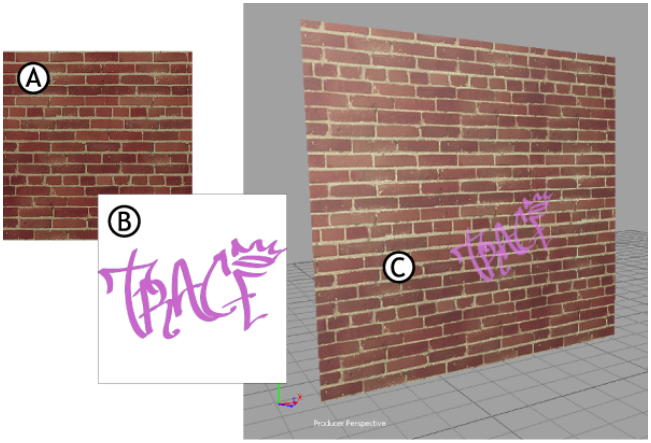
The texture displays in the Texture settings.

10 Add a second texture to the Layered texture, then select new media for the second texture.

11 In the Layer Editor, adjust each layer's Blend mode and Transparency. See Blend Mode on page 584.

The two textures display together on the model in the Viewer window.

NOTE If your textures have alpha channels, you can create interesting blending effects, such as a grass texture giving way to a pavement texture. To use a texture's alpha channels, apply a shader with a Transparency setting, such as the Lighted shader, to the model.



Blending textures *A.* **Tiling brick texture** *B.* **Graffiti texture with alpha channel** *C.* **Both textures combined on one model using a Layered texture**

For information on how to position your texture, see Choosing a mapping method on page 567, Tiling your texture on page 568, and Rotating your texture on page 571.

Detaching textures

You can detach a texture from a material property, model, or Layered texture. You can also choose to detach a texture from multiple assets at once.

To detach a texture from multiple objects

1. Expand the Textures folder in the Scene browser.
2. Right-click the texture you want to detach.
3. Select Detach x From All Objects, where x is the name of the texture.

   The texture is detached from all objects. Objects include models or Layered textures.

To detach a texture from a model

1. Expand the Scene folder in the Scene browser.

2 Double-click the model from which you want to detach a texture. For example, a Shadow Map would be a texture type that is directly applied to a model.

3 Right-click on the texture in the model folder, and select Detach x From y, where x is the name of the texture and y is the name of the model.

The texture is no longer attached to the model, but is still present in the scene.

To detach a texture from a material property

1 Expand the Materials folder in the Scene browser.

2 Double-click the material to display its Material settings.

3 In the Material settings, right-click the name of the texture associated to a material property, such as Diffuse.

NOTE In one material, the same texture may be attached to multiple properties. Detaching the texture from one property does not detach it from the other properties.

4 Select Detach from the menu.

The texture is detached from the material property, but it is still present in the scene.

To detach a texture from a Layered Texture

1 Expand the Textures folder in the Scene browser, then double-click the Layered texture.

2 Click the Layer Settings tab to display the Layer Editor.

3 Select a texture from the list of layers in the Layer Editor.

4 Click the Remove button.

The texture is detached from the Layered texture, but is still present in the scene.

Testing shaders, textures, and materials

Depending on how heavy your scene is, you may want to test it out before applying a texture to your models.

To test a texture:

1. Drag a cube object into the scene from the Asset browser.
2. Apply the shader, texture, or material you want to test by dragging it from the Asset browser onto the cube.
3. Adjust the settings for the shader, texture, or material using the settings in the Navigator window.

Choosing a mapping method

Various mapping methods let you specify how a texture is placed on the model. Place a texture according to the model's UV coordinates or binding box, or choose from a number of wrap options. The mapping method that creates the best results depends on the your model's shape or whether its UV coordinates are mapped, or "unwrapped". Also consider the purpose of the texture and of the model.

See also Mapping area on page 579.

To change the texture's mapping method

1. Apply a texture so that it displays on the model in the Viewer window. See Choosing texture types on page 557 and Adding a texture to a material on page 561.
2. Double-click the texture in the Scene browser.

   The Texture settings display in the Navigator window. Texture properties also display in the Properties window.
3. In the Texture settings, locate the Mapping Method menu. The following steps describe the situations in which you select options available from this menu.
4. If the model's UV coordinates are mapped, that is, if the model is *unwrapped*, select UV from the Mapping Method menu. This option uses the UV coordinates that are assigned to the vertices of your model to place the texture.

   NOTE If your model does not have mapped UV coordinates, the UV option has the same effect as the XY mapping option.

5 Select the XY, YZ, or XZ options to map a selected texture to the bounding box of your object. The bounding box is then applied to your model.
   - Select XY to map the image on the XY plane of the bounding box.
   - Select YZ to map the image to the YZ plane.
   - Select XZ to map the image to the XZ plane.

6 If your model is spherical or cylindrical, wrap your texture around the model using either the Spherical or Cylindrical options.

7 Use the Environment mapping option when your texture is spheroid. You can use this type of texture to create skyscapes or simulate reflective surfaces.

   For the best results, using this mapping method for scenes in which the camera does not move much. See Environment mapping on page 555.

8 Select the Projection option if you want to project the texture image straight onto the object, so that the texture remains flat and always faces the camera.

   A texture with a Projection mapping method is always projected from the current camera's viewpoint.

- Adding a texture to a material on page 561
- Tiling your texture on page 568
- Rotating your texture on page 571
- Texture settings on page 575

Tiling your texture

Use the following steps to tile and adjust a texture on your model. See Texture tiling on page 552.

To tile a texture:

1 Apply a texture so that it displays on the model in the Viewer window. See Choosing texture types on page 557 and Adding a texture to a material on page 561.

2 Select the best mapping method for your texture and model. See Choosing a mapping method on page 567.

3 In the Scene browser, expand the Textures folder and double-click the texture you want to tile. The Texture settings appear in the Navigator and Properties windows.

4 Before or while you tile the texture, it can be useful to adjust its position on the model. Use the Translation values in U and V directions. The Translation values basically set the UV starting position of your texture. Changing the Translation values moves the texture but does not tile it.

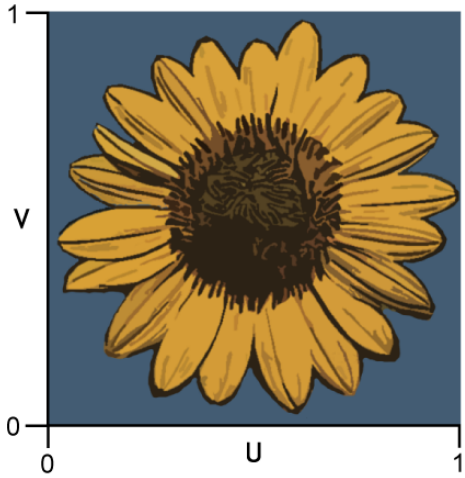
NOTE You can animate the texture's Translation values.

5 Use the Scaling U and V values to tile the texture. The higher the Scaling value, the more a texture is tiled. For example, entering a value of 5 shrinks the texture and tiles it 5 times. Set the values to 1.00 to keep the texture at its original size. Setting the values to less than 1.00 spreads out the texture.

NOTE You can key and animate the Scaling U and V values.

6 When you scale a texture, it scales in or out from its pivot point. By default, a texture's scaling pivot point is one of its corners. If you prefer to scale the texture from a different point, such as its center, you can change the texture's scaling pivot using the Scaling Pivot Offset properties in the Properties window.

The Scaling Pivot Offset U and V values range from 0 to 1.00. Change the value of the Scaling Pivot Offset.u property to move the pivot along the width of the texture. Change the value of the Scaling Pivot Offset.v property to move the pivot along the height of the texture.



A texture's U and V values range from 0 to 1.

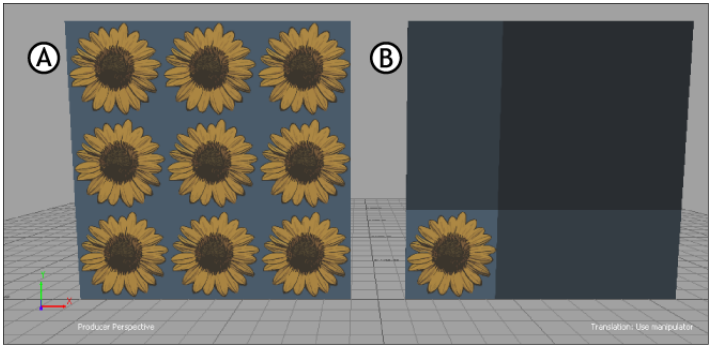
To scale a texture from its center, for example, enter a value of 0.50 for both U and V properties, placing the texture's scale pivot in the middle of the texture.

NOTE You can use the UV Swap option to change the direction of the texture's UV map coordinates.

---

7 Select Repeat in both U Tile and V Tile menus to let your texture tile in both directions. Otherwise, select Clamp from either menu.

NOTE If both U Tile and V Tile menus are set to clamp, your texture will not tile.



Same texture on two planes, with Scaling set to 3. *A.* **Texture set to U and V Repeat** *B.* **Texture set to U and V Clamp**

- UVW coordinates on page 551
- Texture settings on page 575

Rotating your texture

Use the following steps to rotate and adjust a texture on your model.

To rotate a texture

1. Apply a texture so that it displays on the model in the Viewer window. See Choosing texture types on page 557 and Adding a texture to a material on page 561.
2. Select the best mapping method for your texture and model. See Changing texture mapping. See Choosing a mapping method on page 567.
3. In the Scene browser, expand the Textures folder and double-click the texture you want to tile. The Texture settings appear in the Navigator and Properties windows.
4. Before or while you tile the texture, it can be useful to adjust its position on the model. Use the Translation values in U and V directions. The Translation values basically set the UV starting position of your texture. Changing the Translation values only moves the texture but does not tile it.

NOTE You can animate the texture's Translation values.

5 Use the Rotation values to adjust and animate the rotation of your texture on the object to which it is applied. The fields you use depends on whether you are using a 2D texture or a 3D texture.

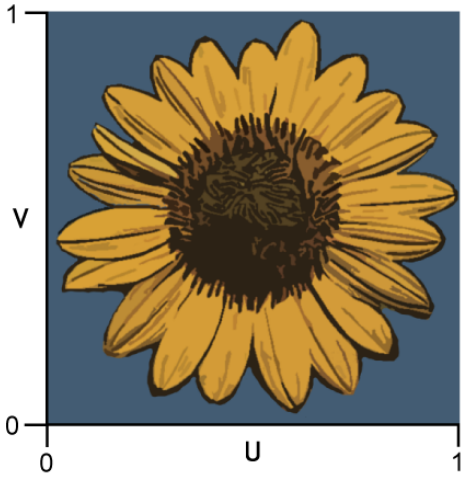
For 2D textures change the value of the Z field only. This value is the degree of rotation, so a value of 180, for example, would be half a rotation.

For 3D textures, use all three Rotation fields in the Texture settings to adjust the texture.

NOTE You can animate the texture's rotation.

6 When you rotate a texture, it rotates around a pivot point. By default, a texture's rotation pivot point is one of its corners. If you prefer to rotate the texture from a different point, such as its center, you can change the texture's rotation pivot using the Rotation Pivot Offset properties in the Properties window.

The Rotation Pivot Offset U and V values range from 0 to 1.00. Change the value of the Rotation Pivot Offset.u property to move the pivot along the width of the texture. Change the value of the Rotation Pivot Offset.v property to move the pivot along the height of the texture. For example, entering a value of 0.50 for both U and V properties places the texture's rotation pivot in the center.



A texture's U and V values range from 0 to 1.

To rotate a texture from its center, for example, enter a value of 0.50 for both U and V properties, placing the texture's rotation pivot in the middle of the texture.

NOTE You can use the UV Swap option to change the direction of the texture's UV map coordinates.

Texture settings

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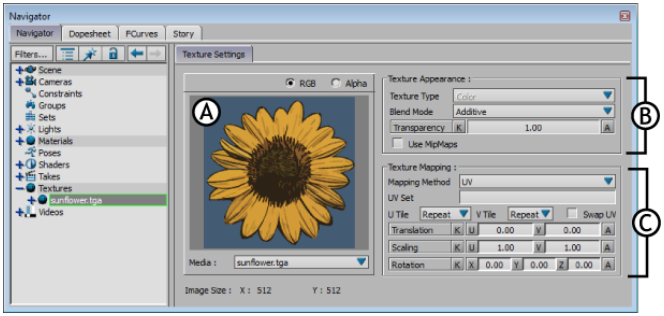
In the Navigator window, the Texture settings let you load and position a texture, once a Texture asset has been applied to a model or attached to a material. See Adding a texture to the scene on page 559 and Adding a texture to a material on page 561.

The Texture settings are divided into three areas, the Image Preview area, the Texture Appearance settings, and the Mapping area.



Texture settings *A.* **Image Preview area** *B.* **Texture Appearance settings** *C.* **Texture Mapping area**

A Layered texture has Layer settings as well as Texture settings. Its Texture settings are the same as for other texture types. For information about the Layer settings, see Layered Texture settings on page 582.

Image Preview area

The Image Preview area lets you load an image or movie, then preview its RGB or Alpha channels.

Texture Proxy

When a texture is selected from the Media menu (see Media menu on page 576), the image or video file displays in the Image Preview area. For video textures, the Texture proxy plays the video clip when you play your take.

The Texture proxy can display either a texture's RGB channels or Alpha channel.

RGB and Alpha options

Select either the RGB option or the Alpha option to preview the RGB channels or the Alpha channel of a loaded image.

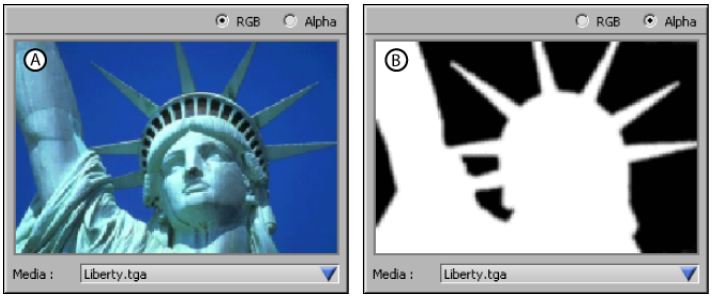


Image Preview *A.* **RGB option selected** *B.* **Alpha option selected**

Image Size

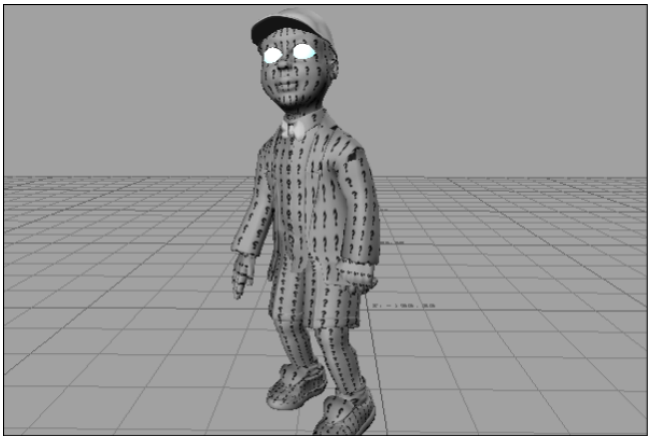
The Image Size values display the X and Y size of your selected texture. These values are a reference only; you cannot change the image size here.

Media menu

The Media menu lets you load an image or video file to use as a texture. The Media menu also lets you select image and video files that are already available in your scene.

You can change the image or video clip used by a texture even after the texture has been applied to a material or model. When you change the texture's media, all models using the texture update to use the new image or video clip.

None



Question marks appear on a model when an attached texture has no media.

The None option applies no media to the object. In place of an image, question marks display on the model in the Viewer window.

New Media

The New Media option lets you load an image or video file for the selected texture.

NOTE MotionBuilder supports .tga, .bmp, .dds, .jpeg, .jpg, .memory, .pic, .png, .rgb, .rgba, .sgi, .switcher, .tif, .tiff, .yuv, and .iff image formats, and supports .avi video formats.

Image files used as texture cannot exceed a maximum size of 1024x1024 pixels. On OpenGL machines, the number of pixels both horizontally and vertically should be to the power of 2. For example, 16, 32, 64, 128, 256, 512, or 1024 pixels.

If the number of pixels is between each range, the image is scaled down to the preceding power of 2. For example, an image measuring 18x32 is scaled to 16x32. An image measuring 40x77 is scaled to 32x64.

NOTE Scaling down images lessens the image's detail. Try to keep your images as close to the power of 2 as possible.

■ Adding a texture to the scene on page 559

- Adding a texture to a material on page 561

Texture Appearance settings

The Texture Appearance settings let you fine-tune the appearance of the selected texture. The Texture Appearance settings consist of Texture Type, Blend Mode, Transparency, and Use Mipmaps.

Texture Type

The Texture Type menu states the texture's type, which determines its purpose in the scene.

NOTE You cannot change the selection in the Texture Type menu. To create a texture of a different type, drag it from the Asset browser. See Choosing texture types on page 557.

Type	Description
Color	Lets you add media to a material or to a Layered texture. Corresponds to the Texture asset or Layered Texture asset in the Asset Browser. See Adding a texture to a material on page 561 and Blending multiple textures on page 563.
Spherical Reflection Map	Used when the Reflection shader is set to Spherical Map type in the shader settings. This type of texture is applied directly to a model. See Reflection effects on page 633.
Sphere Map	Used when the Reflection shader is set to Sphere Map type in the shader settings. This type of texture is applied directly to a model. See Reflection effects on page 633.
Shadow Map	Used when the Shadow Map shader is set to Shadow Map type in the shader settings. This type of texture is applied directly to a model. See Shadows and lighting effects on page 657.
Light Map	Used when the Shadow Map shader is set to Light Map type in the shader settings. This type of texture is applied directly to a model. See Shadows and lighting effects on page 657.

Blend Mode

The Blend Mode menu lets you control how the texture is blended with multiple textures in a Layered texture. To control the blending of many textures, control each texture's Blend mode from the Layer Editor. See Blending multiple textures on page 563 and Blend Mode on page 584.

Transparency

The Transparency field lets you adjust a texture's level of transparency when it is attached to a Layered texture. To control the transparency of many textures, control each texture's transparency from the Layer Editor. See Blending multiple textures on page 563 and Transparency on page 584.

Use MipMaps

Activate Use MipMaps to create a proxy of an existing image. Using MipMaps with large image files provides better image Anti-aliasing and gives optimal resolution. See Mipmapping on page 556.

Mapping area

In the Texture settings, the Texture Mapping area contains controls that let you position and tile the texture. The Texture Mapping settings consist of U and V Tile, Translation, Rotation and Scaling.

NOTE A Layered texture treats multiple textures as if they were a single texture, but you can adjust each texture separately. For example, you can tile, translate, scale, and rotate one texture differently from another texture. However, the Layered texture's mapping method, such as UV or Projection, overrides the mapping method of the textures attached to it. Used individually, each texture retains its original settings, even if they are also attached to a Layered texture.

Mapping Method

The Mapping Method menu lets you specify the mapping settings for your texture. Use the Mapping Method options to map your texture to a selected object according to its coordinates (UV, XY, YZ, or XZ), to a designated wrap option (Spherical or Cylindrical), or use Environment mapping. See Mapping method types on page 552 and Choosing a mapping method on page 567.

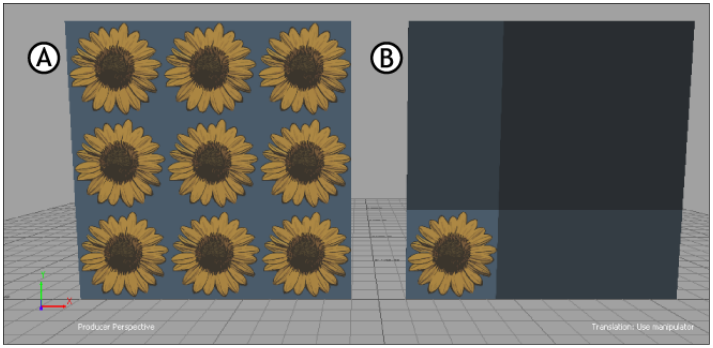
UV Set

The UV Set field lets you select different UV sets (also known as Map Channels) when a model has more than one.

U/V Tile

The U Tile and V Tile menus let you set the repetition of textures on a model's U or V coordinates.

In the following figure, two planes have the same texture applied, but each uses a different mapping method from the U/V tile menus.



The same striped texture on two planes *A.* **Texture set to U and V Repeat.** *B.* **Texture set to U and V Clamp.**

Both menus let you choose one of two options, Repeat and Clamp:

Option	Description
Repeat	Applies the texture over and over on the model's surface until the model is covered. This is the default setting.
Clamp	Applies the texture to a model only once, using the color at the ends of the texture as the "filler".

Swap UV

Activate the Swap UV option to change the direction of the texture's UV map coordinates.

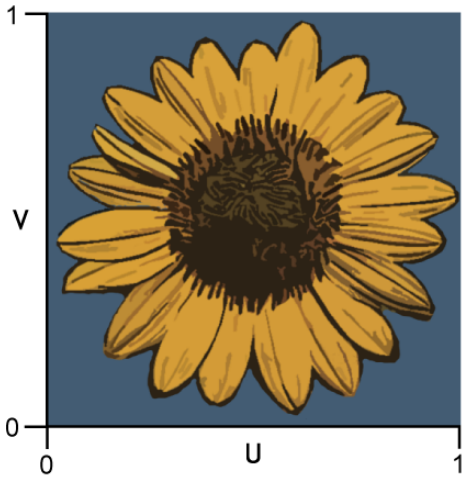
Translation

Use the Translation values to modify the UV starting position of your texture. The data in these fields determines where your texture is applied on a selected model.

Scaling

Use the Scaling values to modify the UV scaling of your texture. Use Scaling to stretch, shrink, or tile your texture. The Scaling values determine the size of your texture relative to a selected object. For example, entering a value of 5 shrinks the texture; the texture tiles 5 times if it is set to Repeat, or only shrinks to 1/5 of its original size if it is set to Clamp. Set the values to 1.00 to keep the texture at its original size.

You can change the texture's scaling pivot using the Scaling Pivot Offset properties in the Properties window. When you scale a texture, it scales in or out from its pivot point. The Scaling Pivot Offset U and V values range from 0 to 1.00. Change the value of the Scaling Pivot Offset.u property to move the pivot along the width of the texture. Change the value of the Scaling Pivot Offset.v property to move the pivot along the height of the texture. For example, entering a value of 0.50 for both U and V properties places the texture's scale pivot in the center of the texture, letting you scale a texture from its middle.



A texture's U and V values range from 0 to 1.

Rotation

Use the Rotation values to adjust and animate the rotation of your texture on the object to which it is applied. The fields you use depends on whether you are using a 2D texture or a 3D texture.

For 2D textures change the value of the Z field. This value is the degree of rotation, so a value of 180, for example, would be half a rotation.

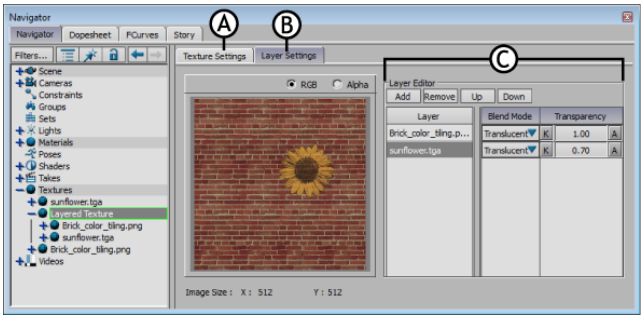
For 3D textures, use all three Rotation fields in the Texture settings to adjust the texture.

You can change the texture's rotation pivot using the Rotation Pivot Offset properties in the Properties window. The Rotation Pivot Offset U and V values range from 0 to 1.00. Change the value of the Rotation Pivot Offset.u property to move the pivot along the width of the texture. Change the value of the Rotation Pivot Offset.v property to move the pivot along the height of the texture. For example, entering a value of 0.50 for both U and V properties places the texture's rotation pivot in the center.

- Adding a texture to a material on page 561
- Choosing a mapping method on page 567

Layered Texture settings

The Layered Texture settings let you blend multiple textures, then adjust the result as if it were a single texture. The Layered Texture settings consist of two panes, the Texture Settings and the Layer Settings.



Layered Texture settings *A.* **Tab for Texture Settings pane** *B.* **Layer Settings pane displayed** *C.* **Layer Editor**

In the case of Layered textures, the Texture Settings pane lets you adjust the result of multiple textures blending as if it was a single texture. The settings

in a Layered texture's Texture Settings pane is the same for any type of texture. See Texture settings on page 575.

NOTE A Layered texture treats multiple textures as if they were a single texture, but you can adjust each texture separately. For example, you can tile, translate, scale, and rotate one texture differently from another texture. However, the Layered texture's mapping method, such as UV or Projection, overrides the mapping method of the textures attached to it. Used individually, each texture retains its original settings, even if they are also attached to a Layered texture.

The Layer Settings pane includes the Layer Editor on page 583 (C), which lets you blend multiple textures.

Layer Editor

In the Layer Settings pane, the Layer Editor lets you blend multiple textures. See Blending multiple textures on page 563. Four buttons at the top of the Layer Editor let you manage the textures in the Layered texture.

Button	Function
Add	Adds a new texture to the scene and attaches it to the Layered texture.
Remove	Detaches the selected texture from the Layered texture. The texture is not deleted from the scene.
Up	Moves the selected texture up in the list of layered textures.
Down	Moves the selected texture down in the list of layered textures.

NOTE When a texture is already in the scene, there are two ways you can add it to a Layered texture. Dragging the texture from the Scene browser, either drop it into the Layer Editor or onto the Layered texture in the Scene browser.

Once you have added a texture to the Layered texture, it appears in the list of layers with Blend Mode and Transparency settings.

Blend Mode

The Blend Mode menu lets you control and animate how textures are mixed in the Layered texture.

Option	Description
Translucent	The texture layer is transparent, depending on the Alpha settings.
Additive	The color of the new texture is added to the previous texture.
Modulate	The color value of the new texture is multiplied by the color values of all previous layers of texture.
Modulate2	The color value of the new texture is multiplied by two and then multiplied by the color values of all previous layers of texture.

Transparency

The Transparency settings let you adjust and animate a texture's level of transparency. See Blending multiple textures on page 563.

Layered texture properties

When you double-click a Layered texture in the Scene browser, its properties display in the Properties window. These properties are mostly the same as those for standard single-layered textures, except for the BackGroundColor property.

BackGroundColor property

Layered textures have a BackGroundColor property, which is set to black by default. When you have only one texture in a Layered texture and it involves transparency, you can choose a background color using this property.

Part 4: Shaders

This section is about using shaders to create effects in MotionBuilder. Like materials and textures, shaders also control the surface appearance of 3D models, creating further depth and detail.

Unlike a texture, which is simply an image file placed on a 3D model, a shader gives your objects descriptive properties like shadowing or reflectivity real time.

Shaders control the way the surface interacts with the lighting in the scene, creating color, specularity, reflection, transparency, shadowing, and refraction effects. Depending on the settings, these effects can change in real time.

This section covers MotionBuilder shaders, their settings, properties, and how you can use them to create environmental and surface effects for your scenes.

Following are the topics included in this chapter.

- Shader basics on page 587
- Cartoon effects on page 601
- Environmental effects on page 617
- Reflection effects on page 633
- Surface effects on page 639
- Shadows and lighting effects on page 657
- Shader manager on page 675

Shader basics

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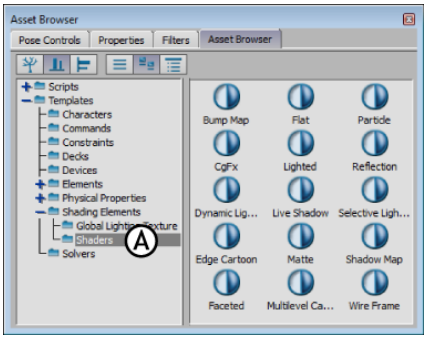
In 3D modeling, the term *shaders* is used to describe an algorithm that specifies how a surface responds to light. In MotionBuilder, *shaders* are assets that you apply to models to create different types of effects. Various types of shaders can define how a surface responds to light, or create special effects like cartoon outlines and bump mapping. You can also use shaders to generate shadow maps and light maps for scenes with a static light source.

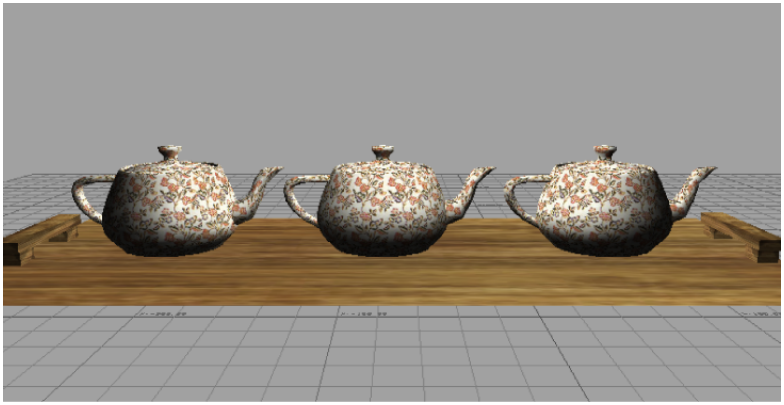
NOTE In addition to the shaders described in this documentation, MotionBuilder supports custom shaders created using the Open Reality® SDK.

In the Asset browser's Shading Elements folder, the Shaders folder contains shaders that you can add to a scene. When you drop a shader on an object, you assign values that control the way the model's surface interacts with the lighting in the scene, creating color, specularity, reflection, transparency, shadowing, and refraction effects.



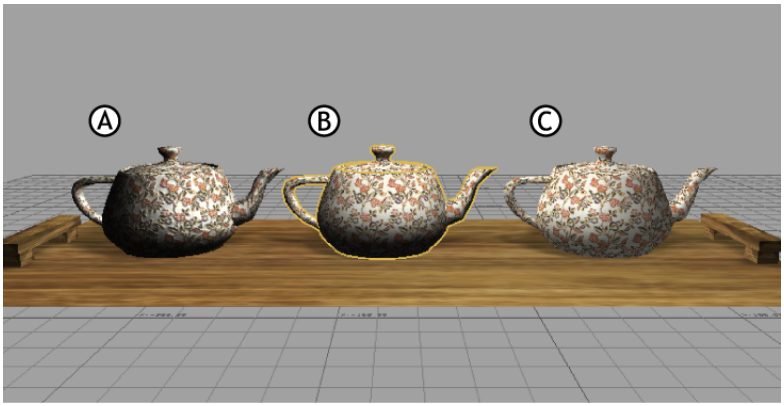
Asset browser *A.* **Shaders folder**

In the following figure, three teapots are arranged on a tray. Materials with textures have been applied to all objects in the scene; a floral pattern for the teapots and a wood texture for the tray.



Textured models with no shaders applied.

Somehow the models are still missing an element of realism. The flat, dull, texture creates the appearance that all objects in the scene are constructed from the same uniform substance.



Shader examples *A.* **Bump Map shader** *B.* **Edge Cartoon shader** *C.* **Lighted shader.**

In the examples above, shaders have been applied to the teapots and tray:

- The first teapot has a has a Bump Map shader applied to it to give it the appearance of a bumpy, modelled surface.
- The second teapot has an Edge Cartoon shader applied to it, so it is outlined like a two-dimensional drawing.
- The third teapot has a Lighting shader applied to it, so the “china” reflects the light, making it slightly shiny.

- The wooden tray has a Live Shadow shader applied to it so it shows the shadow from anything blocking light from it.

While the teapots are all identically modelled and textured, adding shaders can make them appear to be composed of very different substances.

- Shader effects on page 589
- Applying a shader to a model on page 594
- Testing shaders, textures, and materials on page 595
- Activating and disabling shaders on page 598

Shader effects

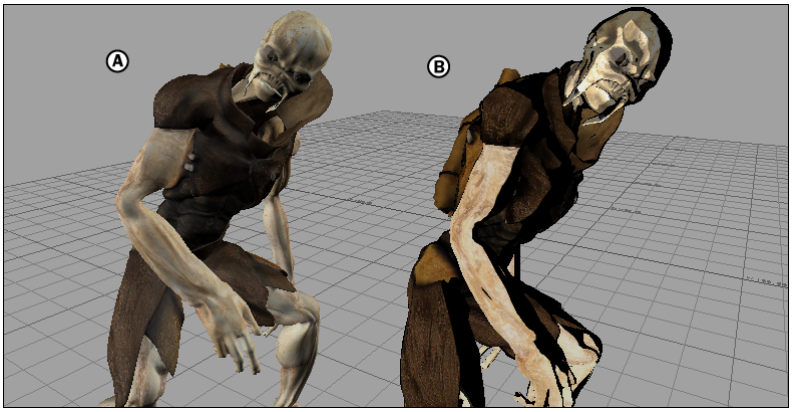
There are many shader types which provide various effects and are used for many purposes. There are equally as many ways to categorize them.

Shaders can provide cartoon, reflection, and environmental effects.

Cartoon look

While most shaders can make your models look more realistic, cartoon-style shaders give your character a comic book look.

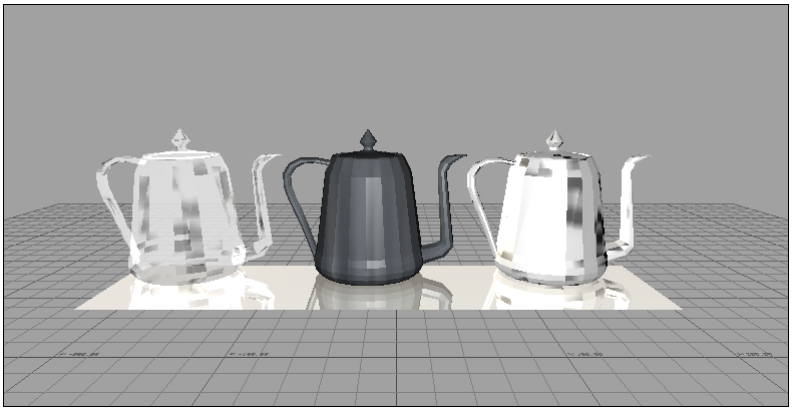
In the following figure, a character has shaders applied which flatten its color depth and outline its form, giving it a two-dimensional cell-animation look to it, even though it is a 3D model.



Cartoon Look *A.* **With no shaders** *B.* **With Cartoon shading.**

Reflections

Textures and materials applied to a 3D model cannot give you the sharp reflection effects needed to imply glass, chrome, or mirror. For these effects, you must use reflection shaders.



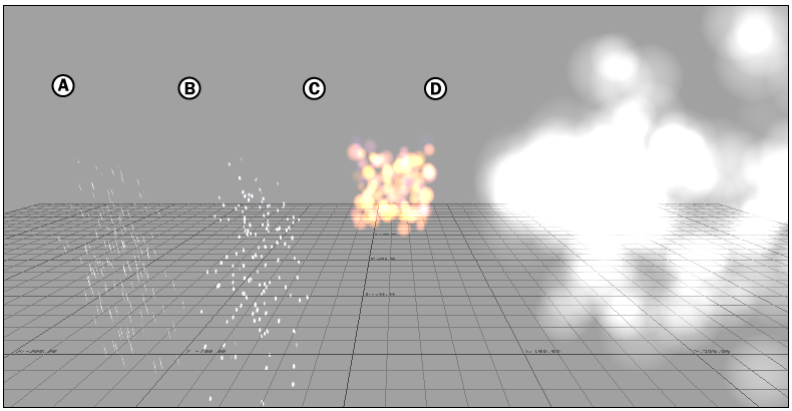
Reflection shader examples

Reflection shaders make your objects reflect the world around them, but their effects are not limited to creating mirrors. Combine them with transparency to create a shiny glass look, or combine them with a dark material to create a brushed steel look.

You can use live reflections, which will accurately reflect animation in the scene, or a map shader to create a static reflection that does not react to animation around it.

Environmental

You can use shaders to create environmental effects such as clouds, fire, fog, and rain.



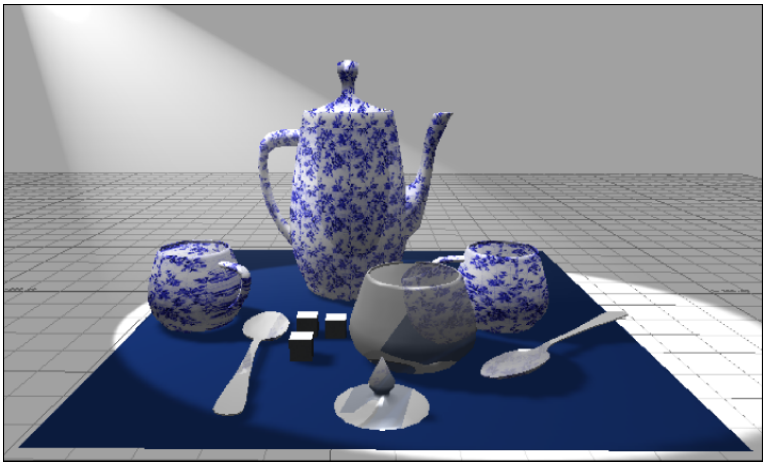
Environmental presets *A.* **Rain** *B.* **Snow** *C.* **Fireball** *D.* **Cloud**

Shaders can be applied to objects to create environmental effects like fire, fog, snow, and rain. Because the shader is meant to create an environmental effect, it is applied to a simple object, such as a cube, that defines the area in which the environmental effect occurs. Instead of appending the shader to the object, you replace the object with the shader, so that the model is hidden and only the effect of the shader is visible.

Shadows and lighting

Lighting alone does not convey atmosphere, but how objects react to light does. Use shaders to create realistic shadows and lighting on planes and objects in your scene.

Adjust the shadow intensity to create subtle differences between a ghostly or silhouette effect.

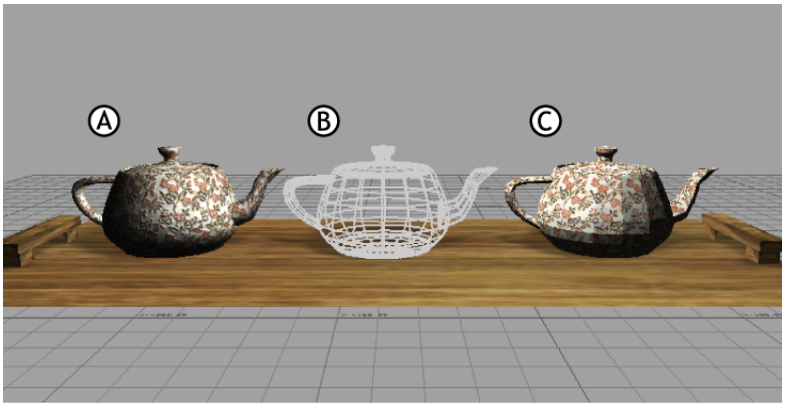


Shadow shader example

Surface effects

You can use shaders to create surface effects on objects that imply that the models have depth and substance, even when the original model was smooth. These effects create further depth and detail.

Some surface effect shaders, such as Faceted and Wireframe, are derived from the model's construction, while other shaders, such as Bump Map, let you create the appearance of relief over simple geometry.



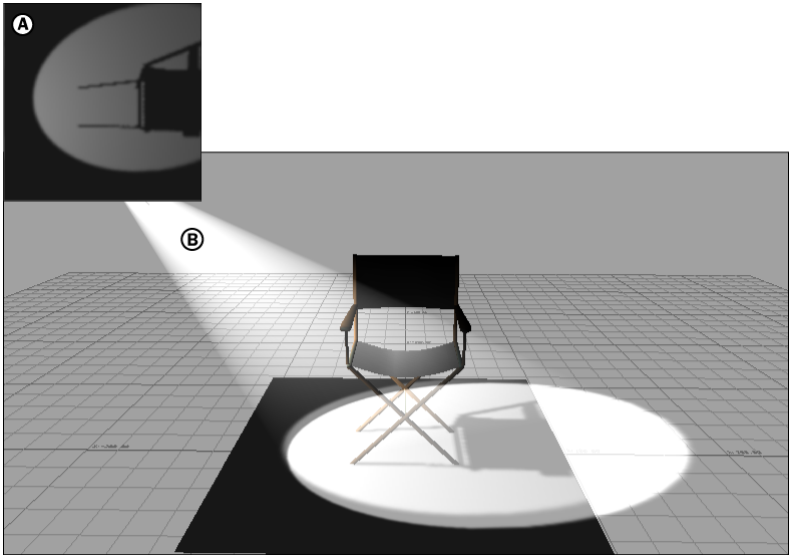
Surface effects *A.* **Bump map** *B.* **Wireframe** *C.* **Faceted**

■ Testing shaders, textures, and materials on page 595

■ Applying a shader to a model on page 594

Map shaders

Map shaders take a “snapshot” of the scene at the moment it is rendered, and applies it to an object as a texture.



Map examples *A.* **Created map** *B.* **Scene with the shadow map applied to the floor plane.**

Map shaders is a useful alternative to live shaders as they do not demand much of the system’s resources to display.

Map shaders are used when the environment surrounding an object does not change. In the figure above, a map shader is used to portray the shadow cast by a chair; as long as the chair, the cast light, and its environment are static, the shadow map is appropriate.

If something crosses the path of the light beam, it does not cast a shadow. You can combine Live Shadow shaders with map shaders in the same scene to save system resources.

That way the light in a scene cast by a sun or lamp never changes by the shadows cast by the animated character does.

■ Shader effects on page 589

■ Applying a shader to a model on page 594

■ Live shaders on page 594

Live shaders

Live shaders are used to show effects caused by moving objects, for example shadows or reflections, providing your animation with a realistic look.

The only setback with live shaders is that they use up active memory, and a scene with too many live shaders can slow down. With careful planning, scenes can be constructed using a combination of live and map shaders to save resources.

■ Shader effects on page 589

■ Applying a shader to a model on page 594

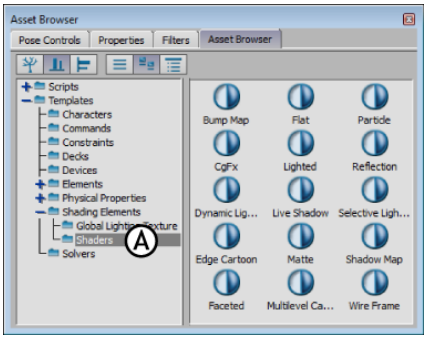
■ Map shaders on page 593

Applying a shader to a model

Apply various types of shaders directly to models to obtain different effects.

To apply a shader to a model:

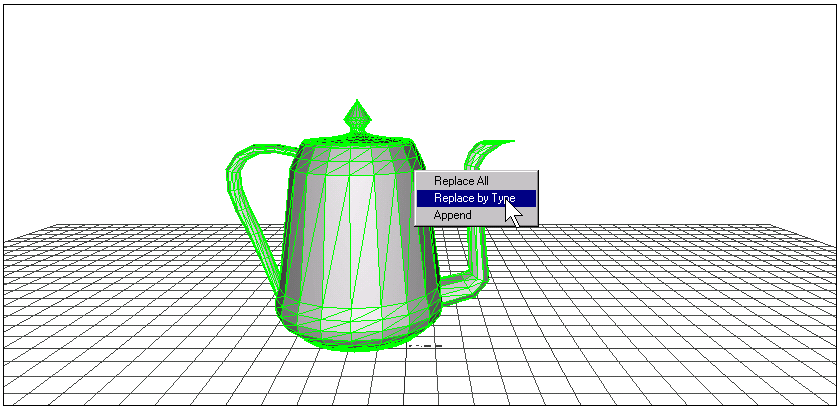
1 Expand Shading Elements > Shaders in the Asset browser.



Asset browser *A.* **Shaders folder**

2 Drag a Shader asset from the Asset browser onto a model in the Viewer window.

A contextual menu appears.



Viewer window *A.* **Shader contextual menu**

3 From the contextual menu, select one of the following three choices.

Option	Description
Replace All	Select Replace All to remove all other shaders applied to this object and use the new shader.
Replace by Type	Select Replace By Type to replace all shaders of a certain type with the new shader.
Append	Select Append to add the new shader to any shaders already applied to the object.

- Activating and disabling shaders on page 598
- Hiding the Default shader on page 597

Testing shaders, textures, and materials

Depending on how heavy your scene is, you may want to test shaders, materials, and textures on simple models before adding them to your scene.

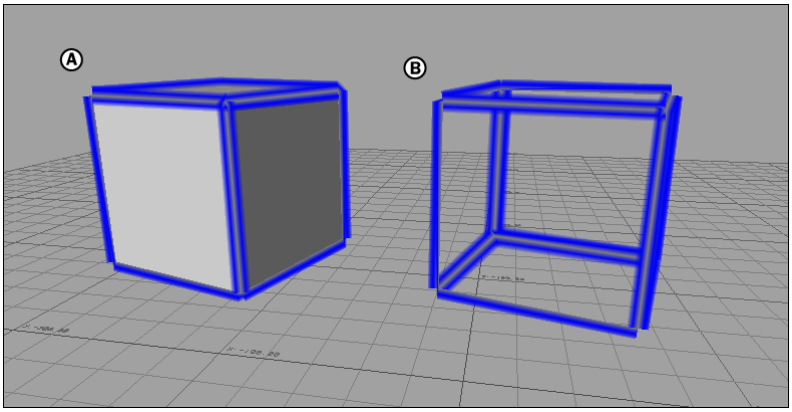
To test shaders:

1. Drag a cube or sphere asset into the scene from the Asset browser's Elements folder.
2. Apply the shader, texture, or material you want to test by dragging it from the Asset browser onto the cube.
3. Adjust the settings for the shader, texture, or material using the settings in the Navigator window.

- Shader effects on page 589
- Applying a shader to a model on page 594
- Applying a material to a model on page 537
- Adding a texture to a material on page 561

Default shader

The Default shader is automatically applied to every model that appears in the scene. When you apply a shader to an object using the Append or Replace by Type selection from the contextual menu, the model remains.



Edge Cartoon shader *A.* **With the Default shader.** *B.* **Without the Default shader.**

If there is no shader applied to a selected object, "Default shader" appears in the Shader 1 column of the Shader manager. Use this shader as a quick way to reset shaders applied to your model.

If you want to remove the object so that it reveals only the effect of the shader, right click the Default shader in the Scene browser and select Detach Default shader from Selected Objects.

You cannot delete the Default shader, you can only detach it from all or selected objects.

- Hiding the Default shader on page 597
- Applying a shader to a model on page 594
- Activating and disabling shaders on page 598

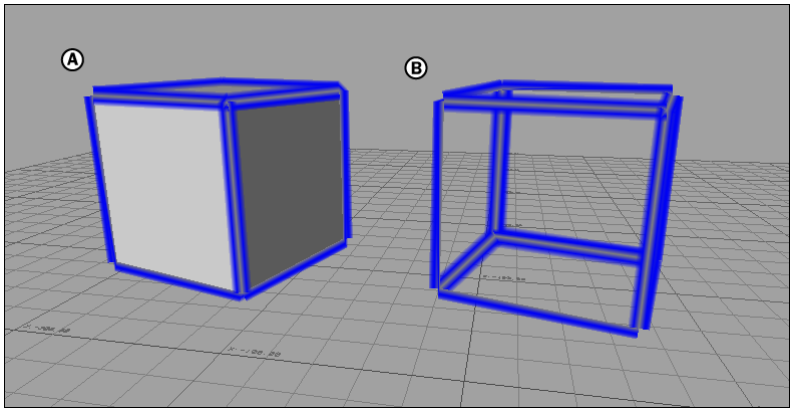
Hiding the Default shader

You cannot delete the Default shader, you can only detach it from all or selected objects.

1. In the Scene browser, expand the Shaders folder and right-click Default shader.
2. Select Detach Default shader From All Objects from the contextual menu.

To remove the object so that it reveals only the other effects applied to it:

- Select the object and right-click the Default shader in the Scene browser, but select Detach Default shader from Selected Objects.



Edge Cartoon shader *A.* **With the Default shader.** *B.* **Without the Default shader.**

- Applying a shader to a model on page 594

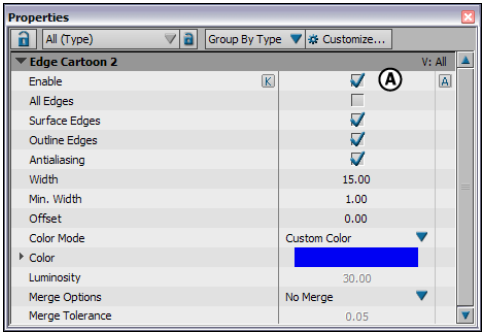
Activating and disabling shaders

Disable shaders when you want to temporarily remove the effect of the shader from an object. This can be useful when you are working on a scene with many shaders that are slowing your system down. There are three ways to do this:

- Properties window on page 598
- Scene browser on page 599
- Shader manager on page 599

Properties window

1. Select the shader that you want to disable in the Scene browser.
2. Open the Properties window and disable the Enable option.
3. Activate the Enable option to restore the shader.



Properties window *A.* **Edge Cartoon shader Enable option**

Scene browser

1 Expand the Shaders folder in the Scene browser.

2 Right-click the shader you want to remove and select Detach Shader from all Objects. Every instance of this shader is removed.

The shader remains in the Scene browser's Shaders folder, so you must reapply the shader to the model if you want to use it again.

Shader manager

1 Select the model with the shader you want to remove in the Viewer window.

2 In the Scene browser, double-click the Shaders folder. The Shader Manager displays.

3 In the Shader columns area of the Shader Manager, select No Shader to detach the selected shader from the selected object.

If you have no model selected, the No Shader option affects all models in the scene.

Changing the culling mode

Use the Culling menu to suppress the drawing of back-facing polygons. The Culling menu displays in the Properties window when you select a model in the scene.

There are three culling modes:

- Both
- Outer (Counter-Clockwise)
- Inner (Clockwise)

If the original model is based on polygons, the proper culling mode depends on the order of points used when you build your polygon model.

Cartoon effects

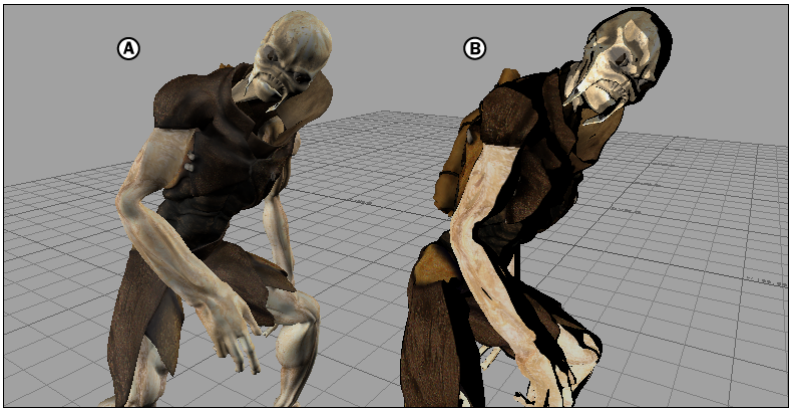
36

While most shaders can make your models look more realistic, cartoon-style shaders give your character a comic book look.

This sub-section covers the Edge Cartoon, Multilevel Cartoon, and Flat shaders, as well as the various properties contained within them and how you can use them to create a cartoon effect.

There are three shaders that can give this effect, see:

- Applying the Flat shader on page 602
- Applying the Multilevel Cartoon shader on page 608
- Applying the Edge Cartoon shader on page 611



Cartoon Look *A.* **With no shaders** *B.* **With Cartoon shading.**

Applying the Flat shader

To apply the Flat shader:

1. Drag the Flat shader from the Asset browser and drop it on a model in the Viewer window.
2. Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
3. Select Custom Color from the Color Source menu to pick a color for the object, or leave it at the default setting to derive its color from the object's material.
4. Adjust the object's brightness with the Luminosity slider, if desired.
5. Choose a form of transparency for the object with the Transparency Type menu.
6. Adjust the amount of transparency applied to the object with the Transparency Factor slider.

Making an object transparent

To make an object transparent:

1. Drag the Flat shader from the Asset browser and drop it on a model in the Viewer window.
2. Select Append.
3. Adjust the object's brightness with the Luminosity slider, if desired.
4. Choose a form of transparency for the object with the Transparency Type menu.
5. Adjust the amount of transparency applied to the object with the Transparency Factor slider.

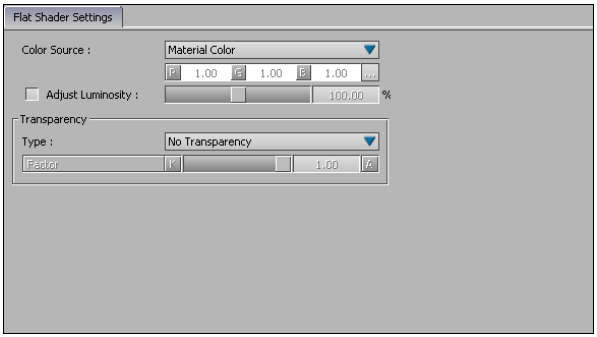
If there is a texture applied to the object, its Alpha channel is affected. If there is no texture, the object's material Transparency property is affected.

- Flat Shader transparency types on page 606
- Edge Cartoon shader settings on page 612

Flat shader settings

Use the Flat shader to color selected objects with a flat color that is unaffected by the lights in your scene.

The Flat shader lets you color selected objects with a flat color.



Flat shader settings

Color Source menu

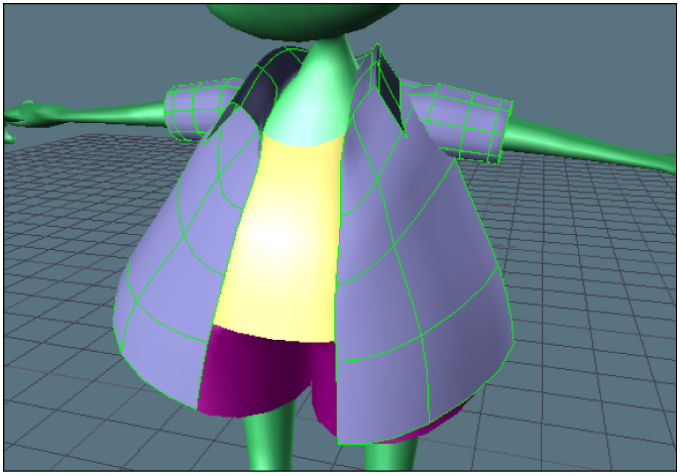
Use the Color Source menu to select one of two options:

Material Color

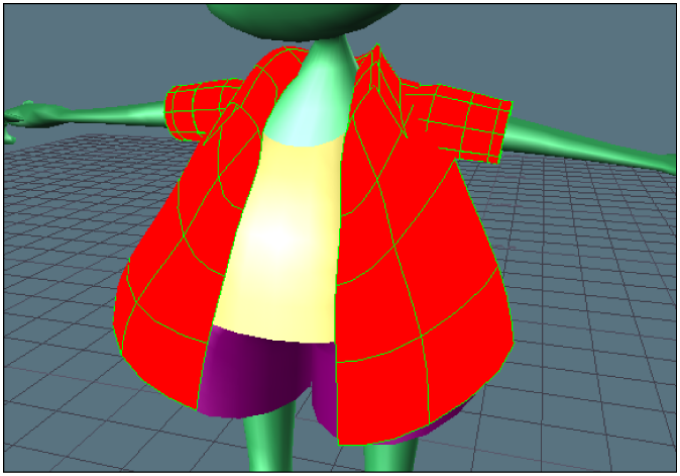
Select Material Color to use the Material Properties in the Materials settings to choose a color for the selected objects. The Color fields are disabled when selecting this color source. Use the Luminosity slider to adjust the material's brightness.

Custom Color

Select Custom Color to change the object using the Color field. To change the color, use the Color field or click the Color button to open the Color window. The Luminosity slider is disabled. The following figures show the jacket of a model without a shader, and with the Flat shader applied.



No shader: The jacket is drawn with a smooth 3D look, which is achieved using the Materials settings.



Flat shader: The jacket is drawn with no edges, and its color is changed to red using the Flat shader.

The color fields always show values for the Custom Color option.

Adjust Luminosity option

Activate the Adjust Luminosity option to access the Luminosity slider, which lets you change the brightness of the material.

When the color is set to Custom Color, the Luminosity slider is disabled.

A value of 0% changes the material to pure black. A value of 100% uses the same material color as applied in the Materials settings. A value of 200% changes the material to pure white.

The Luminosity slider only works when the Color Source menu is set to Material Color.

Transparency Type menu

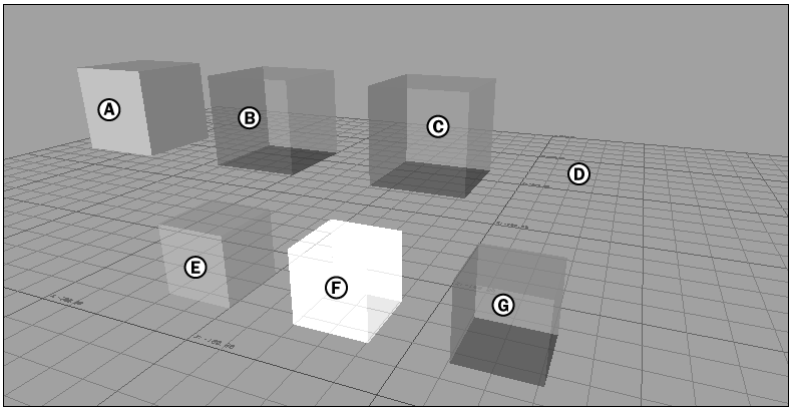
The Transparency Type menu in the Flat shader lets you select a method of calculating transparency and of adjusting the percentage used to boost the object's texture or material opacity.

If there is a texture applied to the object, its Alpha channel is affected. If there is no texture, the object's material Transparency property is affected. See Flat Shader transparency types on page 606 for a description of each kind of Transparency.

Transparency Factor slider

The Transparency Factor slider lets you manipulate or animate the Transparency value for the Flat shader. The default setting is 1.00.

Flat Shader transparency types



The Transparency menu in the Flat shader lets you select a method of calculating transparency and of adjusting the percentage used to boost the object's texture or material opacity. *A.* **No Transparency** *B.* **Accurate Transparency** *C.* **Translucent** *D.* **Matte (set to 0.00)** *E.* **2D Transparency** *F.* **Additive Transparency** *G.* **Translucent (Z Sort Models)**

Transparency type	Effect
No Transparency	Select the No Transparency option to disable the object or texture's opacity. Applying No Transparency results in a fully opaque object. The Opacity Multiplier is not activated with this selection.
Accurate Transparency	Select the Accurate Transparency option to calculate the transparency of the object or texture's opacity using a more accurate, but slower algorithm. Accurate Transparency is intended for objects that are only slightly transparent.Use the Opacity slider to boost the amount of accurate transparency. Low values may show layering problems.
Translucent	Select the Translucent option to calculate the transparency of the object or texture's opacity using a less accurate but faster algorithm. Use Translucent for very transpar-

Transparency type	Effect
	ent objects. Use the Opacity slider to boost or reduce the amount of transparency. A value of 0% makes the shaded object invisible.
Matte	Select the Matte option to use the quickest method of applying transparency. Use the Matte option for objects with textures that have an Alpha matte. The Opacity Multiplier functions differently for the Matte setting. Changing the percentage boosts or diminishes the matte, changing which Alpha channel values are included in the matte. This creates a thinning or thickening effect on the matte.
2D Transparency	Select the 2D Transparency option to apply transparency to the visible surface of the object. When an object has 2D Transparency applied to it, solid objects are visible while partially transparent objects are not. Use the Opacity slider to increase the amount of 2D transparency.
Additive Transparency	Select the Additive Transparency option to apply transparency to the whole object. This option incrementally increases the color value of the object. Use the Opacity slider to change the object's level of transparency. A value of 0% makes the object completely transparent.
Translucent (Models Z Sort)	Select the Translucent (Models Z Sort) option for more accurate effects whenever you have objects in front of one another using transparency. This Transparency type is the only one that sorts models according to their distance from the camera. In cases where the models are very close to each other or overlapping, the algorithm may

Transparency type	Effect
	not be able to determine which model is in front.

- Making an object transparent on page 602

Applying the Multilevel Cartoon shader

To apply a Multilevel Cartoon shader:

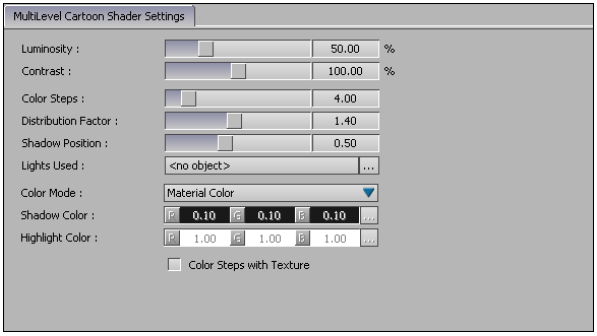
1. Drag the Multilevel Cartoon shader from the Asset browser and drop it on a model in the Viewer window.
2. Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
3. Adjust the shader's color mode, color steps and shadow settings to suit your needs.

- Flat shader settings on page 603
- Multilevel Cartoon shader settings on page 608
- Edge Cartoon shader settings on page 612

Multilevel Cartoon shader settings

The Multilevel Cartoon shader lets you apply a posterized effect with full control over the luminosity, contrast, and number of steps in the gradient between the shadow and highlight colors.

You can also control the colors used by the gradient, the placement of the shadow color, and the distribution of the steps in the gradient.



Multilevel Cartoon shader settings

TIP To take full advantage of the Multilevel Cartoon shader, you should add at least one light to the scene.

Luminosity and Contrast sliders

When reflecting light, the Luminosity and Contrast sliders change the brightness and contrast of the object. Luminosity changes the overall brightness, including contrast.

A value of 0% changes the material to pure black. A value of 100% uses the same material color as the object. A value of 300% changes the material to pure white.

Color Steps slider

The Color Steps slider lets you select the number of steps in the gradient used to create a transition between the Shadow and Highlight colors. A high Color Step produces a smooth transition.

A high Color Step and high Distribution Factor produces an anti-aliased edge effect.

A low Color Step produces a coarse, posterized effect.

A low Color Step and low Distribution Factor produces an obvious posterized effect.

Distribution Factor slider

The Distribution Factor slider lets you adjust how the gradient is distributed between the Shadow and Highlight colors. A low factor results in a wide distribution where the number of gradients between colors increases. A high factor results in a thin distribution.

For example, if you set both the Color Step and Distribution Factor to high, you can produce an anti-aliased effect with strange color edges.

Shadow Position slider

The Shadow Position slider changes the depth of shadow by changing the gradient when the shadow color begins. This gives the effect of the shadow moving or changing position on the object.

Lights Used field

The Lights Used field lets you select the lights that work with the Multi-Level cartoon shader. Alt-drag any lights in your scene into the Lights Used field. You can also click the Lights Used button next to the field to display the Asset list, where you can choose from the lights in your scene.

Color Mode option

Use the Color Mode option to select the colors or materials for the Multilevel Cartoon shader. The Shadow and Highlight colors are only available when Custom Color is selected.

Material Color settings

Bases the Shadow and Highlight color on the Diffuse and Ambient colors set in the Material settings. Use the Luminosity slider to adjust the material's brightness.

Custom Color option

Lets you specify your own color for the shadow and highlight color. To select colors, use the RGB color fields.

Shadow and Highlight Color field

The Shadow and Highlight Color field lets you adjust the color of the shaded areas of your model and the color of the non-shaded areas of your model, respectively.

Applying the Edge Cartoon shader

To apply the Edge Cartoon shader:

1. Drag the Edge Cartoon shader from the Asset browser and drop it on a model in the Viewer window.
2. Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.

3 In the Edge Cartoon shader settings, select a color and width for the outline, and choose on which edges you want the effect to display.

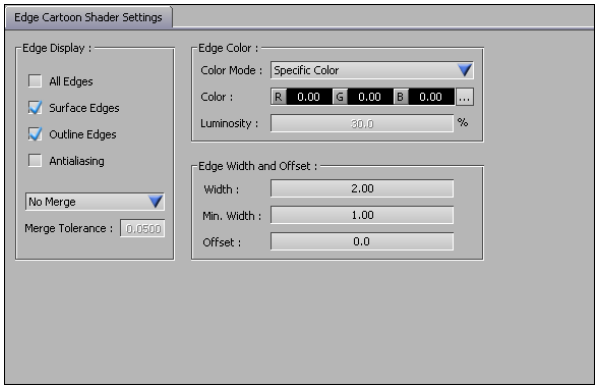
See also the Mesh Tessellation preference settings in the Shading preferences on page 159, for information on tessellation and the Edge Cartoon shader.

Edge Cartoon shader settings

Use the Edge Cartoon shader to draw a cartoon edge around your objects. For best results, append the Edge Cartoon shader over a Lighted shader, Flat shader, or Multilevel Cartoon shader.

The Edge Cartoon shader settings are in three areas:

- Edge Display area on page 612
- Edge Color area on page 615
- Edge Width and Offset area on page 616



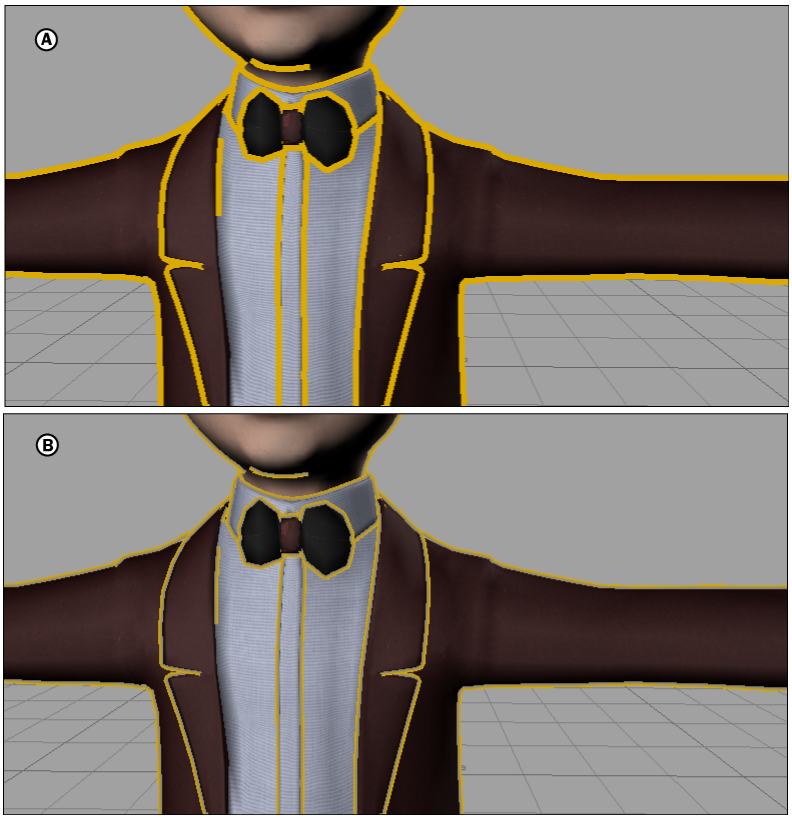
- Mesh Tessellation in Shading preferences on page 159

Edge Display area

The Edge Display area lets you activate the type of edge settings used with the selected model.

Activate options in the Edge Display area to choose edges that you want to draw from the list of buttons in the Display Edges area. You can have more than one edge selected at a time.

Edge type	Effect
All Edges	Shows all edges, including polygon edges. Use this edge to see each polygon or combine it with other shaders for special effects.
Surface Edges	Show the edges of the object.
Outline Edges	Activate Outline Edges to draw an edge around the object where it curves away from the camera. If the object rotates, the edge changes with the curvature.
Antialiasing	Activate Antialiasing to add an anti-aliased edge to the selected edges. For example, the following graphic shows the difference between the edges drawn without Anti-aliasing, and with Antialiasing activated. For both objects, the line width is set to 4.0, and the Edge Cartoon shader is appended over a Flat shader. The Antialiasing option uses the material color of the object or the custom material you applied in the Materials settings. If you apply a Flat shader with the Edge Cartoon shader, make sure the Flat shader is set to Material Color.



Anti-aliasing *A.* **Without anti-aliasing.** *B.* **Anti-aliasing is activated.**

Merge Field

Use the Merge field menu to merge planes together before drawing the selected edge. Merging depends on how you created the selected object before loading it into MotionBuilder.

For example, in the preceding graphic, A shows a cube without any intersecting planes since different vertices are used for each edge. The top and side planes are not connected, so no edge is drawn when Outline Edges is the only selected edge.

In the preceding figure B, merging is set to Merge in Model, which detects that the cube's three planes use the same point, even if the object says they are three different points. The outline of the cube is now drawn correctly.

There are three merging options:

Merge Option	Effect
No Merge	Disables merging.
Merge in Model	Tries to find vertices at the same location as the shaded objects.
Merge All	Takes all objects with the Edge Cartoon shader and tries to find vertices at the same location between all objects. This means that when two objects overlap each other, they are drawn with the same edge.

Merge Tolerance

Enter a value in the Merge Tolerance field to find the maximum distance between vertices where surface merge.

Edge Color area

Use the options in the Edge Color area to select and set the color and material options for a selected edge.

Color Mode

Use the Color Mode menu to select either the object's material or a custom color. Select the Custom Color option to specify your own edge color using the RGB Color fields. Select the Material Color option to base the edge color on the Diffuse and Ambient colors set in the Material settings.

Color

Use the Color settings to change the color of the edge. The Color field is only available when Custom Color is selected in the Source field.

Luminosity

Enter a value in the Luminosity field to change the brightness of the edge.

NOTE The Luminosity setting is only available when Material Color is selected in the Color Mode menu.

Edge Width and Offset area

The Edge Width and Offset area governs the overall appearance of edges used by the Edge Cartoon shader.

Width and Min. Width

Enter a value in the Width field to set the width of the edge. If you increase the width, the object's edge thickens.

The Min. Width field lets you specify the minimum edge width to be drawn when the camera zooms out from the object. As the camera moves away from the object, its edge is drawn using an increasingly smaller width. If you do not want the edge to become less than a specific width, specify the minimum width in the Min. Width field.

You can also use the Min. Width field to provide a constant edge. For example, if you draw an object using a Width of 0 and a Min. Width of 3, the object's edge always has a width of 3 units, regardless of the camera's position.

Offset

Enter a value in the Offset field to offset the edge according to the camera view. If you increase the offset, the edge is drawn closer to the camera and over the object.

You may need to specify an offset if a character is comprised of two or more objects that do not fit together perfectly, and the edge of one object is drawn behind another object.

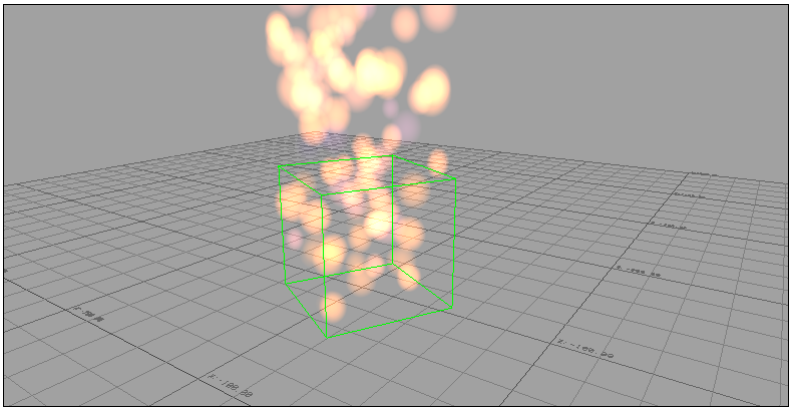
For example, if the arm of a character is built from different objects, the shoulder may occasionally be drawn over the arm when the arm moves. This might not become apparent until a Cartoon shader is added.

Environmental effects

37

Use the Particle shader to apply a particle generator to objects for creating environmental effects such as fog, rain, and fire.

After you apply or append the Particle shader to an object, you can change the shader's settings. The Particle shader updates in real time, which lets you fine-tune the particle settings while watching how it affects your objects. An example of a Particle shader applied to a cube is shown in the following image.



Cube with Particle shader applied.

When you apply a texture to an object with a Particle shader, the texture is applied to both the object and the particles. If the texture has an alpha channel, you can create interesting effects, such as snowflakes or petals for example. See Textures on page 549.

The Particle shader settings are divided into three panes:

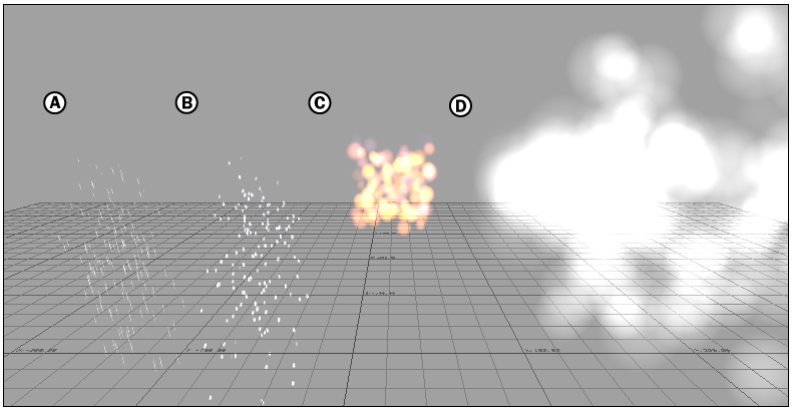
- Particle Physics pane settings on page 620
- Particle Shading pane settings on page 625

■ Global Controls pane settings on page 629

■ Increasing the size, quantity, and color of particles on page 619

Creating environmental effects with shaders

Shaders can be applied to objects to create environmental effects like fire, fog, snow, and rain.



A. **Rain** *B.* **Snow** *C.* **Fire Ball** *D.* **Cloud**

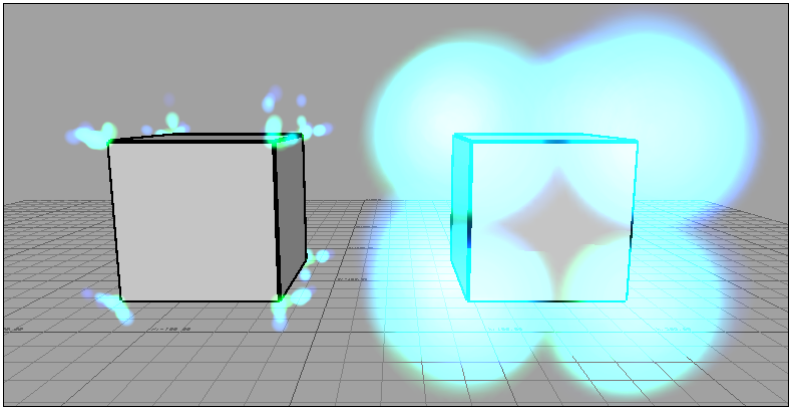
To create environmental effects:

1. Drag a cube into the Viewer window and resize it so that it is the size of the environmental effect you want to create. Do not worry, it will cover your scene, but the application of the shader makes it invisible.
2. Drag a particle shader from the Asset browser onto the cube and select Replace All from the menu that appears.
3. In the Particle shader settings, select Scaling Volume from the Emit From menu in the Particle Physics pane.
4. In the Particle shader settings' Global Controls pane, select Rain, Snow, Fireball, or Cloud from the Preset menu.
5. Adjust the speed and scale with the appropriate sliders.

Increasing the size, quantity, and color of particles

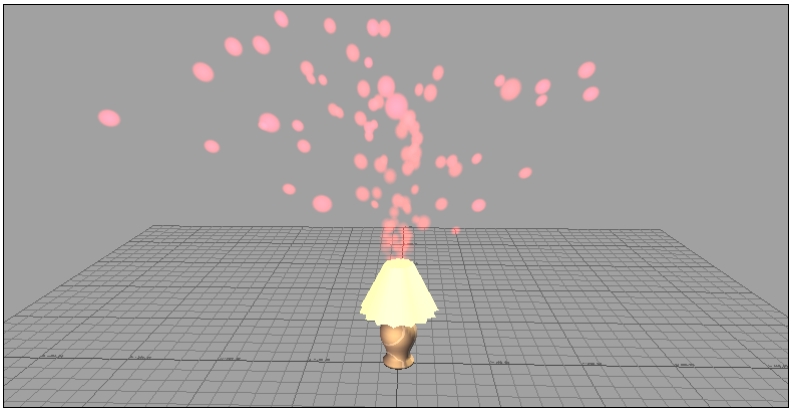
To increase the size, quantity, and color of particles:

1. Select the particle shader in the Scene browser.
2. In the shader's Particle Physics pane, drag in or type a value in the Quantity field to increase the amount of particles emitted by the shader.
3. To increase the size of each particle, go to the Size slider in the shader's Particle Physics pane. and move the slider to the right.



Use the Size slider to affect the size of the particles used by the shader.

4. In the shader's Particle Shading pane, drag in or type a value in the R, G, and B In Color fields to set the color that particles are originally created.
5. The extra value next to the In Color field lets you influence the transparency of the In Color, with 0.0 being invisible and 100.00 being solid.
6. In the shader's Particle Shading pane, drag in or type a value in the Out Color field to set the color that particles end up as they fade away
7. The extra value next to the Out Color fields lets you influence the transparency of the Out Color, with 0.0 being invisible and 100.00 being solid.
8. Use the Life Time settings in the Particle Physics pane to determine how long a particle lasts before changing color and then fading out.



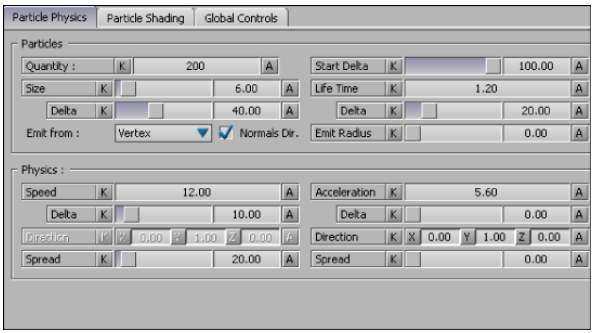
The Life Time setting affects how long a particle lasts.

■ Using the Color window on page 6

Particle Physics pane settings

The Particle Physics pane in the Shader settings lets you customize the size, speed, direction and duration (known as “Life Time”) of the particles used in the Particle shader. It is divided into the Particles area and the Physics area.

NOTE You can key and animate these settings to create dynamic environmental effects.



Particle shader: Particle Physics pane

Particles area

The Particles area governs the actual particles to be used in the shader, and the Physics area which governs the behavior of the particles used in the shader and are divided into the Speed and Acceleration columns.

Quantity

Double-click the Quantity field to enter the specific number of particles you want to appear.

Size

Use the Size slider to increase or decrease the size (in MotionBuilder units, like the grid) of each particle.

Size Delta

Use the Size Delta slider to set the percentage of the size that is allowed beyond the Size settings. The Size field determines the minimum value. For example, if Size is set to 10 and Size Delta is 20%, the particles range from 10 to 12.

Emit From

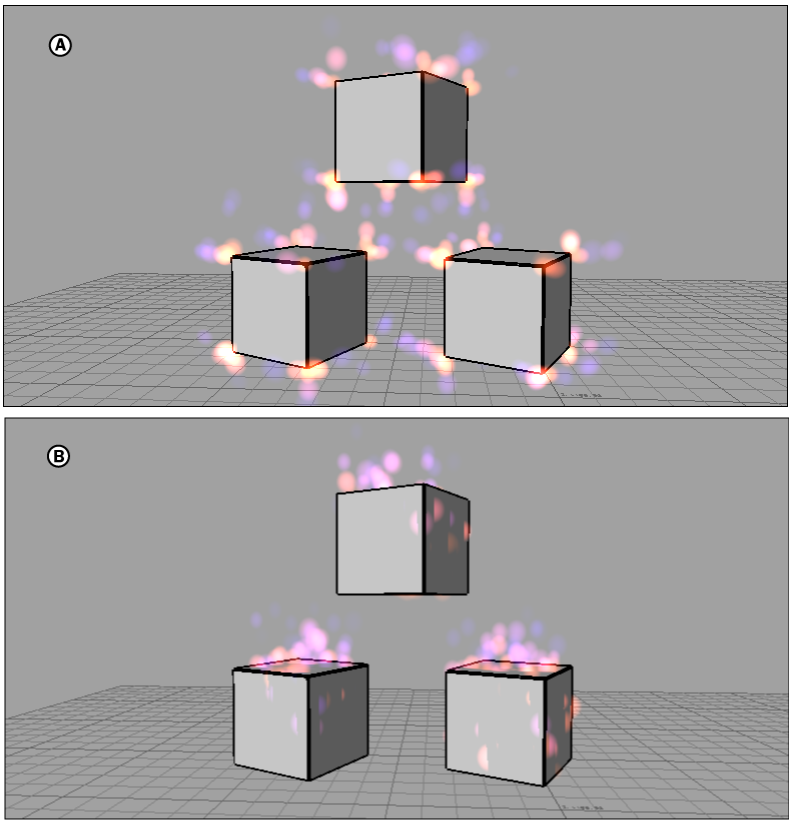
Use the Emit From menu to select from two particle display options:

Vertex

Emits particles from the model's vertices.

Scaling Volume

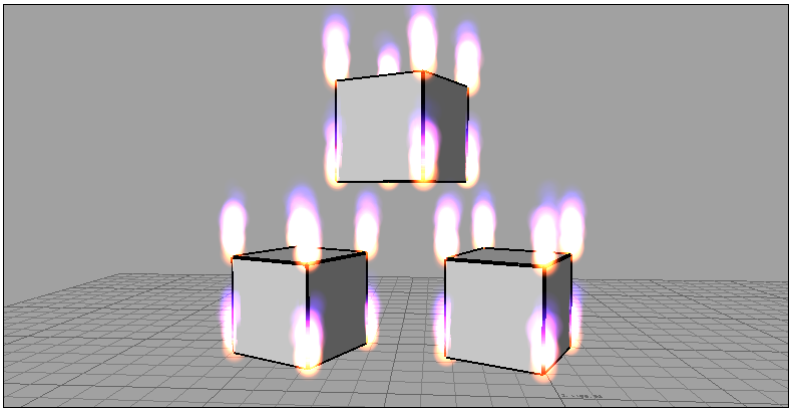
Emits particles from the model's scaling volume



Emit From menu options *A.* **Particles emitted from vertices** *B.* **Particles emitted from Scaling Volume**

Normals Dir

Deactivate the Normals Direction option if you do not want particles emitted along the object's normals.



Normals Direction disabled

Start Delta

Use the Start Delta slider to choose a creation delta of the particles. A value of 0 percent means that all particles are created at the same time. A value of 100 percent distributes the creation of particles evenly over the Life Time.

Life Time

Double-click the Life Time field to enter the length of time (in seconds) you want each particle to exist.

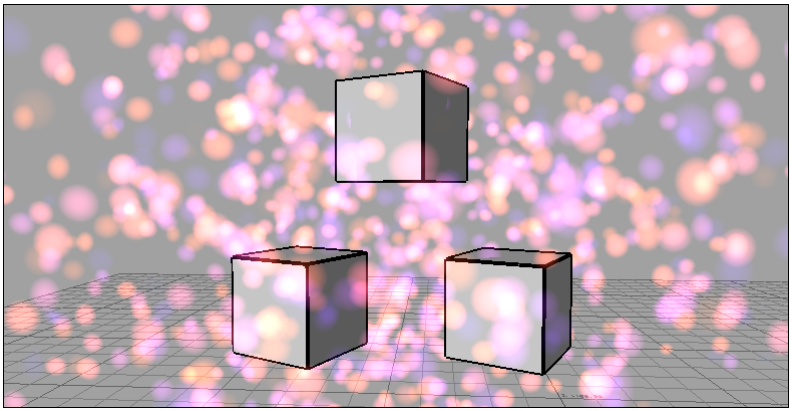
Life Time Delta

Use the Life Time Delta slider to set the percentage of the duration allowed beyond the Life Time settings, with the Life Time field determining the minimum value.

For example, if Life Time is set to 1.2 and Life Time Delta is 50%, the Life Time ranges from 1.2 to 1.8.

Emit Radius

Use the Emit Radius slider to increase or decrease the radius of emission around a source.



Emit Radius value set to 100%.

Speed

Double-click the Speed field to set the speed at which particles initially travel. The higher the value, the faster the particles travel, and the further they can get in the designated lifetime. For example a value of 2 in the Speed field plays your particles twice as fast. Therefore, the distance particles travel increases. Speed coordinates are local values.

Unlike the Play Speed slider in the Global Controls pane, this setting influences distance as well as speed.

Speed Delta

Use the Speed Delta slider to set a percentage of the speed that is allowed beyond the Speed settings. The Speed field determines the minimum value. For example, if Speed is set to 12 and Speed Delta is set to 75%, the speed ranges from 12 to 21.

Direction

Set an X, Y, and Z coordinate in the Direction settings to represent the initial direction that particles travel. This direction may be altered by Speed Spread and Acceleration Direction.

Spread

Use the Spread slider to set a range of the initial direction that individual particles travel. Speed Direction determines the center point for this range. This range is measured in degrees.

Acceleration

Double-click the Acceleration field to enter a constant acceleration to be applied to particles after their creation. A higher Acceleration value changes the Speed Direction to the Acceleration Direction more quickly. Acceleration coordinates are global values.

Acceleration Delta

Use the Acceleration Delta slider to set a percentage of the acceleration that is allowed beyond the Acceleration settings. The Acceleration field determines the minimum value. For example, if Acceleration is set to 6 and Acceleration Delta is set to 60%, the acceleration ranges from 6 to 9.6.

Direction

Set an X, Y, and Z coordinate in the Direction settings to represent the direction that particles travels after the initial Speed Direction based on the Acceleration rate. A higher Acceleration setting causes the Acceleration Direction to come into effect faster. If the Life Time value is low, you may not be able to see this change.

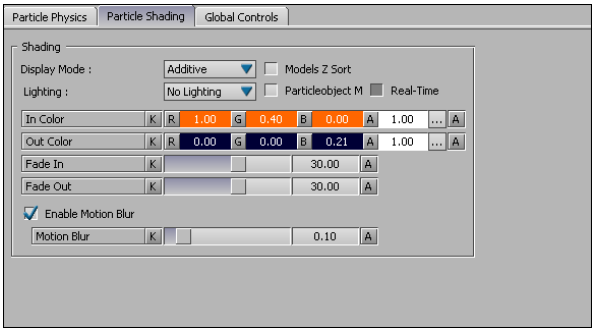
Spread

Use the Spread slider to set a range of direction that individual particles travel based on the Acceleration Direction. Acceleration Direction determines the center point for this range. This range is measured in degrees.

- Increasing the size, quantity, and color of particles on page 619
- Creating environmental effects with shaders on page 618

Particle Shading pane settings

The Particle Shading pane in the Shader settings lets you customize the visual appearance of the particles used in the Particle shader, such as lighting, color and motion blur.



Particle Shading pane

NOTE If you use an NVidia video card, be aware that a driver conflict causes problems with Particle shader display. This occurs especially in cases where the Particle Quantity is set to a value greater than 1000.

Display mode menu

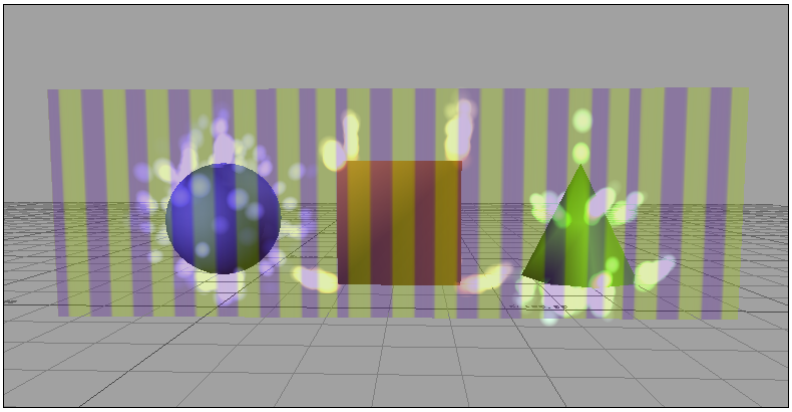
Use the Display mode menu to set the way particles are shown in the Viewer window.

Display mode	Effect
Additive	Displays particles in additive transparency mode.
Matte	Displays particles in the opaque matte mode.
Translucent	Displays particles in translucent mode.

Models Z Sort option

Activate Models Z Sort when you want to show particles behind other transparent models. Models Z Sort redraws the particles so that they appear behind transparent or translucent objects when in Additive or Translucent Display mode.

The Models Z Sort option sorts models by bounding volume and then draws each model from back to front.



Activate Models Z Sort to show particles behind transparent models.

TIP For best results, the bounding volume of a model should not intersect other bounding volumes. Also, the Models Z Sort option works best with simple geometry and polygon culling, if your geometry is constructed with consistent polygon orientation (all polygons should be constructed either clockwise or counter-clockwise). Polygons with opposing orientation are clearly shown as artifacts when attempting transparency.

Polygon culling is specified for each model in the Shader manager. See Flat Shader transparency types on page 606 for a description of transparencies you can use on your models.

Particle Object M option

When using Models Z Sort, activate this setting so that each particle is sorted individually, creating a more realistic particle effect.

Real Time option

Activate this option to view the sorting effects of the Models Z Sort and Particle Object M options in real time. If this option is disabled, the Models Z Sort and Particle Object M effects are only used when rendering.

NOTE Due to the complex particle solving that these three Z-Sorting options present, activating the Real Time option causes processing speed delays.

Lighting menu

The Lighting menu lets you select a method to light the particles.

Lighting method	Description
No Lighting	The Particles are not lit. This is the default setting. **TIP** This method renders particles more quickly.
Simple Lighting	Performs a rough calculation of lighting: 1 normal is used per particle. In this method, the normals always face the camera. **TIP** This method renders particles more quickly than the Smooth Lighting selection.
Smooth Lighting	Performs a more advanced calculation of lighting to create a smooth effect: 5 Normals are used per particle. In this method, Normals surround the particle to create a more realistic effect. **NOTE** This method is slower than the Simple Lighting selection.

In Color settings

Use the In Color settings to set the color applied to particles at the beginning (In point) of their life time.

Out Color settings

Use the Out Color settings to set the color applied to particles at the end (Out point) of their life time.

Fade In slider

Use the Fade In slider to set a percentage of the particle's life time that is used to fade in the particle.

Fade Out slider

Use the Fade Out slider to set the percentage of the particle's life time that is used to fade the particle out.

Enable Motion Blur option

Activate the Enable Motion Blur option when you want the particles to have a blur applied to them to imply motion. The higher the value, the more particles deformed.

Motion Blur slider

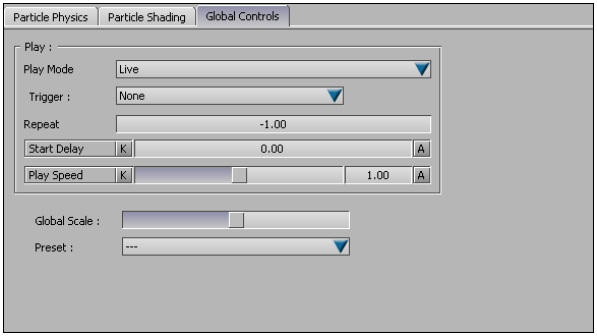
Use the Motion Blur slider to set the blur amount for the particle as it travels, creating a stretching effect. Values range from 0.00 to 1.00.

You can animate the Motion Blur setting.

- Increasing the size, quantity, and color of particles on page 619
- Global Controls pane settings on page 629
- Creating environmental effects with shaders on page 618

Global Controls pane settings

The Global Controls pane in the shader settings lets you control the activity of the particles used in the Particle shader, such as setting the playing speed, playing mode, and scaling.



Play Mode menu

Use the Play Mode menu to select a play mode for particle creation.

Option	Description
Live Mode	Select Live Mode to create particles in real time.

Option	Description
Play Time	Select Play Time to create particles when the Play button in the Global Controls is clicked. To view changes while in Play Time mode, you must play the take.

Trigger menu

Use the Trigger menu to select a trigger created in the Trigger settings. This lets you control particles with a keyboard or joystick. If no keyboard or joystick has been added to the Trigger settings, you can only select None.

Option	Description
None	Select None if you do not want to use triggers for your Particle shader. You can create a refresh trigger to restart your particles from the beginning of their life.
Activate	Select Activate in the Trigger Type field in the Keyboard pane of the Trigger settings, and give the trigger a descriptive name. Activate restarts your Particle shader when you press the appropriate keyboard key.

Repeat field

Double-click the Repeat field to enter the number of times you want each particle created. The default value -1 creates each particle in a continuous loop. A value of 2 means that each particle is created twice and a value of 3 repeats the particle emanation three times.

Start Delay slider

Use the Start Delay slider to set a value for the Delay (in seconds) before particles are created.

Play Speed slider

Use the Play Speed slider to set a multiplication factor of the speed at which particles are created.

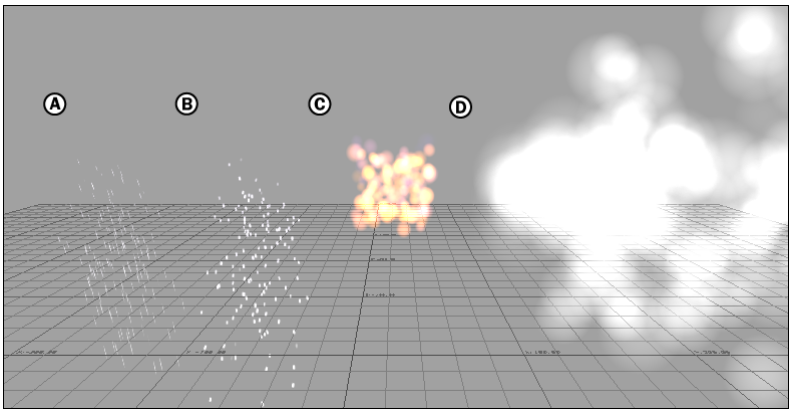
A Play Speed of less than 0.00 freezes the particles. Play Speed differs from the Speed field because it does not alter the distance or direction travelled.

Global Scale slider

Use the Global Scale slider to scale all particle values including size, speed, acceleration, and so on at the same time.

Preset menu

Use the Preset menu to select one of four preset particle options:



Global Presets *A.* **Rain** *B.* **Snow** *C.* **Fire Ball** *D.* **Cloud**

- Rain
- Snow
- Fire Ball
- Cloud

NOTE You can animate the Start Delay, Play Speed, and Global Scale settings.

- Increasing the size, quantity, and color of particles on page 619
- Particle Shading pane settings on page 625
- Creating environmental effects with shaders on page 618

Reflection effects

38

Use the Reflection shader to produce reflections from object to scene, scene to object, and object to object.

Live Planar Reflection shader effect

When a Reflection shader is appended to an object, a map or live reflection plane is generated. Sphere or Spherical reflections are mapped, and Live Planar or Live Planar On Video reflections are generated in real time.

A new map should be generated whenever you want to save adjustments made to the Reflection settings of a selected object.

Reflection types

You can choose from four types of reflections in the Reflection Type menu:

- Live Planar Reflection option on page 634

- Live Planar Reflection on Video option on page 634
- Sphere Map option on page 634
- Spherical Map option on page 634

Live Planar Reflection option

Causes a plane to reflect moving objects. For example, a floor reflects a character that is walking across it.

Live Planar Reflection on Video option

Causes a plane to reflect moving objects when a video is applied to the camera background. The plane is transparent except for the reflections, so 3D objects appear to be reflected in the video.

You must Apply (not Append) all Reflection shaders that use Live Planar Reflection On Video.

Also, your background color must be black for the effect to be realistic.

Sphere Map option

Creates a flat map (texture) that causes a 3D object to reflect the contents of its scene from only one point of view, that is, the reflection is frozen and does not change when filmed by a moving camera.

Sphere Map uses Open GL acceleration.

See Texture settings on page 575.

Spherical Map option

Creates a flat map (texture) that causes a 3D object to reflect the contents of its scene. Unlike the Sphere map, it can be viewed omnidirectionally. A camera can move around the object and still show the reflection.

See Texture settings on page 575.

See also:

- Making objects reflective on page 635
- Choosing texture types on page 557

Making objects reflective

To make objects reflective:

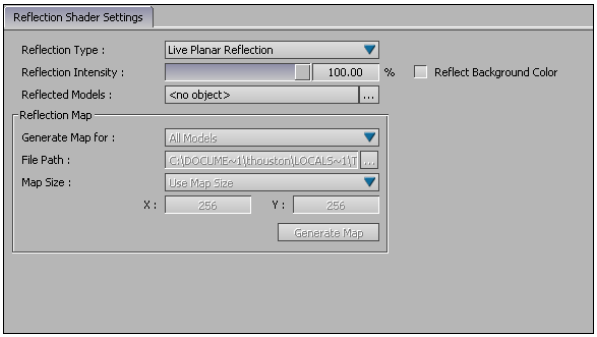
1. Drag the Reflection shader from the Asset browser and drop it on a model in the Viewer window.
2. Select Append to maintain the object's original Global Lighting textures and any other applied shaders.
3. Expand the Reflection Type menu in the Reflection shader settings and select the appropriate reflection type from the menu. See Reflection types on page 633.
4. If you select a map shader, adjust the intensity slider and click generate.
5. If you want, you can drag a Material asset onto the object you want to make reflective from the Asset browser and adjust the Reflectivity, Specularity, and Shininess properties. See Material settings on page 540 for more on Materials.

See also:

- Reflection shader settings on page 635
- Shading preferences on page 159

Reflection shader settings

The Reflection shader lets you append a regular reflection to any model, or a live reflection to any planar surface in your scene.



Reflection shader settings

Once you apply a Reflection shader to a selected object or plane, you can adjust its various settings. Use these settings to specify map size, reflection intensity, and so on.

Reflection type menu

You can choose from four types of reflections in the Reflection Type menu:

- Live Planar Reflection option on page 634
- Live Planar Reflection on Video option on page 634
- Sphere Map option on page 634
- Spherical Map option on page 634

See Reflection types on page 633 for information about each Reflection type.

NOTE You cannot generate a reflection map unless the Save Map Path is valid.

Reflection shader texture settings

When you choose Spherical Map or Sphere Map as a Reflection shader type, a texture is generated to project the reflection map. You can manipulate this texture and its appearance in the Navigator window. See Texture settings on page 575.

Option	Description
Reflection Intensity	The Reflection Intensity slider lets you change the level of reflection for a selected object or plane. The Reflection Intensity can be modified in a generated map. The default intensity is 100%.
Reflect Background Color	Activate Reflect Background Color to match the reflection color in the selected plane or object with the background color.Reflect Background Color is not available for Live Planar Reflection On Video.This option is only available for Live Planar Reflection and Live Planar Reflection On Video reflection types.

Reflected Models field

Alt-drag any models in your scene that you want to use with the Reflection shader into the Reflected Models field. You can also click the Reflected Models button next to the field to display the Asset list, where you can choose from the models used in your scene.

The Models Casting Reflections area lists all the objects in your scene that cast reflections. If you want several object to cast reflections on a plane that uses the Reflection shader, select and *Alt*-drag each object into this list, or keep the default All option. If the All value is in the list, all objects in your scene cast reflections.

Option	Description
Add All	Adds all objects in the scene to the Models Casting Reflections list.
Remove	Removes a selected object from the Models Casting Reflections list.
Remove All	Removes all objects from the Models Casting Reflections list.

Reflection Map area

The reflection map area is only active when you select Spherical Map or Sphere Map from the Reflection Type menu.

These settings let you control the creation of a reflection as a static map or texture. This map can also be controlled using the Texture settings in the Navigator. See Texture settings on page 575.

Setting	Description
Generate Map For	The Generate Map For menu lets you select which objects are included in the Reflection shader's map texture. Choose either All Models or select particular models you want to appear and choose Selected Shaded Models.
File Path	The File Path specifies the location of the file and saves the generated map to disk

Setting	Description
	as a texture file. The default path is *C:\temp*.
Map Size	Use the Map Size menu to choose the size (in pixels) of the generated map. The default size is 256 x 256. This option is only available with the Spherical Map and Sphere Map.There is a higher resolution, a longer generation waiting period, and a greater memory requirement with a larger map size.
X and Y	The X and Y menus let you choose the size (in pixels) of the generated map. The default is 128 by 128.There is a higher resolution, a longer generation waiting period, and a greater memory requirement with a larger map size. For more information, see Choosing a mapping method on page 567..

Generate Map option

Click Generate Map to create a map for all objects with the Reflection shader applied. Choose whether you want to generate a map for All Models or only the Selected Shaded Models in your scene. You must have a valid Save Map Path before you can generate a map.

See also:

- Making objects reflective on page 635
- Materials and surface consistency on page 533

Surface effects

39

Some shaders create effects that appear to alter the surface of your objects. They give the illusion of texture without actually changing your models, such as the Bump Map, Matte, Faceted, and Wireframe shaders.

NOTE The Normal map shader is in the Shadows and Lighting topic. See Normal Map shader on page 672 for more information.

This sub-section covers those shaders, their settings, and how you can configure them to give your models more depth and realism.

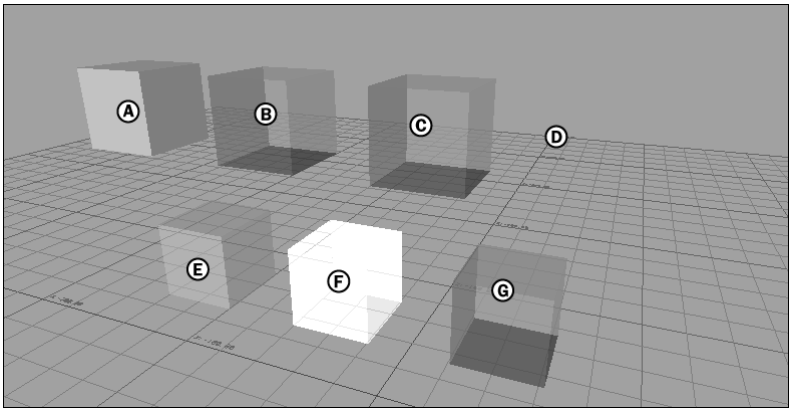
Creating transparent objects

You can use the Flat shader to create models that are partially visible.

To create transparent objects:

1. Drag the Flat shader from the Asset browser and drop it on a model in the Viewer window.
2. Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
3. In the Flat shader settings, select one of the following types from the Transparency type menu.

   For a description of the different effects caused by the Transparency types see Shader transparency types on page 665.



A. **No Transparency** *B.* **Accurate Transparency** *C.* **Translucent** *D.* **Matte (set to 1.00)** *E.* **2D Transparency** *F.* **Additive Transparency** *G.* **Translucent Models Z sort**

See also:

- Creating transparent objects on page 639
- Shader transparency types on page 665

Creating a Bump Map

Use bump mapping to create the appearance of detailed relief on a model with simple geometry. Make sure that there are lights in your scene or the Bump Map shader will not work.

To create a Bump Map:

1. Drag a Texture asset from the Shading Elements folder in the Asset browser, and drop it onto your model.
2. Select Attach Texture To Material > Bump Map from the contextual menu that appears. You can also choose the Normal Map option.

   If there was no material applied to the model, a new material is created. The new texture is attached to the materials' Bump Map or Normal Map property, depending on which option you selected. You can access these properties in the Material settings. See Materials on page 531.
3. In the Navigator, expand the Textures folder and double-click the new texture to display the Texture settings.

4 In the Texture settings's Media menu, select New Media and browse for your bump map or normal map image file.

5 In the Asset browser, expand the Shading Elements > Shaders folder.

6 Drag a Bump Map shader from the Asset browser, and drop it onto your model in the Viewer.

7 Select Replace by Type from the contextual menu that appears.

8 If there is no light in the scene, add one. When you translate the light, the bump mapping is apparent and its lighting and shadows update in real time.

9 Use the Bump Map shader settings to adjust and fine-tune your bump effect.

- Adding color to Bump textures on page 641
- Texture settings on page 575

NOTE The Normal map shader is in the Shadows and Lighting topic. See Normal Map shader on page 672 for more information.

Adding color to Bump textures

You can increase the realism of a Bump Map texture by adding a second, colorized version of the bump map or normal map image and use it to color the model.

To add color to Bump textures:

1 Begin by creating a bump map effect on your model. See Creating a Bump Map on page 640.

2 Save a colored version of the bump map or normal map image file.

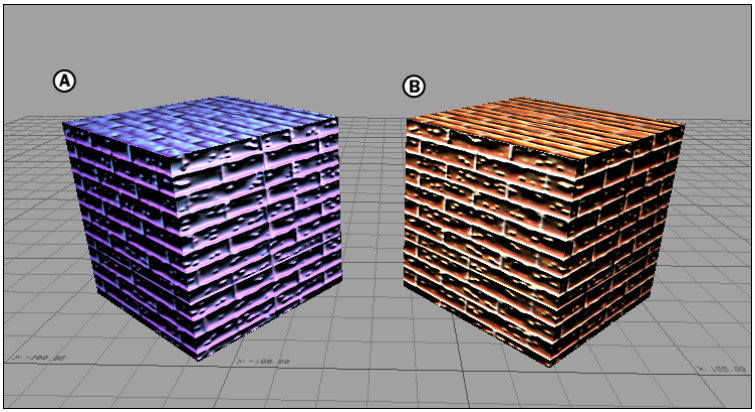
3 From the Shading Elements folder in the Asset browser, drag a Texture asset onto the model in the Viewer.

4 Select Attach Texture To Material > Diffuse from the contextual menu that appears.

The new texture is attached to the materials' Diffuse property. You can access these properties in the Material settings. See Materials on page 531.

5 In the Navigator, expand the Textures folder and double-click the new texture to display the Texture settings.

6 In the Texture settings's Media menu, select New Media and browse for the colored image.

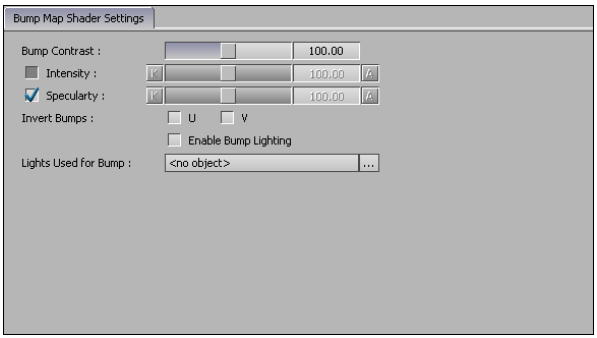


Bump Map shader *A.* **No color texture applied** *B.* **Color texture applied**

7 Ensure that the texture is positioned exactly as the Bump Map texture is positioned by comparing the U and V tiling, as well as the Translation, Rotation, and Scaling coordinates in the Texture setting.

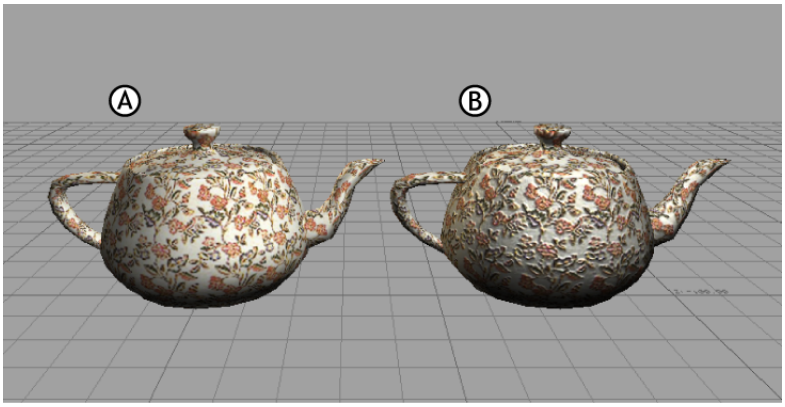
Bump Map shader settings

Use the Bump Map shader to create a three-dimensional texture effect on models from a normal map texture.



Bump Map shader settings

This lets you simulate roughness or smoothness, depending on how the texture reflects light, such as in the image below.



Bump Map shader *A.* **An object with no shader.** *B.* **The same object with the Bump Map shader.**

Use the Bump Map settings to create specularity effects and increase the contrast of the Bump Map texture.

The Bump Map shader works with either a black and white bump map texture or a normal map texture. These textures define the details for the shader. To associate a texture with a Bump map shader, see Creating a Bump Map on page 640.

The effect of the applied Bump Map shader texture is visible as soon as any lights are added to the scene. Otherwise, there is no effect in the Viewer window. When you translate the light, the bump mapping effect updates in real time.

NOTE Some sliders in the Bump Map shader settings require a video card capable of supporting 4 textures, such as the NVIDIA GeForce 3 (or higher). Otherwise some settings are disabled.

Bump Contrast

Use the Bump Contrast slider, or enter a value in the Bump Contrast field to adjust the level of contrast created by the Bump Map. Increasing the contrast creates a higher texture relief.

Intensity

Activate the Intensity option to apply the Bump Map's color concentration as a map for the shader. Use the Intensity slider to manipulate the dark areas of the texture created by the Bump Map, which creates a high relief effect. The default intensity is 100%. You can animate this setting.

NOTE Only one light is used to create the Bump Intensity effect. This is always the last light in the Lights Used For Bump list.

Specularity

Activate the Specularity option to apply the Bump Map's light reflection which define the Bump Map's light peaks.

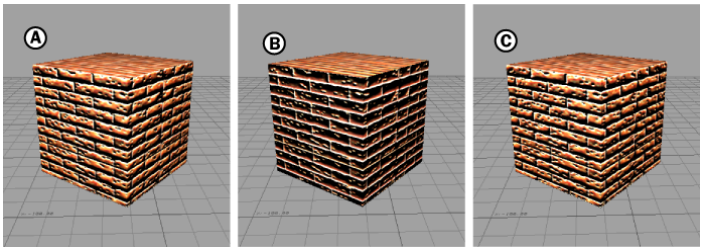
Use the Specularity slider to manipulate how the Bump Map reflects light peaks, to create matte or shiny effect. You can animate this setting.

Invert Bumps

Select either the U or V Invert Bumps option to choose which UV coordinate creates the Bump Map texture.

Choosing either U or V inverts the normals of the Bump Map in order to create the opposite texture effect. For example, raised textures appear lower and lower textures appear raised.

The U and V direction can be important if, for example, you were using a brick wall texture and you did not want the mortar to stand out beyond the brick surface.



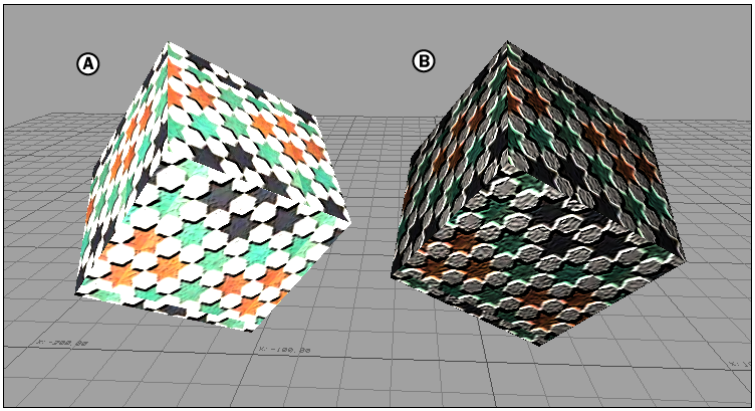
Invert Bumps *A.* **U is activated.** *B.* **V is activated.** *C.* **Both U and V activated.**

Activating both the U and V settings flattens the texture's appearance.

Enable Bump Lighting

Activate the Enable Bump Lighting option to use a more accurate per-pixel lighting effect on the bump texture, instead of vertex-based lighting. Using Enable Bump Lighting creates a dramatic contrast on the object.

The Enable Bump Lighting option uses only one light to create its effect.



Enable Bump Lighting option *A.* **Disabled** *B.* **Activated**

Lights Used for Bump

The Lights Used for Bump field lets you select the lights that produce Bump Map textures. *Alt*-drag any lights in your scene into the Lights Used for Bump field. You can also click the Lights Used for Bump button next to the field to display the asset list, where you can choose from the lights in your scene.

See also:

- Creating a Bump Map on page 640
- Choosing texture types on page 557
- Adding color to Bump textures on page 641

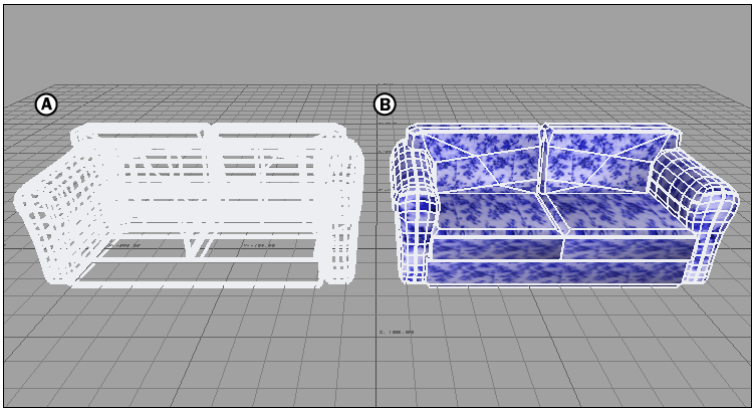
Drawing an object's wireframe

To draw an object's wireframe:

1 In the Asset browser, expand the Shading Elements > Shaders folder.

2 Drag the Wire Frame shader from the Shaders folder and drop it onto your model.

3 Select Replace by Type from the contextual menu that appears to completely hide the object and display only the wireframe, or select Append to show the object with the wireframe outline.



Wire Frame shader *A.* **Replaced Default shader on sofa** *B.* **Appended to sofa**

4 In the Wire Frame shader settings, set a the line width you want.

See also:

- Displaying a model's polygons on page 647

Wire Frame shader settings

Use the Wire Frame shader settings to draw objects using their wireframes.

Wire Frame shader settings

You can adjust the size of the wireframe using the Line Width field. The wireframe uses the material color from the Material settings.

The following example shows the effect of a Wire Frame shader appended over a Flat shader. The wireframe has a Line Width of 2.0.

A Wire Frame shader is appended to the jacket with a Line Width of 2.0.

Displaying a model's polygons

To display a model's polygons:

1. Drag the Faceted shader from the Shaders folder in the Asset browser, and drop it onto your model.
2. Select Replace by Type from the contextual menu that appears.

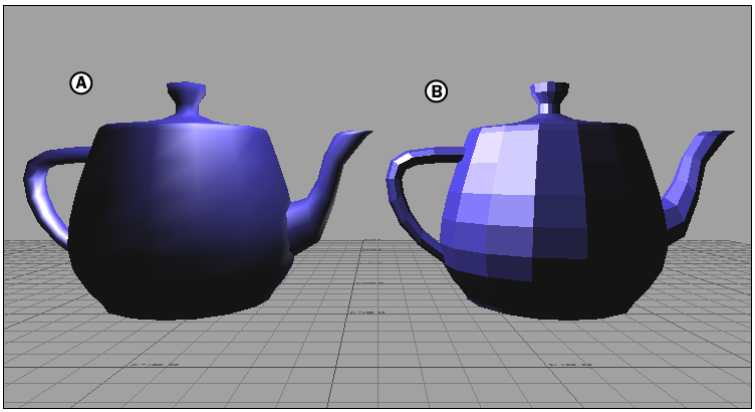
NOTE There are no controls for the Faceted shader; the polygons are drawn from the model.

See also:

- Faceted shader settings on page 648
- Drawing an object's wireframe on page 645

Faceted shader settings

The Faceted shader lets you display your model's original polygon shape.



Faceted shader *A.* **Without shader.** *B.* **Faceted shader applied.**

The Faceted shader has no options to adjust; it reads the polygons directly from the model.

Creating a 3D matte

Use the Matte shader with camera back plate textures or videos. See Setting a camera Front or Back Plane on page 447.

To create a 3D matte:

1. Drag the Matte shader from the Shaders folder in the Asset browser, and drop it onto your model.

2 Select Replace by Type from the contextual menu that appears.

3 In the Matte shader settings, select Highlight Matted Objects to surround the object with a faint outline if you are having trouble viewing the matted objects in your scene.

4 Activate Enable 3D Masking option to apply the 3D Matte shader to the selected object. When Enable 3D Masking is not active, the shader appears as a wireframe.

5 Activate Adjust Alpha to control the video Alpha channel sent either through your video option board or viewed in the Render window.

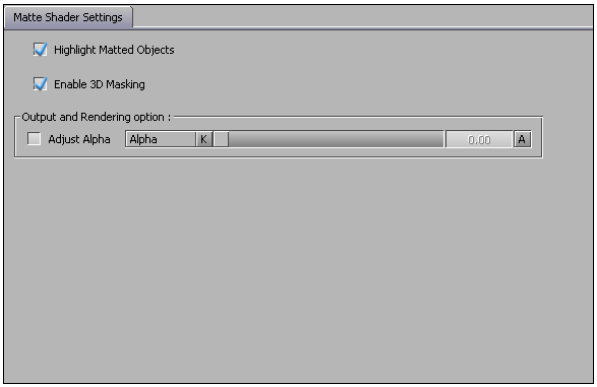
6 Use the Alpha slider to manipulate the transparency of the Alpha channel. This lets you, for example, make the output slightly transparent so you can pre-visualize characters interacting with live Actors.

See also:

- Matte shader settings on page 649

Matte shader settings

Use the Matte shader to create a 3D matte for a scene. When you apply the Matte shader to an object, the object turns into a colorless 3D matte.



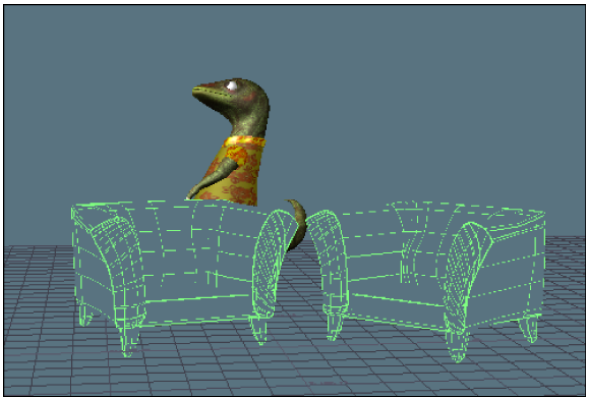
Matte shader settings

A 3D matte has depth, and is therefore respected by all other 3D objects in the scene. A 3D matte lets you block out parts of a scene to be replaced by video footage.

For example, the following figure shows the Matte shader applied to objects representing chairs and a film projector. This gives the illusion that the lizard character named Bill Gecko is walking behind the chairs and talent. The image of chairs and talent is a video applied to the current camera's back plate. See Setting a camera Front or Back Plane on page 447.

There are no objects representing the chairs. Bill Gecko walks in front of the video clip that is being broadcast on the back plane of the current camera.

In the following image, you can see how after the models of the chair are added to the scene, and then had the Matte shader applied to them. This creates them as matte objects. The video clip is not applied to the back plane of the current camera.



Models are added to the scene. The Matte shader is applied to the chairs, making them matte objects. The video clip is not applied to the back plane of the current camera.

In the next image, you can see the composite image, and how the gecko character interacts with the matted chair models, giving the impression that he has walked behind them.

The left chair obstructs Bill Gecko. Bill Gecko now appears to walk behind the chairs in the video clip as if they were 3D objects.

Highlight Matted Objects option

When you apply the Matte shader to an object, the object becomes invisible against the background of your screen. For example, you would not be able to see the objects in the preceding figure if there was not a wireframe outlining them.

Activate Highlight Matted Objects to make it easier to locate the objects in your scene.

Enable 3D Masking option

The Enable 3D Masking option allows the 3D Matte shader to be applied to the selected object. When Enable 3D Masking is not active, the shader appears as a wireframe.

Adjust Alpha option

The Adjust Alpha option lets you control the video Alpha channel sent either through your video option board or viewed in the Render window.

Activate Adjust Alpha to create an Alpha channel matte for the model shaded with the Matte shader.

Alpha slider

The Alpha slider lets you manipulate the transparency of the Alpha channel so you can, for example, make the output slightly transparent so you can pre-visualize characters interacting with live Actors.

Using Alpha Matte and its slider does not affect what displays in the Viewer window. To use this feature, you must render your scene using a 32-bit format (such as *.tiff*), or send your output through a video board that supports the Alpha channel.

Controlling a CgFX shader

You can control the CgFX shader using the CgFX shader properties in the CgFX shader settings.

These controls are read from the shader and only adjust the parameters that have been programmed with the shader.

NOTE Using Transparency and Alpha channels with the CgFX shader has limitations as there are some render problems whenever you use the Accurate Transparency and Z-Sort options with self-hiding or intersecting models.

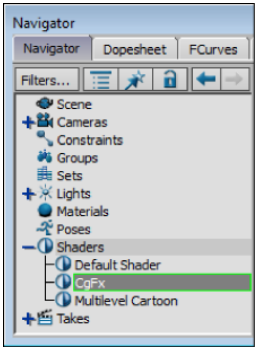
See also:

- CgFX shader settings on page 652
- Flat Shader transparency types on page 606
- Testing shaders, textures, and materials on page 566

CgFX shader settings

Use the CgFX shader settings to access controls specific to the CgFX shader you are using.

When you open an object with a CgFX shader in MotionBuilder, the CgFX shader appears with any other MotionBuilder shaders in the Asset and Scene browsers.



CgFX shaders display with MotionBuilder shaders in the Scene browser.

The CgFX shader settings are split into two parts, the Shader area, and the Shader properties.

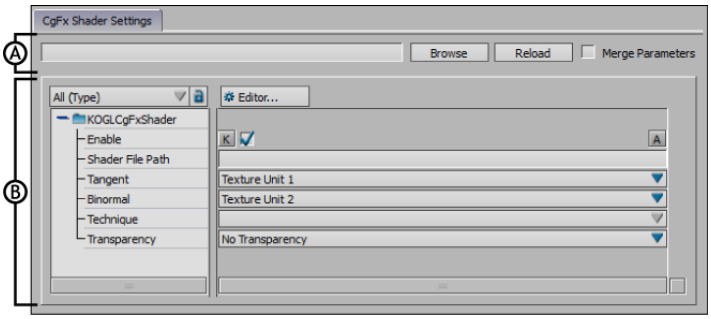
NOTE Use conversion utilities available from Nvidia to convert older .fx files to the .cgfx format. For more information about Cg and CgFX consult your Nvidia documentation.

Shader area

The Shader area displays the name of the *.fx* file in the Name field. Click Browse to open a file browser and locate an *.fx* file, then click Reload to refresh the CgFX shader's appearance.

When loading or reloading CgFX shaders, activate the Merge Parameters option to keep the shader's property settings and references to *.dds* files. Disable the option to clear these settings when you load or reload CgFX shaders.

NOTE When saving a file containing a CgFX shader, enabling the Embed Media option in the Save File dialog lets you embed *.cgfx* and *.dds* files in the *.fbx* file. When the file is reopened, the *.cgfx* and *.dds* files are extracted to an *.fbm* folder and the path in the CgFX shader settings updates to point to this *.fbm* folder.



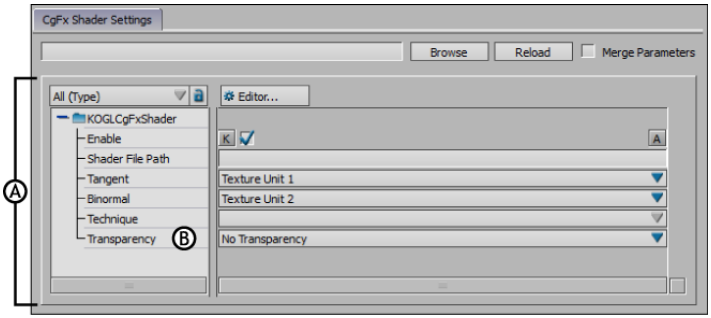
CgFX shader settings *A.* **Shader area** *B.* **Shader properties**

Shader properties

You can control the CgFX shader in the Shader properties. These controls are read from the shader and only adjust the parameters that have been programmed with the shader.

Transparency Type menu

The Transparency Type menu lets you select a method of calculating transparency, and set a percentage to boost or reduce the object's texture or material transparency. For a description of the transparency types you can select, see Shader transparency types on page 665.



CgFX shader settings *A.* **Shader properties** *B.* **Transparency Type menu**

NOTE Do not use the Transparency Type menu if your shader does not use transparency or alpha blending, as it slows down scene rendering.

Limitation

Using Transparency and Alpha channels with the CgFX shader has limitations as there are still some render problems when you use the Accurate Transparency and Z-Sort options with self-hiding or intersecting models.

Shadows and lighting effects

40

How models react to lighting is one of the keys to creating realistic scenes. This is done using the Shadow Map, Live Shadow, Selective Lighting, and Dynamic Lighting shaders.

The following sections cover those shaders, their settings, and how you can configure them to give your models more realism and drama.

Applying shadows to objects

There are two shaders you can add to models that will cause them to make shadows, the Live Shadow and Shadow Map shaders.

To apply the Live Shadow shader:

1. In the Asset browser, open Shading Elements > Shaders.
2. Drag the Live Shadow shader from the Asset browser and drop it on a model in the Viewer window.
3. Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.
4. Alt-drag any models in your scene that you want to cast shadows into the Models Casting Shadows field in the Live shader settings.

   You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from models used in your scene.
5. Adjust the other shader settings to suit your needs.

To apply the Shadow Map shader:

1. In the Asset browser, open Shading Elements > Shaders.
2. Drag the Shadow Map shader from the Asset browser and drop it on a model in the Viewer window.
3. Select Replace, Replace All, or Append to specify how the shader reacts to the other surfaces on your model.

   When you apply the Shadow Map shader, the selected object turns blue. Your object or plane is then ready for the Shadow Map shader.
4. Alt-drag any models in your scene that you want to cast shadows into the Models Casting Shadows field in the Live shader settings.

   You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from models used in your scene.
5. Click Generate Map in the shader settings. The shadow map is generated and is visible in the Viewer window.

   Generate a new map each time you want to save adjustments made to the Shadow Map shader settings.

To apply the Dynamic Lighting shader:

1. In the Asset browser, open Shading Elements > Shaders.
2. Drag the Dynamic Lighting shader from the Asset browser and drop it on a model in the Viewer window.
3. Select Replace All or Replace By Type to specify how the shader reacts to the other surfaces on your model.

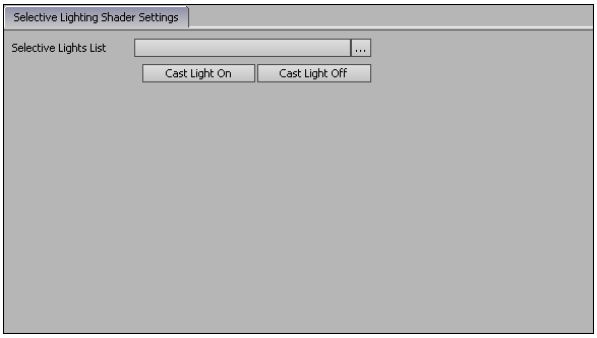
   NOTE If you select Append to apply the Dynamic Lighting shader when the Default shader is also applied to the model, you may see undesirable results, such as flickering. Select Replace By Type or Replace All when you apply the Dynamic Lighting shader to detach the Default shader.
4. In the Navigator, open the Light settings of the light affecting the object, then select Linear or Quadratic from the Attenuation menu.

- Live Shadow shader settings on page 660
- Mapped textures on page 550

■ Shadow Map shader settings on page 667

Selective Lighting shader settings

The Selective Lighting shader lets you specify which lights illuminate an object in your scene.



Selective Lighting shader settings

Since there is a maximum of eight lights available in any given MotionBuilder scene due to OpenGL limitations, you can use Selective Lighting shaders to add lights to the scene. For example, you can use Selective Lighting shaders to set up association between lights and objects to increase the number of lights in your scene to eight per object.

NOTE Do not append a Selective Lighting shader on the same object to which a Dynamic Lighting shader is applied. To work around the OpenGL limitation, you can use the Dynamic Lighting shader's Affecting Lights field instead. See Dynamic Lighting shader settings on page 671.

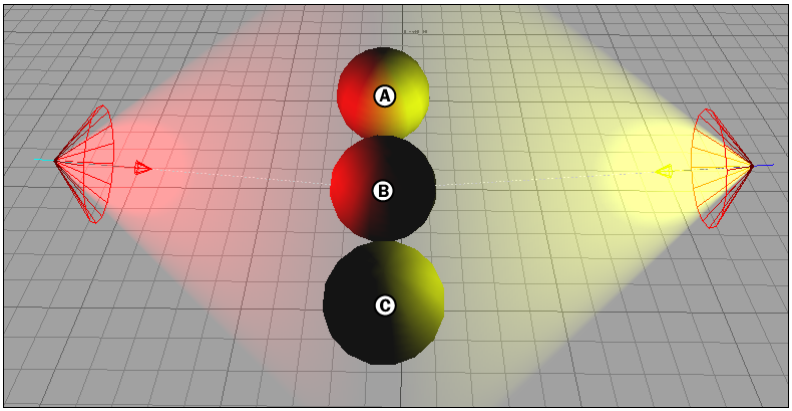
NOTE You can also perform selective lighting effects using the Cast Light On option in the light settings. See Cast Light on Object on page 517.

Lights Used field

The Lights Used field lets you select the lights you want to use with the Selective Lighting shader.

Alt-drag any lights in your scene into the Selective Lights field. You can also click the Selective Lights button next to the field to display the Asset list, where you can choose from the lights used in your scene.

After applying the Selective Lighting shader to a model, you can select which lights you want to apply to the model using the Selective Lights list. The default option is All.



A. **All lights** *B.* **Left (red) light only** *C.* **Right (yellow) light only**

Cast Light On/Off buttons

The Cast Light On and Cast Light Off buttons are the same as the Cast Light On Object button in the Lights settings. Click one of these buttons to change the settings for all lights in the Lights Producing Shadows list without modifying each light separately in the Lights settings.

Live Shadow shader settings

Use the Live Shadow shader to apply real-time shadows to models. You can specify shadow intensity as well as the lights and objects that cast shadows in a scene.

Adjust the Live Shadow shader settings and apply or append the Live Shadow shader to the plane.

When you apply the Live Shadow shader to your plane, this new layer of real-time shadows replaces the selected plane's texture, material, and other shaders. The areas of your plane that are without shadows become transparent.

When you append the Live Shadow shader to a plane, a layer of real-time shadows generates on top of the shaders already present on the plane. Use the Append option when you want to retain the selected plane's material, textures, or previously created shaders.

Shadow Type menu

The Shadow Type menu lets you select from five different kinds of shadow:

Shadow type	Effect
Planar Shadow	The default shadow setting. Use this shadow type to create darkened shadow areas only on planar surfaces.
Projective Shadow	Uses a texture projection to create a shadow. Like the Planar shadow, it darkens the shadowed areas, but you can apply this shadow to non-planar surfaces.
Projective Light Map	Uses a texture projection as a shadow, like the Projective Shadow, but instead of darkening the shadow area, it remains the same and the areas hit by light are brightened. The Projective Light Map can be applied to non-planar surfaces.
Projective Z Shadow	Similar to the Projective Shadow, except that it uses a boolean algorithm to create a self-shadow. This shadow does not work with translucent objects.
Projective Z Light Map	Similar to the Projective Light Map except that it uses a boolean algorithm to create a self-shadow.

Shadow Intensity slider

The Shadow Intensity slider lets you manipulate the darkness of shadows cast by a selected object. The default intensity is 100%.

The Shadow Intensity affects the intensity of all shadows created in the Live Shadow shader because shadow intensity is a global value. The strength of a shadow is also affected by the Light Intensity option in the Lights settings. Light Intensity is a local value specified for each individual light.

Shadow Z Offset field

The Shadow Z Offset field is available only when the Shadow Type is set to Projective Z Shadow or Projective Z Light Map.

The Shadow Z Offset field lets you specify the offset of the Live Shadow shader's plane from the original selected plane. It alters the direction in which the object's shadow falls on the plane.

This is useful when two planes, objects, or shaders are too close to each other and there is a conflict between the two locations.

Local (Per Object Shadow) option

The Local (Per object shadow) option is available only when the Shadow Type is set to Projective Shadow or Projective Light Map.

Activate the Local (Per object shadow) option to create an accurate projection of a shadow for each object. This allows for more precision but creates a slower display.

If you disable the Local (Per object shadow) option, all the shadows cast are combined into one large projection. This method is less accurate but does not slow down the display, as one shadow is created instead of many.

Use gobo option

The Use Gobo option is available only when the Shadow Type is set to Projective Shadow or Projective Light Map.

Activate the Use Gobo option if you want the gobo to be included in the shadow map calculation. See Attaching a gobo to a light on page 506 for more on Gobos.

Framing Type menu

The Framing Type menu is available only when the Shadow Type is set to Projective Shadow or Projective Light Map.

Use the Framing Type menu to select the shadow calculation method.

Shadow Receiver option

Select Shadow Receiver to base the shadow calculation on the size of the Shadow Receiver.

Shadow Caster option

Select Shadow Caster to base the shadow calculation on the size of the Shadow Caster.

Lights Producing Shadows field

Alt-drag any lights in your scene that you want to produce shadows into the Lights Producing Shadows field. You can also click the Lights Producing Shadows button next to the field to display the Asset list, where you can choose from the lights in your scene.

The Lights Producing Shadows area lists all the lights in your scene that produce shadows. If you want a light to produce shadows on a plane that uses the Live Shadow shader, select and Alt-drag each light into this list.

Models Casting Shadows field

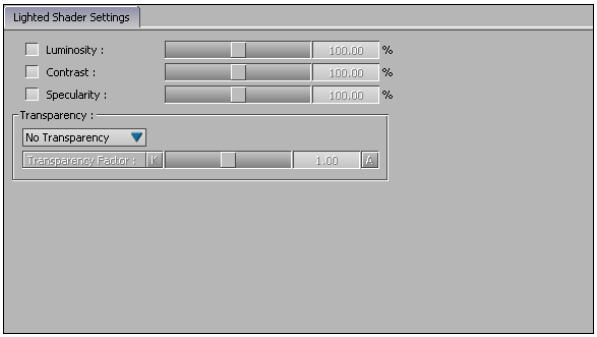
Alt-drag any models in your scene that you want to produce shadows into the Models Casting Shadows field. You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from the models in your scene.

The Models Casting Shadows area lists all the objects in a scene that cast shadows. If you want an object to cast shadows on a plane that uses the Live Shadow shader, select and Alt-drag each object into this list.

Lighted shader settings

Use the Lighted shader settings to control how your object reacts to lighting in the scene.

The Lighted shader contains three color controls: Contrast, Luminosity, and Specular Factor. To use one of these controls, activate the Use option beside the control. The corresponding color control bar is activated.



Lighted shader settings

Luminosity option

Activate the Luminosity option and use the Luminosity slider to change the brightness of the object when reflecting light. This increases overall brightness, including contrast.

Contrast option

Activate the Contrast option and use the Contrast slider to change the contrast of the object when it reflects light.

Specularity option

Activate the Specularity option and use the Specularity slider to change an object's level of shininess when it reflects light by increasing or decreasing the size of the specular highlight.

The specular highlight is the reflection of the light source, and usually appears as a bright circular area.

Transparency Type menu

The Transparency Type menu lets you select a method of calculating transparency, and set a percentage to boost or reduce the object's texture or material transparency. For a description of the transparency types you can select, see Shader transparency types on page 665.

The following figures show the vest of a model with no shader and with a transparent Lighted shader.

A. **Vest with no transparency shader** *B.* **Vest with Lighted shader Accurate Transparency set to 0.43.**

Transparency Factor slider

The Transparency Factor slider lets you manipulate or animate the Transparency value for the Lighted shader. The default setting is 1.00.

A material's Transparency settings can also interact with the Lighted shader's Transparency values and affect the result. See Advanced material settings on page 546.

- Applying shadows to objects on page 657

Shader transparency types

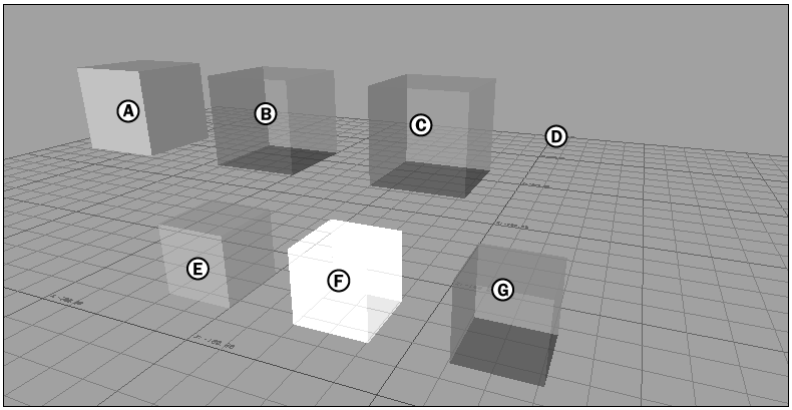
The Transparency menu in the Flat, Lighted, CgFX. and Dynamic Lighting shaders lets you select a method of calculating transparency and of adjusting the percentage used to boost the object's texture or material transparency.

When a material is also applied to the model, its Transparency settings can interact with the shader's Transparency settings. See Advanced material settings on page 546 for more on a material's Transparency settings.

NOTE The CgFX shader has limitations with using the Transparency and Alpha channels with the Accurate Transparency and Translucent (Models Z-Sort) options with self-hiding or intersecting models.

No Transparency option

Select the No Transparency option to disable the object or texture's opacity. Applying No Transparency results in a fully opaque object. The Opacity Multiplier is not activated with this selection.



A. **No Transparency** *B.* **Accurate Transparency** *C.* **Translucent** *D.* **Matte** *E.* **2D Transparency** *F.* **Additive Transparency** *G.* **Translucent (Z Sort Models)**

Accurate Transparency option

Select the Accurate Transparency option to calculate the transparency of the object or texture's opacity using a more accurate, but slower algorithm.

Accurate Transparency is intended for objects that are only slightly transparent.

Use the Opacity slider to boost the amount of accurate transparency. Low values may show layering problems.

Translucent option

Select the Translucent option to calculate the transparency of the object or texture's opacity using a less accurate but faster algorithm. Use Translucent for very transparent objects.

Use the Opacity slider to boost or reduce the amount of transparency. A value of 0% makes the shaded object invisible.

Matte option

Select the Matte option to use the quickest method of applying transparency. Use the Matte option for objects with textures that have an Alpha matte.

The Opacity Multiplier functions differently for the Matte setting. Changing the percentage boosts or diminishes the matte, changing which Alpha channel values are included in the matte. This creates a thinning or thickening effect on the matte.

2D Transparency option

Select the 2D Transparency option to apply transparency to the visible surface of the object. When an object has 2D Transparency applied to it, solid objects are visible while partially transparent objects are not.

Use the Opacity slider to increase the amount of 2D transparency.

Additive Transparency option

Select the Additive Transparency option to apply transparency to the whole object. This option incrementally increases the color value of the object.

Use the Transparency slider to change the object's level of transparency.

Translucent (Models Z Sort) option

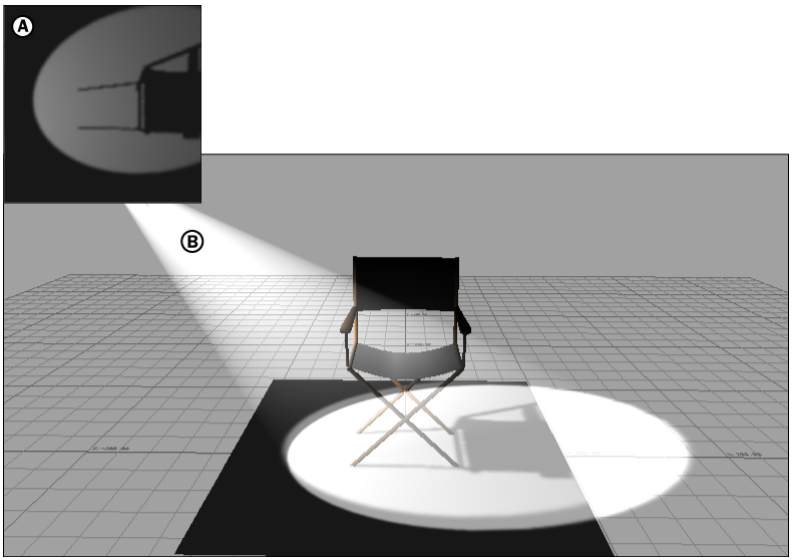
Select the Translucent (Models Z Sort) option for more accurate effects whenever you have objects in front of one another using transparency.

NOTE This Transparency type is the only one that sorts models according to their distance from the camera. In cases where the models are very close to each other or overlapping, the algorithm may not be able to determine which model is in front.

Shadow Map shader settings

The Shadow Map shader settings govern the use of shadow maps in the shader.

Map shaders take a "snapshot" of the scene at the moment it is rendered, and applies it to an object as a Shadow Map texture.



Map examples *A.* **Created map** *B.* **Scene with the shadow map applied to the floor plane.**

The Shadow Map shader is a useful alternative to live shaders as they do not demand much of the system's resources to display. Use the Shadow Map shader to apply a shadow image to an object or a plane.

Map Type menu

The Map type menu lets you create textures that appear in the Texture settings when you generate a map. The resulting texture depends on the shadow type that you choose.

For more on Map textures, see Mapped textures on page 550.

Shadow Map option

The Shadow Map selection creates a texture combining all shaders, materials, textures, and lights applied to your model. Shadow Map is faster but less accurate than Light Map.

Light Map option

The Light Map selection creates a texture using only the lights in your scene. Other textures, materials, and shaders do not affect the Light Map texture. It is best to use this option with another shader to add a more realistic color to the object.

Contrast slider

The Contrast slider lets you manipulate the contrast of shadow to the surrounding plane. Contrast must be set before the map is generated. You cannot modify the contrast after generating the map, unless you regenerate the map. The default intensity is 70%.

Generate Map For menu

Use the Generate Map For menu to select the objects on which you would like to generate a shadow map.

Model Casting Shadows field

The Models Casting Shadows field lists all the objects in your scene that cast shadows. You can also click the Models Casting Shadows button next to the field to display the Asset list, where you can choose from models in your scene.

The Models Casting Shadows area lists all the models in your scene that can produce shadows. If you want an object to cast shadows on a plane that uses the Shadow Map shader, select and Alt-drag each object into this field.

If the Asset list shows the Scene with a check mark next to it, all objects in your scene cast shadows.

Generate Map For menu

The Generate Map For menu lets you choose the models for which you want to create maps. You can select All Models or Selected Shaded models.

File Path field

The File path field lets you specify the path used for the file as well as save the generated map to disk as a texture file. The default path is C:\temp.

You can only save maps that are generated using the Generate Map For button. Define a Save Map Path before generating a map.

Map Size settings

You can choose to use the size of the texture (if there is a texture applied to the selected object) or you can use the size of the map as defined in Map Size. This option is only available with the Spherical Map and Sphere Map.

X and Y menu

The X and Y menus let you choose the size (in pixels) of the generated map. The default is 128 x 128.

There is a higher resolution, a longer generation waiting period, and a greater memory requirement with a larger map size.

Preview Map button

Click Preview Map to generate a preview map for all or selected objects with the Shadow Map shader applied. Use this option to quickly generate a low resolution map, so that you can preview the result of the Shadow Map shader.

Use the Generate Preview Map option with the adjacent menu. This lets you choose between generating the map for all objects or only selected shaded objects in your scene.

Generate Map button

Click Generate Map to generate a full resolution map of all or selected objects with the Shadow Map shader applied.

Use the Generate Map button with the adjacent menu to select between generating the map for all objects or only selected shaded objects. The shadow map cannot be generated unless the Save Map Path is valid.

Lights Producing Shadows field

Alt-drag any lights in your scene that you want to have cast shadows into the Lights Producing Shadows field. You can also click the Lights Producing Shadows button next to the field to display the Asset list, where you can choose from lights used in your scene.

The Lights Producing Shadows area lists all the lights in your scene that produce shadows. If you want a light to produce shadows on a plane that uses the Shadow Map shader, select and Alt-drag each light into this list.

If the Asset list shows Lights with a check mark next to it, all lights in your scene will produce shadows.

Cast Light On/Off buttons

The Cast Light On and Cast Light Off buttons are shortcuts to the Cast Light On Object button in the Lights settings. Click these buttons to globally change the settings for all lights in the Lights Producing Shadows list without modifying each light separately in the Light settings.

Shadow Map texture settings

The Shadow Map shader creates a *.tiff* image of the shadow to be projected as the shadow map. You can manipulate this *.tiff* in the Texture settings.

The two Texture Type settings that can be used with the Shadow Map shader are Shadow Map and Light Map

Light Area field

The Light Area field contains settings that let you create soft shadows in your scene.

Sample Count field

Enter a value in the Sample Count field to create a more precise map of the lighted area. The more light area sampled, the longer the generating time, and the better the resolution.

The default Sample Count is 3.

Radius setting

The Radius determines the light radius distribution (in centimeters) for all the light in a scene. A larger radius results in a larger penumbra, which is the space between perfect shadow and full light.

NOTE The default Radius is 1.000 cm.

You must use Generate Map to view the results of Radius and Sample Count. Generate Preview Map does not show changes.

■ Applying shadows to objects on page 657

Dynamic Lighting shader settings

Use the Dynamic Lighting shader settings to control the light falloff your object reacts to lighting in the scene. MotionBuilder uses vertex per-face lighting by default, but the Dynamic Lighting shader gives you a softer per-pixel falloff, for more realistic effects.

NOTE If you select Append to apply the Dynamic Lighting shader when the Default shader is also applied to the model, you may see undesirable results, such as flickering. Select Replace By Type or Replace All when you apply the Dynamic Lighting shader to detach the Default shader.

NOTE The Dynamic Lighting shader works in conjunction with the Light Settings pane Attenuation menu. See Attenuation on page 515.

NOTE When working with Dynamic Lighting shaders, use the Dynamic Lighting shader's Affecting Lights field to specify which lights the shader uses, instead of appending the Selective Lighting shader. If you do not specify any lights, the Dynamic Lighting Shader uses the first eight lights or default global lights from the scene.

The Dynamic Lighting shader is not affected by the Global lighting Fog settings on page 526.

Transparency Type menu

The Transparency Type menu lets you select a method of calculating transparency, and set a percentage to boost or reduce the object's texture or material transparency. For a description of the transparency types you can select, see Shader transparency types on page 665.

Transparency Factor slider

The Transparency Factor slider lets you manipulate or animate the Transparency value for the Dynamic Lighting shader. The default setting is 1.00.

A material's Transparency settings can also interact with the Dynamic Lighting shader's Transparency values and affect the result. See Advanced material settings on page 546.

Affecting Lights

The Affecting Lights field lets you specify which lights illuminate the object to which the Dynamic Lighting shader is applied. Since there is a maximum

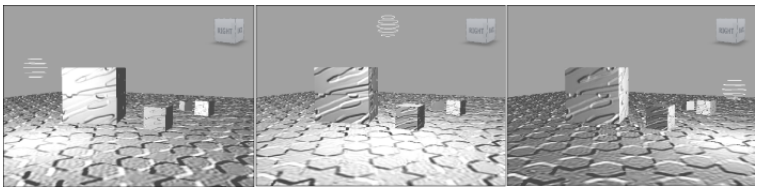
of eight lights available in any given MotionBuilder scene due to OpenGL limitations, you can use the Affecting Lights field to add lights to the scene. For example, you can use the Affecting Lights field to set up association between lights and objects to increase the number of lights in your scene to eight per object.

NOTE The Affecting Lights field has the same function as the Selective Lighting shader. Do not use the Selective Lighting shader with the Dynamic LIghting shader; this may cause problems. Use the Dynamic Lighting shader's Affecting Lights field instead.

Alt-drag any lights in your scene into the Affecting Lights field. You can also click the Affecting Lights button next to the field to display the Asset list, where you can choose from the lights in your scene.

Normal Map shader

You can also use the Dynamic Lighting shader to read relief from Normal maps.



Use the Dynamic Lighting shader to create Normal map effects

To add relief with a normal map:

1. In the Asset browser, expand the Shading Elements folder and select the Shaders folder.
2. From the Shaders folder, drag a Dynamic Lighting shader onto the objects you want to affect.
3. From the Shading Elements folder, drag a Texture asset onto the same objects.

   NOTE You can also apply a Layered Texture asset. See Blending multiple textures on page 563.

4 In the menu that appears, select Attach Texture to Material > Normal Map. You can also select Bump Map.

   A new material is created if no material was applied to the model. The texture is attached to the materials' Normal Map or Bump Map property, and the material attached to the model. If there was already a material attached to the model, the texture is attached to its property and no new material is created.

5 In the Navigator, expand the Textures folder and double-click the new texture to see its settings.

6 In the Texture settings, select New Media in the Media menu then browse to select a Normal map texture.

   The texture appears on the model in the Viewer.

Shader manager

41

When you add a shader to a model, that shader's settings appear in the Navigator window. These settings let you adjust the shader so that you can customize and refine its effect. Each shader's settings are specific to the shader applied.

To manage all shaders with every model in the scene, use the Shader manager. To access the Shader manager, double-click the Shaders folder in the Navigator window. The list of models in the Shader manager depends on which models are selected.

Shader columns

The Shader columns in the Shader manager let you prioritize any Shaders used in your scene.

Shader 1 menu

Use the Shader 1 menu to select a base shader to be used with your model.

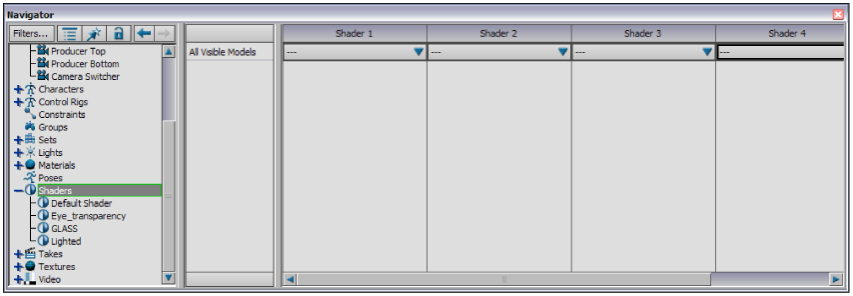
No Shader option

Select No Shader to detach the selected shader from the selected object. The shaders listed include all the shaders created using the shader options in the Asset browser.

Use the Shader 2 through Shader 5 columns to append additional shaders. Each shader is applied over the previous one, letting you combine shaders.

To view hidden Shader Manager columns:

1. Double-click the Shaders root folder in the Scene browser.
2. Shift-click and drag left in the table or resize the columns.



Shader Manager

■ Defining settings for a shader on page 676

Defining settings for a shader

Define the shader's settings using the shader settings in the Navigator window.

To define settings for a shader:

1. Double click to expand the Shaders folder in the Scene browser.
2. Double-click the shader whose settings you want to change.
3. The shader is selected and its settings appear in the Navigator and Properties windows.
4. Adjust the settings as directed in the appropriate shader reference.

Part 5: Manipulating Objects

Knowing how to effectively manage, move, and alter objects is an important part of animation. In MotionBuilder, you can manually manipulate an object using the simple Transformation modes, or you can associate the object with a device that controls its movement. You can adjust the pivot points from which the object is manipulated, or control it using an associated Handle. You can also define Degrees of Freedom to limit an object's movement.

This chapter covers the following topics:

- Transformation on page 679
- Handles on page 713
- Degrees of Freedom (DOF) on page 727

To find out how you can manipulate objects in 3D space using constraints and devices, see the following chapters:

- Animating with Devices on page 1211
- Animating with Constraints on page 1023

Transformation

42

All 3D objects have groups of values (X, Y, Z values) that describe the size of the object, the orientation of the object, and the location of the object in 3D space. At the origin of an object, all three values have a zero value. This means that X=0, Y=0, and Z=0, defined as (0,0,0).

By changing the X, Y, or Z coordinate values of an object in 3D space, you can reposition, resize, or re-orient it. Any time this is performed on an object in 3D space, it is called transformation.

There are three fundamental transformation methods for changing objects in 3D space:

- Translation on page 686
- Rotation on page 689
- Scaling on page 695
- Setting a default manipulation mode for objects on page 684

Reference modes

When you transform an object, you can change the way the values that define its location, size, and orientation are displayed. Any transformation value can be defined relative to the scene (globally) or relative to the object itself (locally). Rotation values can also be defined using the Additive Reference mode.

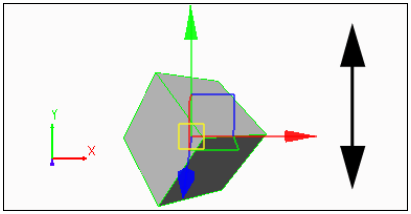
The Reference mode menu in the Viewer window lets you choose which way you want to define transformation values. See Reference mode menu on page 67.

Global Reference mode

Select the Global Reference mode if you want an object's transformation values displayed relative to the center of the scene (the global axis).

When you activate the Global Reference mode while transforming objects, the Translation arrows and Rotation rings are shown with the same orientation as the center of the scene. Scaling handles are always oriented to match the axis of the object itself.

For example, in the following figure, Global Reference mode is selected so that when the object is translated along the Y-axis, it moves along the global Y-axis.



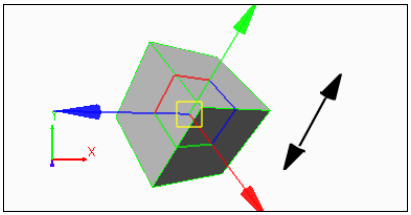
Global Reference mode: The marker translates along the global Y-axis.

Local Reference mode

Select Local Reference mode if you want an object's transformation values to be displayed relative to its own center, or from the center of its parent if it is parented. If the object does not have a parent, the values of Local mode are the same as Global mode.

When you activate Local Reference mode while transforming objects, the Translation arrows, Rotation rings, and Scaling handles all display relative to the center of the object itself.

For example, in the following figure, Local Reference mode is active, so the marker is translated along its local Y-axis.



Local Reference mode: The marker translates along the local Y-axis.

The object's center (its local axis) is determined by the placement of its Transformation pivots on page 701. You can offset an object's Transformation

pivots using the Transformation pivots properties. (See Transformation pivots on page 701.)

While the Local Reference mode can be used to rotate any group of objects, it is particularly useful when you rotate objects that are part of the same hierarchy, such as a character's spine, fingers, or tail. Since the rotation of each object in the hierarchy is calculated relative to its parent, you can easily create natural bending.

Additive Reference mode

NOTE Additive Reference mode is only available if you are in Rotation mode. In addition, you cannot use it when you have selected a Control rig effector while in Full Body or Body Part keying mode.

Select Additive Reference mode if you want the selected object's transformation values to reflect its actual local coordinates on the current layer only. This is useful when you are working with FCurve values because it lets you work with each axis independently.

The Additive mode lets you perform individual and continuously incrementing axis rotations. It lets each axis rotate freely to show the calculation behavior of the real Euler rotations, which can help identify why gimbal locks occur in your animation.

■ Scaling mode on page 696

Transforming objects

There are two basic methods to transform your objects: using the Transformation handles, or by entering specific coordinates.

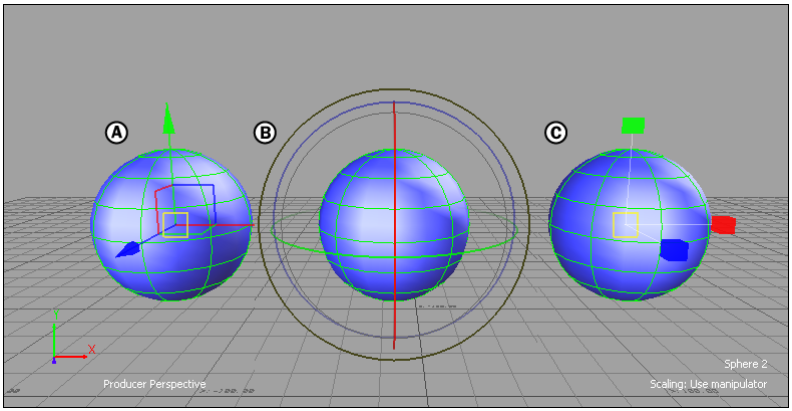
By default, when you transform an object, the transformation is applied from a starting point or 'pivot' at the center of the object. If you want to transform an object from a point other than it's own origin, you can adjust the Transformation pivots. See Transformation pivots on page 701 for more information.

To transform objects with Transformation handles:

1. Select Translation, Rotation, or Scaling manipulation mode by clicking the appropriate Transformation button in the Viewer window toolbar. (See Transformation buttons on page 69.)

2 Select an object.

Transformation handles (arrows for translation, rings for rotation, and handles for scaling) appear on the selected object.



Transformation handles on a sphere *A.* **Translation** *B.* **Rotation** *C.* **Scaling**

3 Drag these handles to manipulate your objects in the Viewer window.

NOTE You can Increase or decrease the size of the Transformation handles (arrows, handles, or rings) by pressing the plus sign or minus sign keys of the numeric key pad when they are the active selection.

To transform objects using the Free Transform plane:

1 Select the object you want to transform.

NOTE Make sure you are in Selection or XYZ mode in the Selection Mode Menu on page 65 at the side of the Viewer window.

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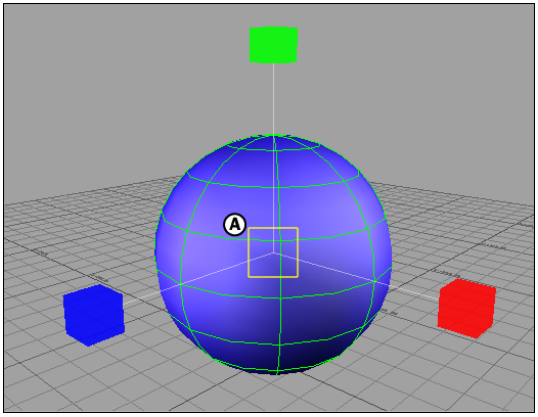
2 Click in the Viewer window and press T, S, or R on the keyboard to activate translation, scaling, or rotation mode for the object. The yellow Free Transform plane (or ring) appears.



Sphere in Scaling mode *A.* **Free Transform plane**

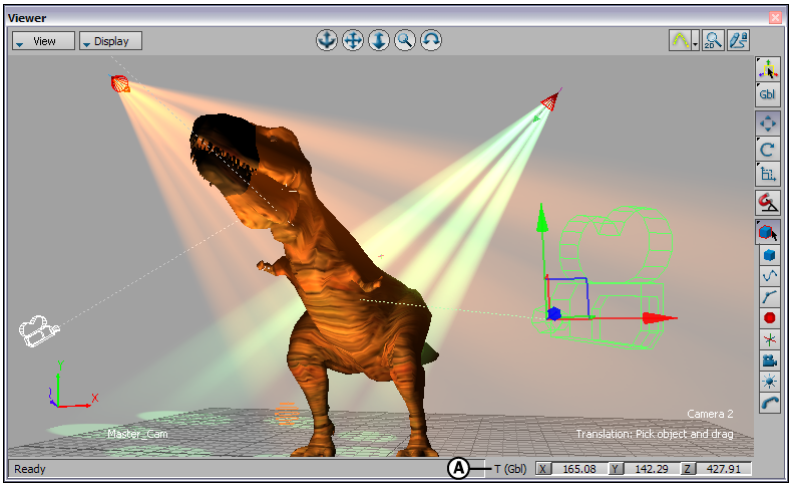
3 If translating or scaling, hover your mouse over the Transform plane; the transform plane highlights as the mouse passes over.

4 When the plane is highlighted, drag the object. If rotating the object, drag the yellow rotation ring.

- Scaling mode on page 696
- Free Transform plane on page 685
- Transformation pivots on page 701

To transform objects using specific coordinates:

- Click and drag left or right in the Global/Local/Layer fields of the Viewer window to decrease or increase the value.
  To drag through numbers more slowly, right-click and drag in the field.
- Double-click in the X, Y, or Z fields, type the new value, and click Enter.
  The currently selected Transformation and Reference modes are displayed beside the Global/Local/Layer fields in the Viewer window.



Viewer window *A.* **Global/Local/Layer fields**

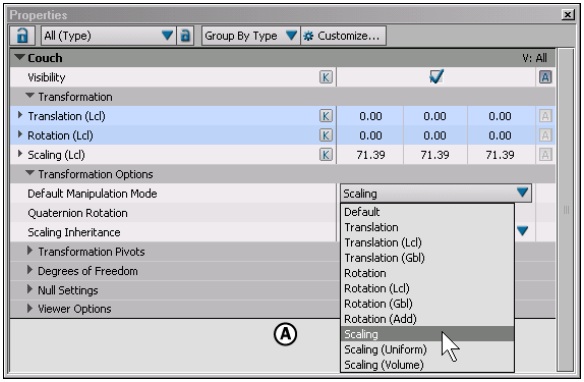
- Transforming objects on page 681
- Status bar area on page 73

Setting a default manipulation mode for objects

You can specify a default manipulation mode (Translation, Rotation, or Scaling) for any object, so that when you select the object it is automatically set to the preferred manipulation mode.

To set a default manipulation mode:

1. Select the object in the Viewer window.
2. In the Properties window, expand Transformation Options.
3. From the Default Manipulation mode menu, select a manipulation mode that you want to be active whenever you select the object.



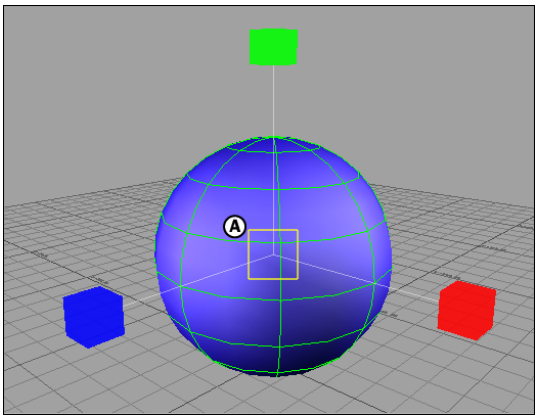
Properties window *A.* **Setting a model's Default Manipulation mode to Scaling.**

NOTE This mode is overridden whenever a new manipulation mode is selected.

- Translation on page 686
- Rotation on page 689
- Scaling on page 695

Free Transform plane

A yellow square appears at the center of the Transformation planes when you are in the Selection or XYZ Selection mode. This is the Free Transform plane.



Sphere in Scaling mode *A.* **Free Transform plane**

Dragging the Free Transform plane in Translation or Scaling mode lets you move or scale an object in any direction.

In Rotation mode, the Free Transform Plane becomes a yellow Free Rotation ring so you can rotate your object in any direction.

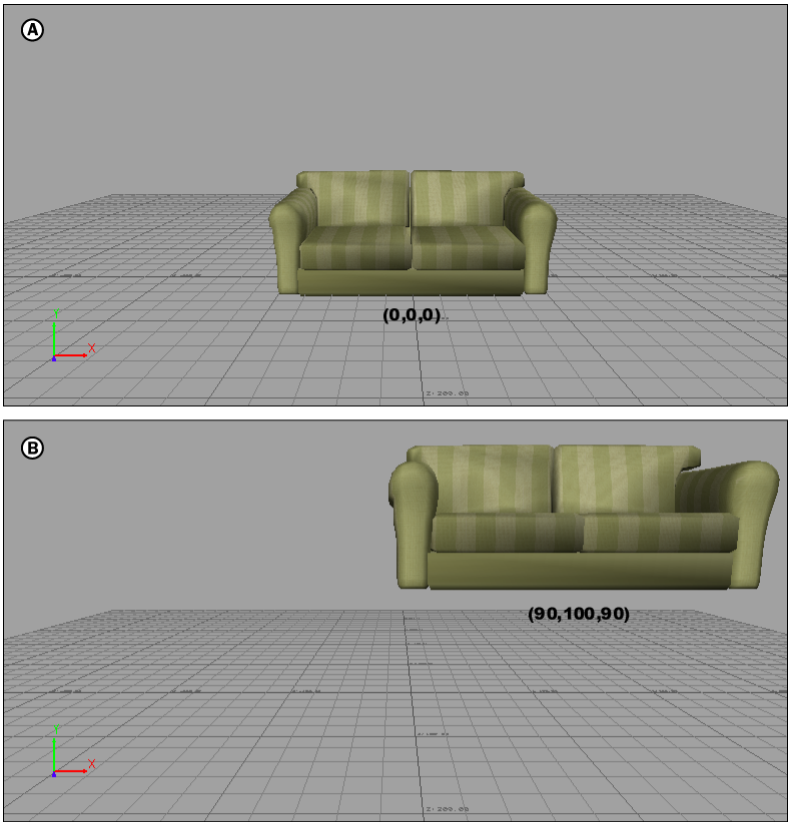
- Scaling mode on page 696
- Translation mode on page 687
- Rotation mode on page 689
- Transforming objects on page 681
- Viewer toolbar on page 64

Translation

You can define the location of any point in 3D space relative its original position by specifying a value for each point. Assigning a positive or negative value for each point in the XYZ coordinate system lets you move, or translate, the object in 3D space.

Translating an object moves all the points of the object by the same amount, without changing its orientation.

For example, to move an object in a scene to the location defined by (90,100,90), start at the origin (0,0,0) move 90 units in the X (left) direction, 100 units in the Y (up) direction, and then 90 units in the Z (forward) direction.



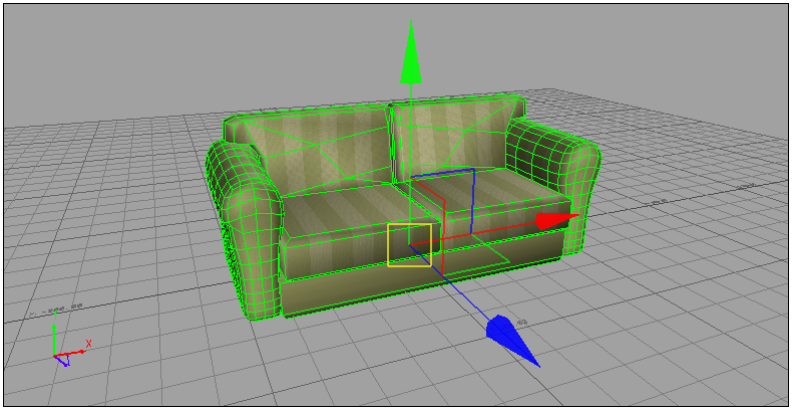
Viewer window *A.* **Sofa's position at the center of the 3D world (0,0,0)** *B.* **Sofa's position at (90,100,90)**

In the Viewer window, when you are using Translation mode, the object can be transformed using graphically selected's rotation rings with your mouse in the Viewer window, or this can be done precisely by entering values in the Properties window.

Translation mode

When you activate Translation mode in the Viewer window, you can move selected objects up, down, and back and forth using the Translation arrows. Depending on what you have selected in the Selection Mode Menu on page 65, you can move the object by dragging these handles around the camera view.

For example, in the following figure, a sofa is shown in the Viewer window with Translation arrows, representing each axis. If you select one of the arrows and move the mouse in a direction, the sofa is translated along that axis.



Selected object in the Viewer window displays with Translation arrows for translating on the X, Y, or Z axis

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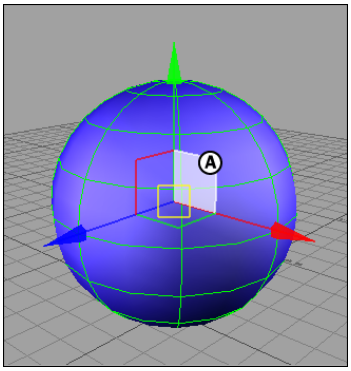
NOTE You can transform objects using transformation handles in the Viewer window or by specifying exact coordinates in the Transforms or Properties windows.

Each Translation arrow is color-coded to its specific axis. The red arrow translates along the X-axis, the blue arrow translates along the Z-axis, and the green arrow translates along the Y-axis.



Transformation arrows *A*.
Transformation plane

At the centre of the Translation arrows, Transformation planes appear at the center of the handles. These Transformation planes let you move an object exclusively along a plane, for example, the XY plane.

- Translating an object on page 689
- Transforming objects on page 681
- Status bar area on page 73
- Transformation pivots on page 701

Translating an object

1. Activate the Translation manipulation mode by doing one of the following:
   - Select the Translation mode button from the Transformation buttons on page 69 in the Viewer window.
   - Click in the Viewer window and press T.
2. Select the object and drag the translation arrows that appear to move your object in the Viewer window.

   You can also enter specific coordinates in the Global/Local/Layer field.

- Translation on page 686
- Transforming objects on page 681
- Transformation pivots on page 701

Rotation

The rotation of an object is its orientation in the scene. When you rotate an object, you are changing the properties that define its degree of rotation around each of the three axes.

To rotate objects, you must be in Rotation mode.

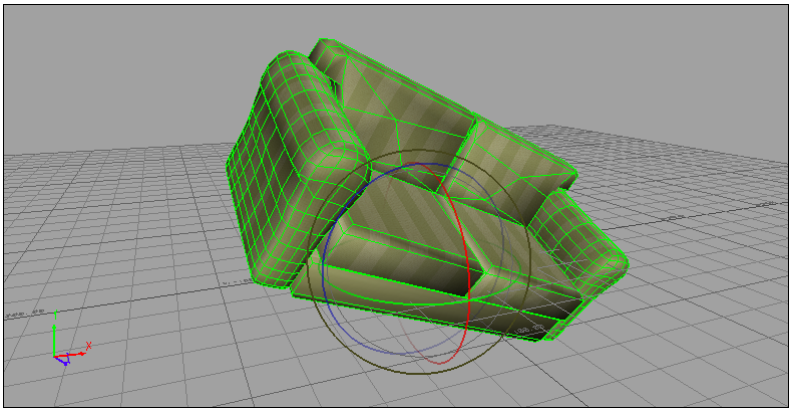
Rotation mode

Rotation mode lets you change the orientation of selected objects in the Viewer window. To activate Rotation mode, select the appropriate button from the

Transformation buttons on page 69, or click in the Viewer window and press R.

Activating Rotation mode makes Rotation rings appear on selected objects, so you can change the orientation of objects by dragging the rings.

For example, the following figure shows a sofa in the Viewer window with Rotation rings representing each axis.



Selected object in the Viewer window displays with Rotation rings for rotating on the X, Y, or Z axis

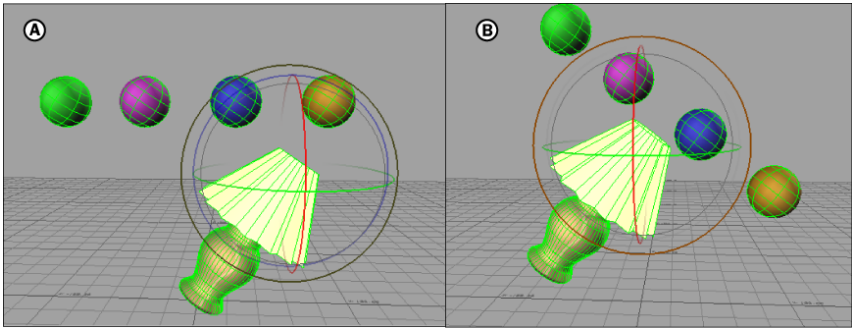
Three of the Rotation rings are color-coded to their specific axis. The red ring rotates the object along the X-axis, the blue ring rotates along the Z-axis, and the green ring rotates along the Y-axis. The brown ring rotates along a perpendicular angle from wherever the camera projects its angle.

NOTE When in Rotation mode, you can also use the Layer (Additive) mode from the Reference mode menu in the Viewer window. See Reference mode menu on page 67.

Rotate Around mode

Rotate Around mode lets you take a group of selected objects, designate one object as the 'manipulation point', and rotate all other objects around that manipulation point.

In this mode, Rotation rings appear only on the manipulation point object, and as you rotate, the other objects in the selection rotate around it.



Rotation modes: *A.* **Rotate** *B.* **Rotate Around**

This manipulation point creates a new center of rotation for the selected objects, replacing the local or global origin as the center of rotation.

This manipulation mode can be very powerful when used with effector pivots, for example to rotate a character's entire foot around the toes.

You can also change the center of rotation for each individual object using the Rotation Pivot properties on page 704.

NOTE When you keyframe objects using the Rotate Around mode, remember that as the manipulation point rotates, the other selected objects rotate and translate.

- Transformation Pivots properties on page 704
- Rotating an object on page 692
- Status bar area on page 73
- Transformation pivots on page 701
- Setting a default manipulation mode for objects on page 684

Activating Rotation mode

To activate Rotation mode, do one of the following:

- Select Rotation from the Transformation buttons on page 69 in the Viewer window.
- Click in the Viewer window and press R.

You can now rotate any selected object. See Rotating an object on page 692 for more information.

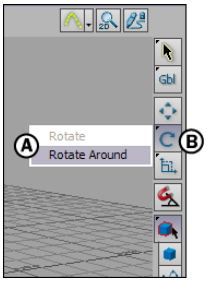
- Rotation on page 689
- Setting a default manipulation mode for objects on page 684

Rotating an object

To rotate an object:

1 Activate Rotation mode. (See Activating Rotation mode on page 691.)

2 Expand the Rotate menu from the Viewer window Transformation buttons and select a Rotation mode from the Rotate options.

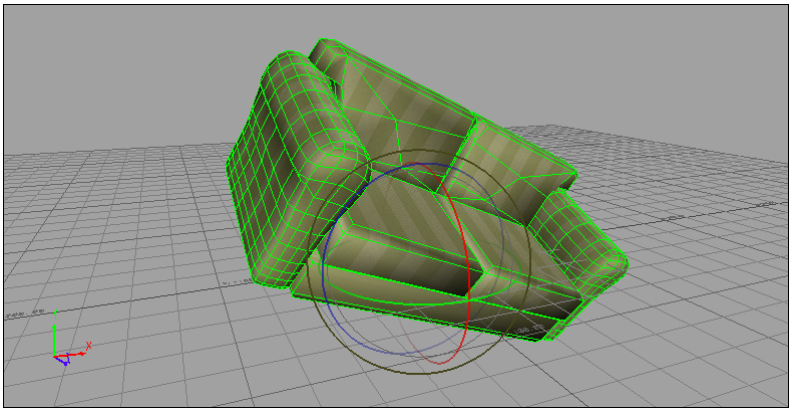


Viewer window Selection mode menu *A.* **Rotate menu** *B.* **Rotate options**

- Select Rotate if you want to “spin” the object.
- Select Rotate Around if you want the other objects in the selection group rotate to around the manipulation point.
- If you want to rotate objects incrementally, use the Snap Angle button. See Snap Rotation on page 70.

NOTE When in Rotate transformation mode, the reference menu includes the Layer (Additive) option.

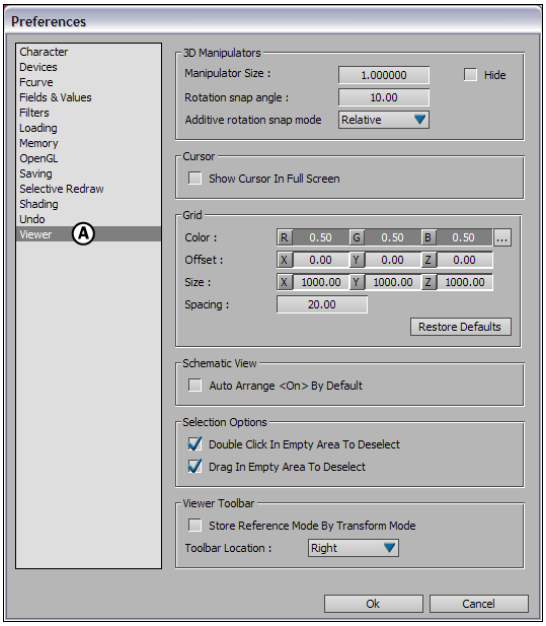
3 Select the object’s rotation rings in the Viewer window and drag them or enter precise values in Properties windows.



Selected object in the Viewer window displays with Rotation rings for rotating on the X, Y, or Z axis

To snap the rotation of objects at specific increments:

1. Select Settings > Preferences from the menu bar.
2. In the Preferences window, select the Viewer preferences.



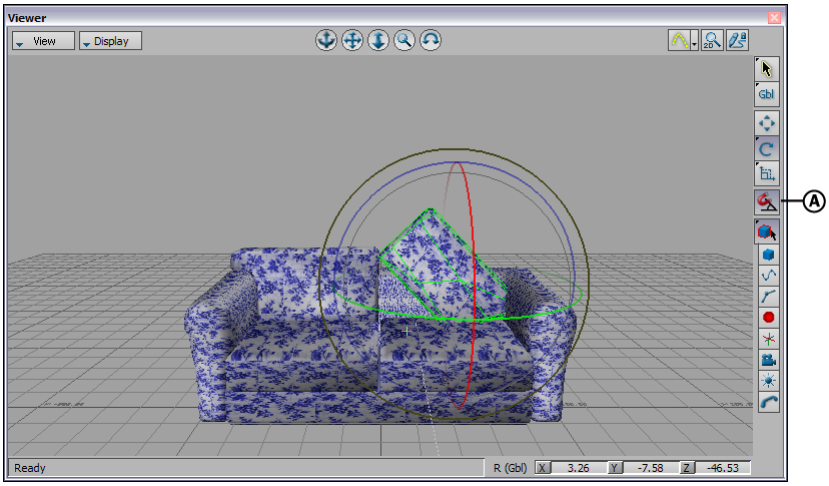
Preferences window *A.* **Select the Viewer preferences**

3 In the 3D Manipulators area, enter the size of increment (in degrees) in the Rotation snap angle field.

TIP Right-click the Snap Rotation button to view the last five increments set for the Snap Rotation and to open the Preferences window and set a new increment size.

---

4 Activate the Snap Rotation button in the Viewer toolbar. You can also hold down the M key to activate Snap Rotation mode temporarily.



Viewer window: *A.* **Snap Rotation button**

If no rotation increment is specified, objects rotate in 10-degree increments by default.

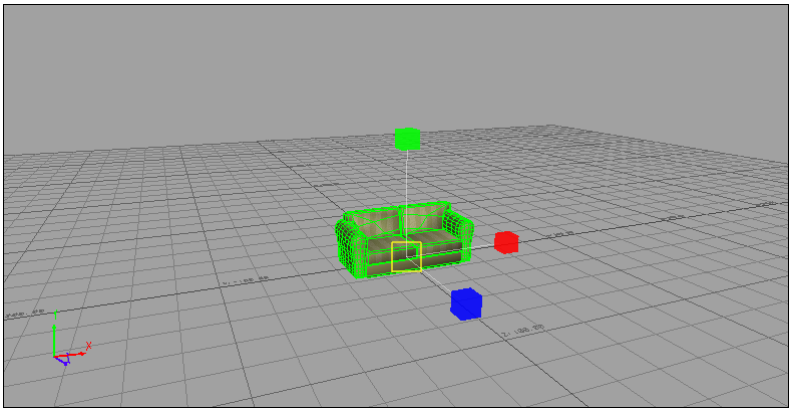
5 To return to regular (non-incremental) rotation, disable the Snap Rotation button.

6 To return to regular (non-incremental) rotation, disable the Snap Rotation button.

- Rotation on page 689
- Transformation pivots on page 701
- Transformation Pivots properties on page 704

Scaling

Scaling an object changes its size. You can uniformly expand or shrink an object on all axes to uniformly change its size, or you can scale an object on only one axis to deform it.



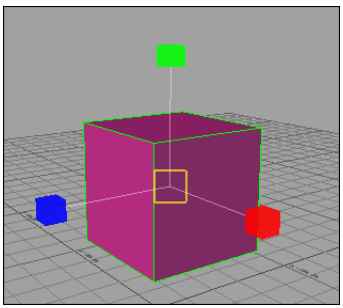
Selected object in the Viewer window displays with Scaling handles for scaling the object on each axis

For example, in the preceding figure, the sofa has Scaling handles that you can drag with your mouse to scale the object.

In order to scale objects, you must put the Viewer window in scaling mode.

Scaling mode

When you are in Scaling mode, Scaling handles appear on any selected object. Each Scaling handle is color-coded to its specific axis. The red handle scales along the X-axis, the blue handle scales along the Z-axis, and the green handle scales along the Y-axis.



Scaling handles on the selected object

There are two types of Scaling used in MotionBuilder, Volumetric and Uniform. The following table explains the differences between the two:

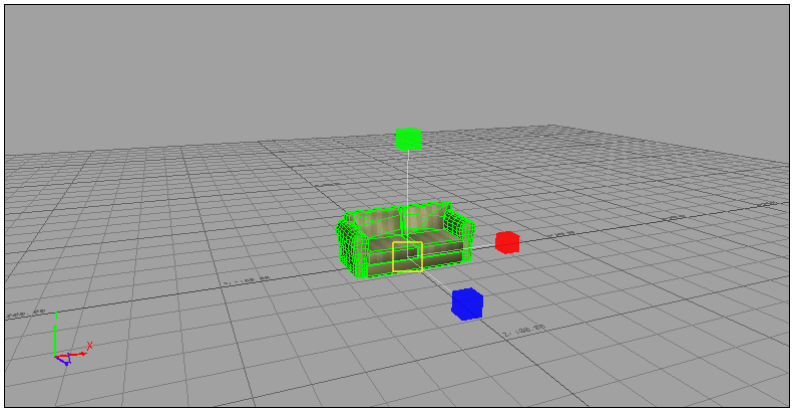
Scaling mode	Purpose
Volumetric	Choose Volumetric scaling mode to scale your object without changing its volume. Volumetric scaling uses the same manipulation principles as XYZ, but scaling a model in Volume mode does not change the surface volume.Instead, the non-edited axes compensate for the axis that is being scaled. For example, when scaling out your model along the Y-axis, the model simultaneously scales in along the X- and Z- axes in order to keep the volume constant.
Uniform	Choose Uniform scaling mode to scale a selected object uniformly along the XYZ axes, without changing its proportions.

- Scaling an object on page 698
- Activating Scaling mode on page 697
- Setting a default manipulation mode for objects on page 684
- Viewer toolbar on page 64

Activating Scaling mode

To activate scaling mode in the Viewer window, do one of the following:

- Click in the Viewer window and press S.
- Select the Scaling button from the Transformation buttons on page 69 in the Viewer window.
  Depending on what you have selected in the Selection Mode Menu on page 65, Scaling handles appear on any selected object. If you select “Selection” you can drag the scaling handles to change the size of the object on any axis. The following figure displays the scaling handles of the selected object, enabling you to scale the object on each axis.



Scaling handles enables you to scale the object on each axis

See Scaling an object on page 698.

- Setting a default manipulation mode for objects on page 684

Scaling an object

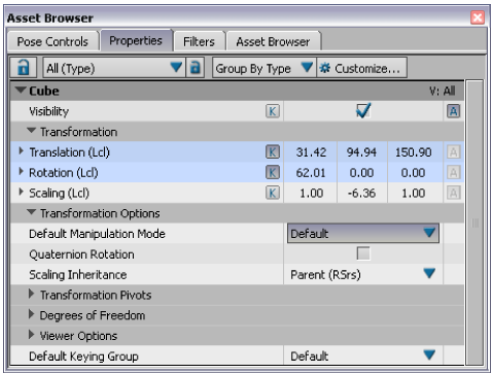
1. Activate Scaling mode. (See Activating Scaling mode on page 697.)
2. Optional: Expand the Scaling mode button to choose one of the following scaling modes:
   - Choose Uniform to scale a selected object uniformly along the XYZ axes, without changing its proportions. (This option is selected by default.)
   - Choose Volumetric to scale your object without changing its volume.
3. Select the object you want to scale and drag the scaling handles to resize it.

   You can also enter specific coordinates in the Global/Local/Layer fields.

- Scaling mode on page 696
- Viewer window on page 49

Transformation Options properties

In the Properties window, the settings found in the Transformation Options group let you set advanced properties for transforming objects.



Properties window: Transformation options

Default Manipulation mode

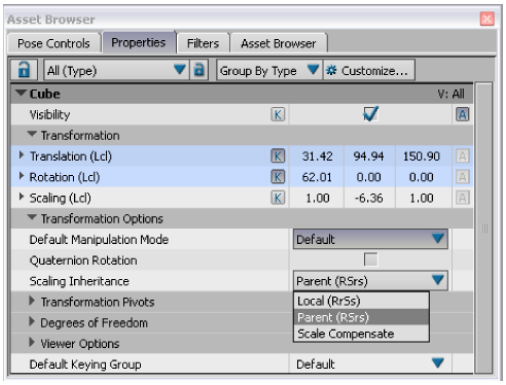
This menu lets you set a default manipulation mode (translation, rotation, scaling, and so on,) to be the active transformation mode whenever you select an object.

Quaternion Rotation

This option lets you activate or disable quaternion rotation calculations, which can help to avoid gimbal lock problems when rotating some objects.

Scaling Inheritance

When you modify the scaling of a parent object, the child object is affected. This menu lets you select what type of scaling inheritance you want between parent and child objects.



Properties window: Scaling Inheritance options

Choose from the following three types:

Scaling type	Description
Local (RrSs)	Activates local scaling mode. If you scale a parent object on its X-, Y-, or Z-axis, child objects scale on their local X-, Y-, or Z-axis. The child objects also translate to keep proportional distance from the parent. You can still scale the child object without affecting the parent.
Parent (RSrs)	Activates parent scaling mode. If you scale a parent object on one axis, Child objects deform to maintain their volume while stretching to scale on the same axis. For example, you can use this option if you have a group of models and you want them all to scale down on the same axis and appear squashed.
Scale Compensate	In this mode, Child objects do not inherit scaling from parent objects at all. When a parent object is scaled, the child does not scale, but translates in order to keep proportional distance between models.

Creating pivot offsets

There are two ways you offset a transformation pivot from its object: in the Viewer window or properties window:

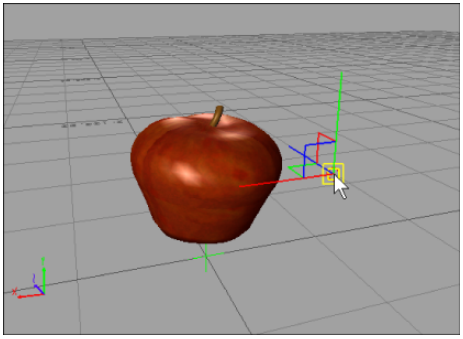
To create a pivot offset in the Viewer window:

1 Select the object with the pivot you want to offset.

2 Switch to Pivot in the Viewer window Object Mode selection menu.

3 Select Translate.

4 In the Viewer window, select and drag the pivot to reposition it. To specify exact XYZ coordinates, enter them in the Global/Local/Layer fields at the bottom of the Viewer window.



Translate the Pivot handles to move the pivot.

To create a pivot offset in the Properties window:

1 Select the object with the pivot you want to offset.

2 Open the Properties window (or the Properties tab in the Asset browser).

3 Switch to All (Type) in the Select Property View menu.

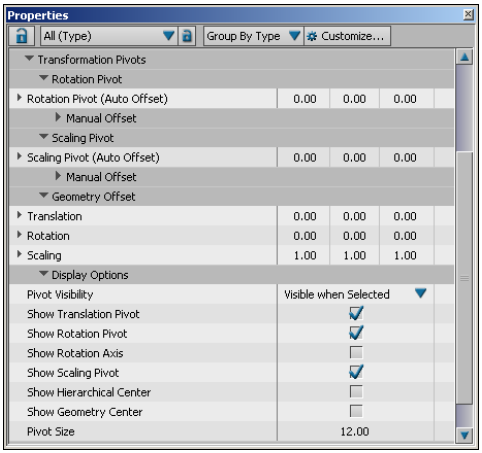
4 Expand Transformation Pivots, expand Rotation Pivot or Scaling Pivot and specify coordinates in the Auto Offset XYZ fields.

NOTE You can only offset rotation and scaling values.

Transformation pivots

A pivot is the point from which a selected object is transformed. MotionBuilder lets you adjust the position of pivots so that you can manipulate an object from a point other than the default.

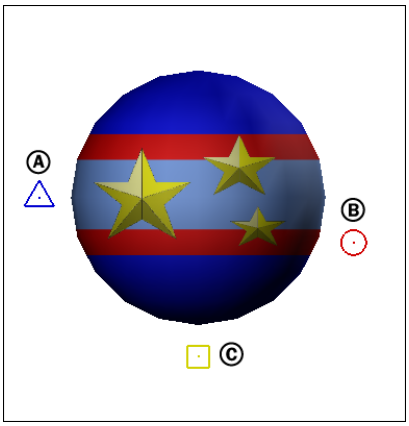
The Transformation Pivot group of properties lets you manipulate separate pivots for rotation and scaling. Each pivot can be positioned independently relative to the object's geometry. This lets you move the point on which an object's transformational properties are based. See Creating pivot offsets on page 700 for information on how to repositioned pivots independently of your object's geometry.



Properties window, Transformation Pivots properties

For example, to animate a bouncing ball, you might rotate the ball around the center of the model, but scale the ball from the top or bottom to simulate a squash and stretch effect as the ball hits the ground.

In the Viewer window, pivots are represented by two-dimensional icons that always face the camera and always appear to be the same size regardless of the position or zoom of the camera. Translation pivots are represented by a blue triangle icon, rotation pivots by a red circle icon, and scaling pivots as a yellow square icon.



Transformation pivots displayed on a ball *A.* **Translation pivot** *B.* **Rotation pivot** *C.* **Scaling pivot**

The visibility of transformation pivots is automatically turned on when you offset the pivots of a selected object. You can also change the Pivots Visibility options in the Viewer Options section of the Properties window. There are additional properties in the Viewer Options to specify how you want each pivot to display.

NOTE Transformation pivots are only visible in X-ray and Normal display modes. You can convert Transformation pivots created in Maya using the FBX plug-ins.

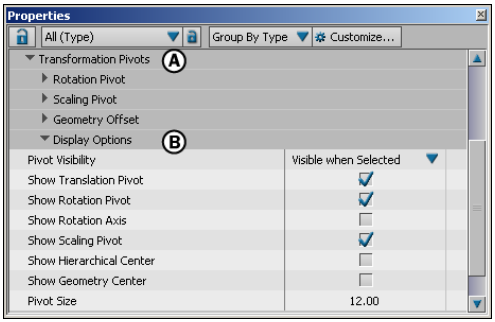
See Transformation Pivots properties on page 704 for descriptions of each type of Transformation pivot and the properties you can define in order to offset pivots from objects.

- Viewing Transformation pivots on page 703
- Transformation Pivots properties on page 704

Viewing Transformation pivots

1. Select the object on which you want to view the transformation pivots.
2. In the Properties window, expand the Transformation Pivots group of properties.
3. Expand the Display Options heading and select Visible from the Pivot Visibility menu.

You can also select Visible on Selection if you only want the pivots to display when objects are selected.



Properties window *A.* **Transformation Pivot properties** *B.* **Display Options**

4 Enable the Show option for any of the pivots that you want to view for the selected object. For example, enable Show Rotation Pivot if you want to view Rotation pivots.

NOTE When the Transformation pivots visibility options are active, the pivots might still be hidden within an object. To view the pivots, define offsets to set them apart from the model, or switch the model to display as a wireframe.

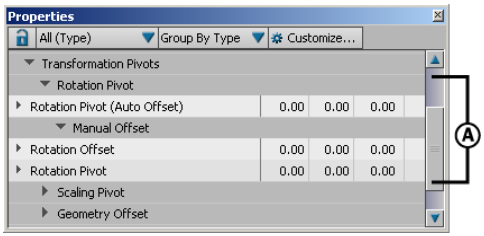
- Transformation pivots on page 701
- Transformation Pivots properties on page 704

Transformation Pivots properties

In the Properties window, the Transformation Pivots group of properties let you define the placement of Transformation Pivots for all objects.

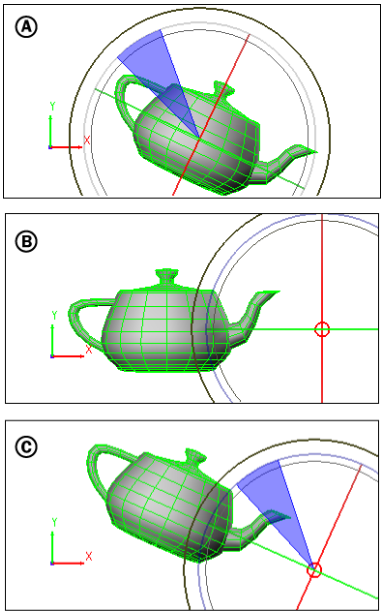
Rotation Pivot properties

Use the Rotation Pivot properties to define the placement and behavior of Rotation pivots.



Properties window *A.* **Rotation Pivot properties**

Rotation pivots let you rotate an object from a point other than its own default pivot. When you rotate an object without adjusting its pivots, it rotates around itself. If you use the Pivots properties to offset the Rotation pivot for the object, you can define a new point from which you want the object to rotate. Instead of rotating in place, the object rotates around the offset pivot.



A. **A tea pot rotates in place on the Z-axis.** *B.* **Tea pot Rotation pivot is offset** *C.* **Tea pot rotates around the offset pivot**

Rotation Pivot (Auto Offset)

These values let you define where the rotation pivot is offset on the X-, Y-, and Z-axis. The selected object is rotated around this point.

Adjusting the position of the rotation pivot does not affect the translation of the selected object, as an offset is automatically calculated to keep the object in place. The values used to create this offset display in the Rotation Offset fields.

Manual Offset

Exact Rotation Offset values are calculated by MotionBuilder when you adjust the Rotation Pivot (Auto Offset) values, and you do not need to adjust them manually. The following table describes the options in the Manual Offset group of properties:

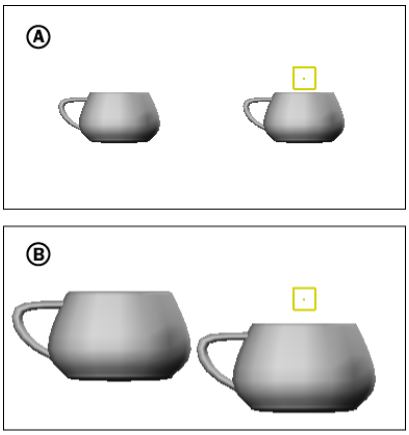
Option	Description
Rotation Offset	These values make it possible for you to offset rotation pivots using the Rotation Pivot (Auto Offset) values without affecting the translation of the selected object. These fields display the values used to compensate for changes to the selected object's translation caused when the "real" Rotation Pivot offset is calculated.
Rotation Pivot	These values display the real X, Y, and Z position of the rotation pivot, relative to the local translation point of the selected object. Adjusting these values can cause the selected object to move in translation. Instead of adjusting the position of rotation pivots using these values, you should use the Rotation Pivot (Auto Offset) values. The Rotation Pivot (Auto Offset) values automatically calculate Rotation Offset values to preserve the current location of the selected model.

- Rotating an object on page 692

Scaling Pivot properties

Scaling pivots let you define the point from which you want a selected object to be scaled.

For example, in the following figure, the mug on the left has a scaling pivot placed at its approximate center. The mug on the right has a scaling pivot offset to the top of the mug. When both mugs are scaled the same amount, the one on the left expands outward from the center, and the one on the right expands outward from the pivot.



A. **Mug on the right shows the Scaling pivot is offset on the Y-axis.**
B. **Models scaled from the two different points**

Scaling Pivot (Auto Offset)

These values let you define where the scaling pivot is offset on the X-, Y-, and Z-axis. The selected object is scaled from this point.

Adjusting the position of the scaling pivot does not affect the translation of the selected object, as an offset is automatically calculated to keep the object in place. The values used to create this offset display in the Scaling Offset fields.

Manual Offset

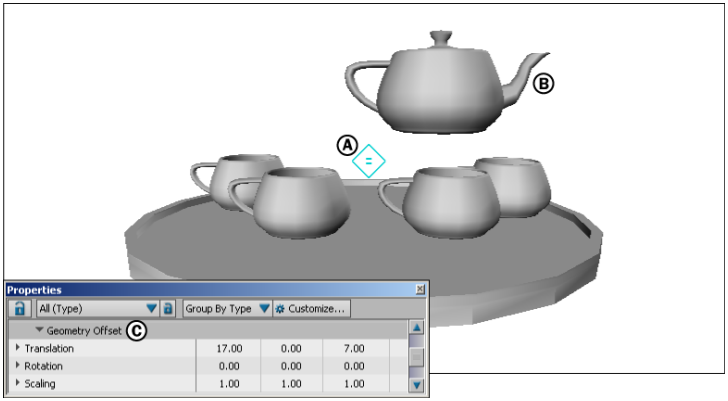
Exact Scaling Offset values are calculated by MotionBuilder when you adjust the Rotation Pivot (Auto Offset) values, and you do not need to adjust them manually. The following table describes the options in the Manual Offset group of properties:

Option	Description
Scaling Offset	These values make it possible for you to offset the scaling pivots using the Scaling Pivot (Auto Offset) values without affecting the translation of the selected object.These fields display the values used to compensate for changes to the selected object's translation caused when the "real" Scaling Pivot offset is calculated.
Scaling Pivot	These values display the real X, Y, and Z position of the scaling pivot, relative to the local translation point of the selected

Option	Description
	object. Adjusting these values can cause the selected object to move in translation. Instead of adjusting the position of scaling pivots using these values, you should use the Scaling Pivot (Auto Offset) values. The Scaling Pivot (Auto Offset) values automatically calculate Scaling Offset values to preserve the current location of the selected model.

Geometry Offset properties

The Geometry Offset properties let you define offsets between the geometry of the selected model and its hierarchical center. This means you can offset an object from its pivots without affecting its children.



A. **Hierarchical center icon indicates the hierarchical center of the tea pot object** *B.* **Tea pot geometry is offset from its hierarchical center, and the tea cup children are not affected.** *C.* **Properties window, Geometric Offset properties**

Translation

These X, Y, and Z values define the translation offset of a selected object from its hierarchical center.

Rotation

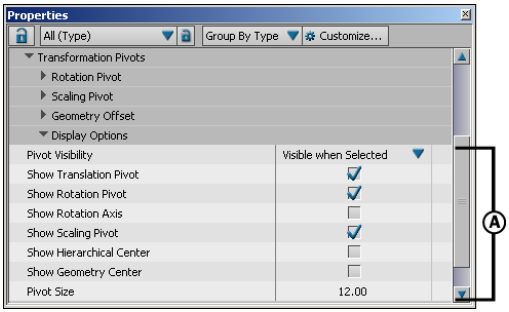
These options let you set X, Y, and Z values to offset the orientation of selected model's geometry from its hierarchical center.

Scaling

Use these X, Y, and Z values to define an offset when scaling the selected object from its hierarchical center.

Display Options properties

The Display Options group of properties let you decide when Transformation pivots display, show or hide individual Transformation pivots, and define their size.



Properties window *A.* **Pivot Display Options**

Pivot Visibility

This menu lets you specify when you want translation, rotation, and scaling pivots for selected models to display. You can choose from the following three options:

Option	Function
Disabled	Pivots are never visible.
Visible on Selection	Pivots are visible only when the object is selected.
Visible	Pivots are always visible.

Pivot Options

Expand the Pivot Options group of properties to view a set of properties that let you show and hide each type of Transformation pivot, as well as set their size.

Show Translation Pivot

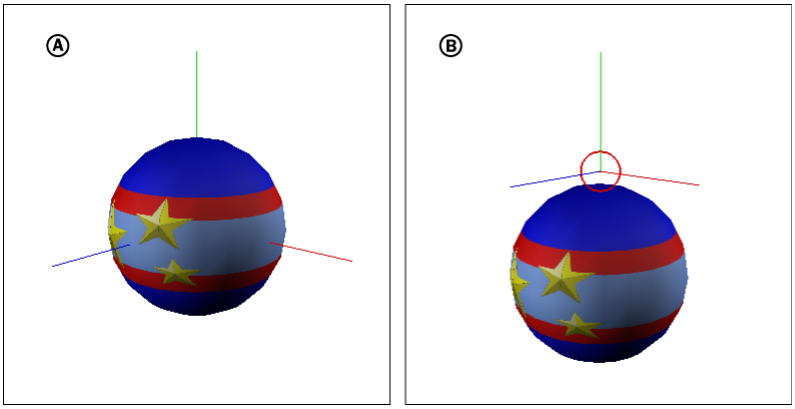
Displays the translation pivot, indicating where the local translation of the selected object is calculated.

Show Rotation Pivot

Displays the rotation pivot, indicating where the local rotation of the selected object is calculated.

Show Rotation Axis

Displays an axis icon that represents the rotational axis of the selected object. If you have not offset a rotation axis for the selected object, the axis displays at the object's center. If the rotation pivot is offset from the object, the axis displays on the rotation pivot.



Rotation axes *A.* **Rotation Axis at the center of a ball** *B.* **Rotation Axis is offset with the Rotation pivot to the top of the ball**

Show Scaling Pivot

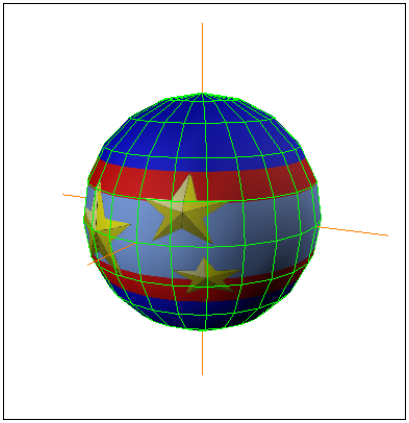
Displays the scaling pivot to show the point from which the local scaling of the selected object is calculated.

Show Hierarchical Center

Displays a light blue icon to indicate the final transformation of the selected object after the influence of transformation pivots, Degrees of Freedom, and pre- and post-rotation order are calculated. If the selected object is a parent to any child objects, transformations for the child objects are calculated from this point.

Show Geometry Center

Displays an orange axis at the center of a selected object when it is offset from its hierarchical center.



Geometry center icon displayed on a ball

Pivot Size

Sets the size of the transformation pivots. The default size is 12. Pivots always appear the same size in the Viewer window even when you zoom in or out.

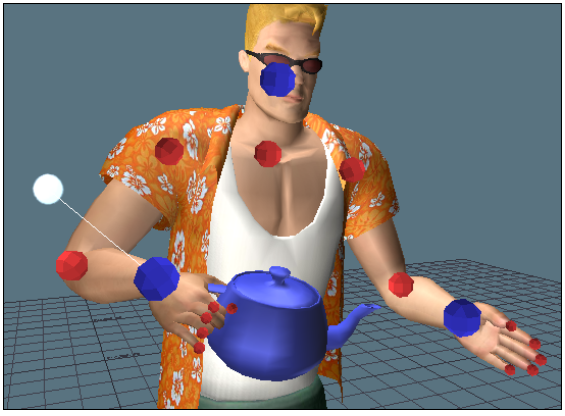
- Transformation pivots on page 701
- Manipulating Objects on page 677

Handles

43

Handles are 3D controls that give you quick access to the manipulation of objects in a scene. There are two ways you can use a Handle. The first use is to let you select objects, and the second is to let you access specific manipulation modes for the objects.

For example, you can use the handle to select a group of objects that do not have a hierarchy relationship, for example, a character's hand model and a teapot model.



Handle attached to the character's wrist.

This way, a Handle lets you select and manipulate a group of unrelated objects.

The second use of a Handle is that once you add a Handle to an object, it lets you create Follow objects which let you create a Parent/Child relationship that can be used as an instant transformation pivot.

With both of these uses, Handles let you quickly establish links between objects, and then use the Follow object as a pivot. See Connecting a Handle to an object on page 715.

In the image above, a Handle is attached to the model's wrist effector and a teapot model. You can then use the Handle to move both objects together.

Handles are Viewer window-based, which means the handle is applied directly to the object you want to affect in the Viewer window, and are created so you can easily select or disable them.

The Handle protrudes from the object, and always faces the camera. You can change the size, color, and position of the Handle, or attach an image to it to make it more easy to identify and select in scenes with many objects.

You can only see Handles when you are in X-Ray viewing mode in the Viewer window.

Follow and Manipulate objects

When you create a Handle you must assign objects to the Follow and Manipulate fields in the Handle settings.

Follow objects

Creating a Handle requires you to assign objects to the Follow field in the Handle settings. The Follow object is used as a Reference point for the Handle as well as a pivot point for the Manipulate object.

When you select a Handle, the Follow object is considered to be the only selected object within the Handle. This means that if you activate pinning when a Handle is selected, pinning is activated only for the Follow object. If you paste a pose with Match options activated, the pose is matched to the Follow object.

Manipulate objects

There are four kinds of Manipulate object types: Manipulate TR, Manipulate Translation, Manipulate Rotation, and Manipulate Scaling.

These are used to specify which way each object is transformed.

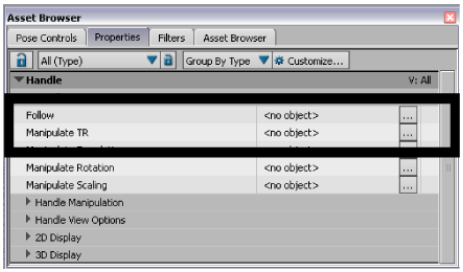
Object type	Description
Manipulate TR	Uses the Handle to influence translation and rotation of the Manipulate objects.
Manipulate Translation	Limits the Handle's influence to the translation of the Manipulate objects only.
Manipulate Rotation	Limits the Handle's influence to the rotation of the Manipulate objects only.

Object type	Description
Manipulate Scaling	Limits the Handle's influence to the scaling of the Manipulate objects only.

NOTE If you set an IK key with a Handle selected, a keyframe is set on all objects selected by the Handle. All Reach properties are keyed, but only the Reach of the Follow object is keyed at 100%. Reach values for all other objects are keyed at 0%.

Connecting a Handle to an object

1 Drag a Handle asset into the scene from the Elements folder in the Asset browser.



When you drop a Handle asset on an object, it is assigned to both the Follow and Manipulate TR fields.

2 Expand Handles in the scene browser. The new Handle is listed, named "Handle" by default.

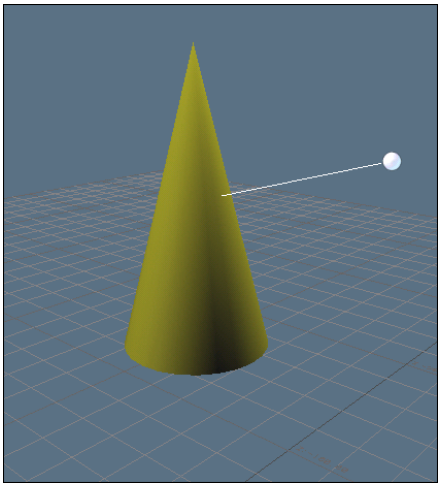
3 Alt-drag the object to be affected by the Handle from either the Scene browser or the Viewer window into the Manipulate TR field.

NOTE If you drop a Handle on top of an object, that object is automatically assigned to both the Manipulate TR and Follow fields in the Handle settings.

4 Assign any objects that you want to manipulate the translation, rotation, or scaling exclusively to the Manipulate Translation, Rotation, and Scaling fields. See Manipulate objects on page 714.

5 Alt-drag an object or objects into the Handle settings and drop it in either the Manipulate or Follow fields.

You can also drag a Handle into an empty space in the Viewer window and then assign objects to both the Manipulate and Follow fields. The Handle appears in the Viewer window as a line with a round knob protruding from of the Follow object.



A handle sticks out of an object with a round knob.

NOTE If you cannot see the Handle's knob, try changing the offset values.

Defining Handle Follow and Manipulate objects

To set a Follow object:

1. Select the Handle in the scene browser.
2. Expand the Handle settings in the Properties window.
3. Do one of the following things:
   - Alt-drag the object(s) that you want to use to lead the Manipulate objects into the Follow field.
   - Expand the Follow field's Asset list and activate the models that you want to assign as follow objects.

     NOTE When you select a handle, the follow object is considered the only "selected object" within the handle.

To set a Manipulate object:

1. Select the Handle in the scene browser.
2. Expand the Handle settings in the Properties window.
3. Do one of the following things:
   - Alt-drag the object(s) that you want to be affected by the actions of the Follow objects into the Manipulate TS, T, R, and/or S fields.
   - Expand the Manipulate fields' Asset list and activate the models that you want to assign as Manipulate objects.
   - Assign the object(s) you want to make the child of the Follow object to the Manipulate object field. The Manipulate object pivots around the Follow object.

Manipulating objects with Handles

Once you have created a Handle that connects objects, you can do the following:

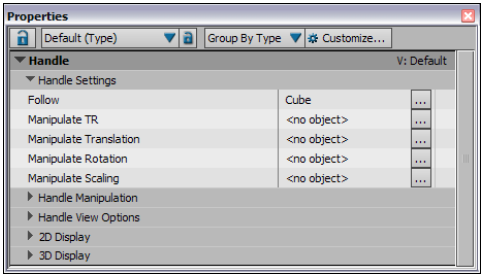
- Select the Handle and transform the Manipulate object.
- Select the Manipulate and/or Follow objects by themselves and transform them.

Handles can be resized, angled (offset), colored, and have text and images attached to them. See Handle settings on page 717.

Handle settings

The Handle settings let you set up your handle, assign Follow and Manipulate objects, and change other settings that affect the behavior of Handles.

Select the Handle to display the Handle settings in the Properties window.



Handles properties

The following settings appear in the Properties window when a Handle is selected in the Scene browser:

Follow

Contains the names of the objects designated to lead the Manipulate object. The Follow object is used as a reference point for the Handle as well as a pivot point for Manipulate objects.

The Follow object is not transformed if it is not assigned to any Manipulate fields. See Follow and Manipulate objects on page 714.

NOTE When you select a handle, the Follow object is considered the only "selected object" within the handle.

Manipulate TR

Assign the object(s) that you want to be manipulated in both Translation and Rotation mode to this field.

Manipulate Translation

Assign any Manipulate object(s) whose translation you want the Handle to influence to this field.

Manipulate Rotation

Assign any Manipulate object(s) whose rotation you want the Handle to influence to this field.

Manipulate Scaling

Assign any Manipulate object(s) whose scaling you want the Handle to influence to this field.

Handle Manipulation properties

The Handle Manipulation settings represent the translation and rotation modes you use when transforming objects with Handles.

Property	Function
Translation Mode menu	Select Rigid to lock the rotation of the effector. This is useful when you work with a character's hand and a prop.
Translate in Local	Activate to translate the object(s) relative to its Local coordinates, instead of the Scene's coordinates.
Rotate in Local	Activate to rotate the object(s) relative to its Local coordinates, instead of the Scene's coordinates.
Manipulate Around Handle	Activate to make the manipulator assume the Handle's position. You can use the Handle as the pivot for the object's translation and rotation.
Manipulate Around Origin menu	When Manipulate Around Handle is activated, select from this menu which handle you want to use as a center of manipulation. Select Prefer 2D to use the 2D Handle or Prefer 3D to use the 3D Handle.
Default Manipulation Mode menu	Lets you set a default manipulation mode (translation, rotation, scaling, and so on,)

Property	Function
	to be the active mode whenever you select the handle. See Manipulate objects.

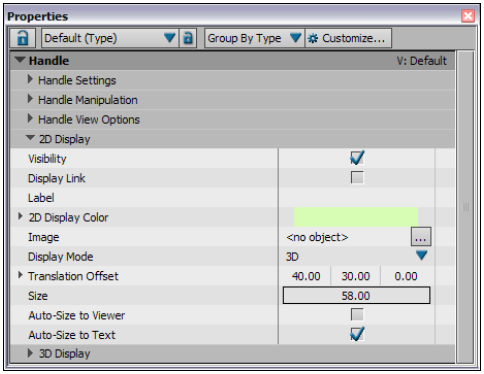
Handle Viewer Options

The Handle view options let you control for the visibility of Handles.

Visibility mode	Description
Show Handles	Disable this option to hide both the 2D and 3D Handles. Activate to show them. This option is different from the Visibility option in the 2D and 3D Handle settings. The Show Handle option hides the handle object, whereas the 2D or 3D Visibility options only hide the 2D or 3D view of the handle.
Visibility Mode	Lets you show or hide the Handle independently of the model being shown or hidden. Select Independent so the Handle continues to show even when you have hidden the Manipulate object.

2D Display properties

The 2D display settings let you customize the look of the 2D Handle and the Handle's knob so you can easily identify and select it.



Handles: 2D Properties

Customizing Handles is a good idea if you have a crowded scene where you cannot easily select the Handle without selecting something else.

NOTE You can have both 2D and 3D handles simultaneously.

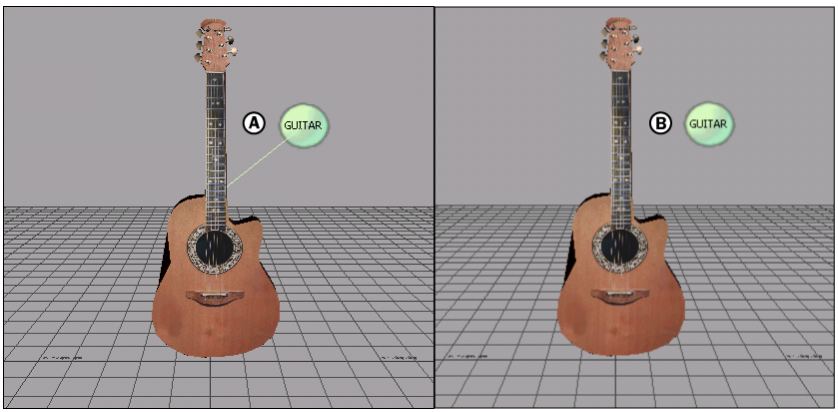
Select the Handle to display the Handle settings in the Properties window.

Visibility

Deactivate the Visibility option to hide the 2D Handle.

Display Link

Lets you show or hide the line that displays between the Handle knob and the Follow object.



Show Link option *A.* **The Show Link option is active.** *B.* **Show Link is disabled.**

Label

Click the Label field to give the Handle a name that appears on the handle.

This is not the same as renaming a handle in the Scene browser.

2D Display Color

Use the Color R, G, and B fields to set a different color for the 2D Handle. (The default is white.)

Image

Attach an image to your Handle so you can identify it quickly in crowded scenes. To do so, click the Asset List button in the Image field and select an image from the Asset list.

Display Mode menu

Lets you choose how the 2D Handle knob is shown in the Viewer window.

There are two options:

2D

Always the same XY distance from the object, relative to the Viewer.

3D

Always the same XYZ distance from the object, relative to the 3D world of the scene.

Translation Offset

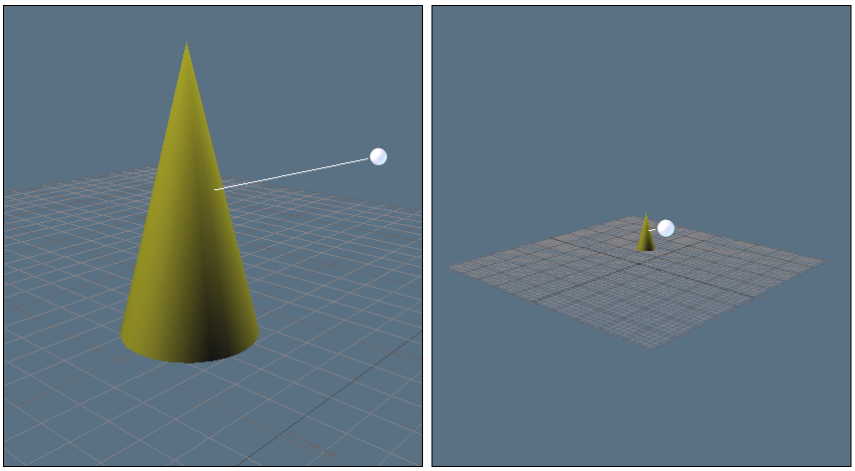
Lets you modify the X, Y and Z distance of the 2D Handle from the Follow object.

Size

Increase or decrease the size of the Handle knob so you can select it easily.

Auto-Size to Viewer

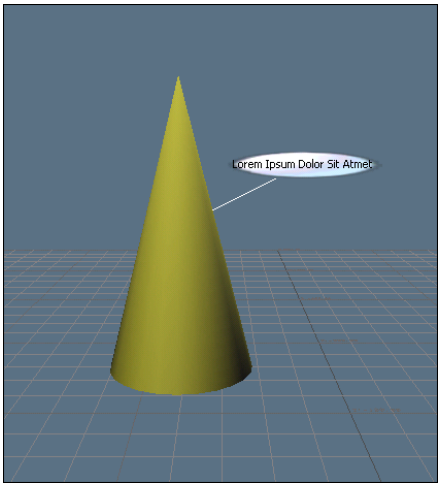
Activate to make the Handle a consistent size Label text, no matter how far away you get from it.



Activate Autosize to Viewer to make the handle the same size no matter how close you zoom in.

Auto-Size to Text

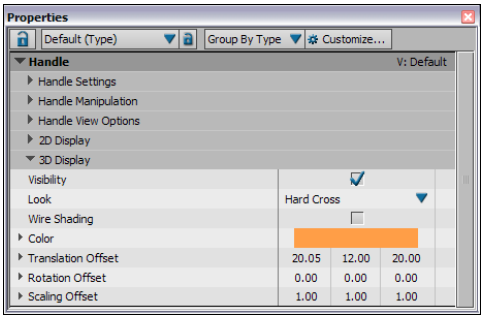
Activate to make the 2D Handle accommodate the label text (Label field), regardless of the Handle size or camera distance.



Using Auto-Scale to Text, the handle accommodates any text entered in the Label field

3D Display properties

The 3D display settings create a handle that appears in three dimensions. The 3D Display settings also let you customize aspects of the Handle's appearance, so you can easily identify and select it.



Handles: 3D Properties

Select the Handle to display the Handle settings in the Properties window.

NOTE You can have both 3D and 2D handles simultaneously.

Visibility

Deactivate the Visibility option to hide the 3D Handle.

Look

Lets you select a shape for the handle to assume, so you can easily distinguish it from the objects in the scene.

There are 4 shapes for the Handle knob:

- Cube
- Hard Cross
- Light Cross
- Faceted Sphere

Wire Shading

Lets you display the Handle in wireframe.

Color

Use the Color R, G, and B fields to set a different color for the Handle. (The default is gray.)

Translation Offset

Lets you modify the X, Y and Z distance of the 3D Handle from the Follow object.

Rotation Offset

Lets you rotate the handle so you can identify and select it easily.

Scaling Offset

Lets you scale the handle so you can identify and select it easily.

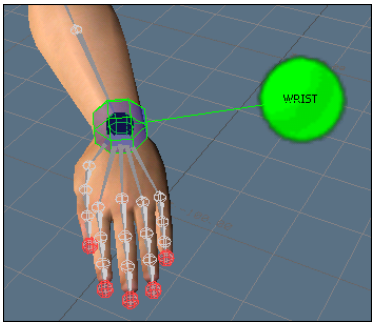
Transparency

Lets you set the visibility of the handle, with 0.0 being invisible and 100 being solid.

Auto Position 3D Model

Activate to center the 3D Handle to the geometry of the object that it is applied to. You can resize the handle to make a group of bones, for example, in a hand, easier to select.

This is useful for selecting bones on a complicated Control rig.



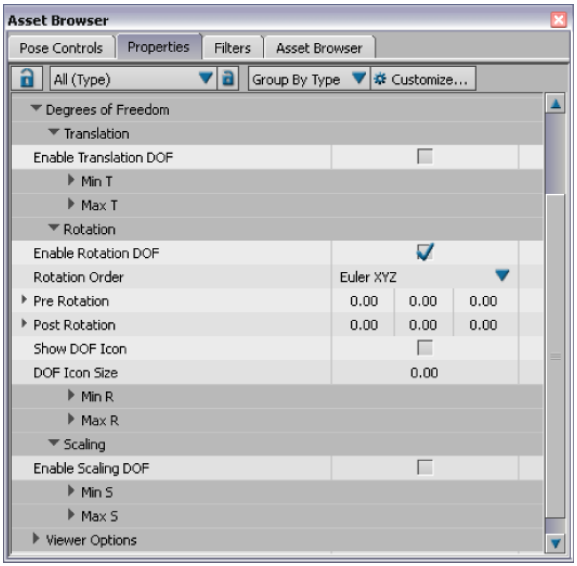
Activate Auto Position 3D Model to center the 3D Handle (the black

sphere) on the object to which it is applied (the wrist bone).

- Connecting a Handle to an object on page 715

Degrees of Freedom (DOF) 44

Degrees of Freedom (DOF) are a set of properties that let you set limits on the translation, rotation, and scaling of any selected object or animated hierarchy. Defining Degrees of Freedom for objects in a scene lets you restrict their range of movement.



Asset Browser Degrees of Freedom properties

Degrees of Freedom for translation let you define the coordinates an object is allowed to occupy on the X-, Y-, and Z-axes. For rotation, Degrees of Freedom properties let you define the angles an object can rotate through on the X-, Y-, and Z- axes. Degrees of Freedom properties for scaling let you limit the size of the selected object.

Although many objects can have DOF properties to limit their movement, these properties are commonly used with characters. For example, you can define Degrees of Freedom for the bones in a skeleton so that the arms of a model do not rotate through the body. You can also use DOF to prevent a character's limbs from colliding with other limbs in the same chain, or

to ensure that their joints do not rotate in impossible directions. You can also define Degrees of Freedom for a glove device even if no character is used.

With Degrees of Freedom, you can set limits on both the axis and rotation of any bone in a model's skeleton. You can retarget animation including DOF from one character to another, keeping the amount of data required low.

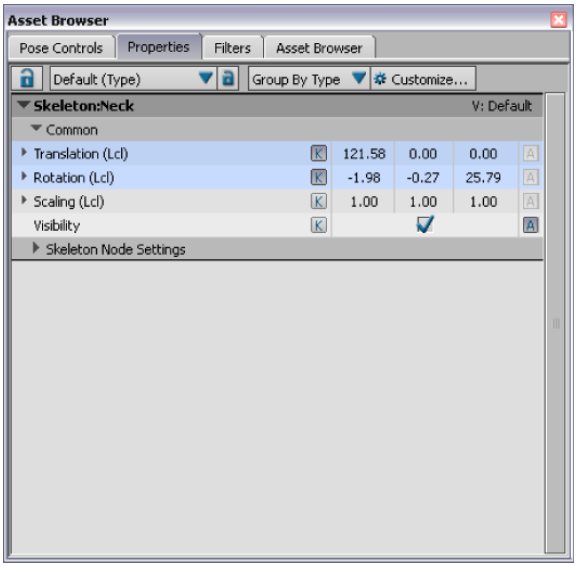
Degrees of Freedom are also important in terms of performance and overall efficiency, as they allow you to reduce the number of keyframes going into a project. This is crucial if you are trying to create animation with lighter amounts of data, such as in game development.

The DOF properties consist of the following main areas:

- DOF Translation Properties on page 730
- DOF Rotation Properties on page 732
- DOF Scaling Properties on page 737
- Viewing and modifying Degrees of Freedom on page 728

Viewing and modifying Degrees of Freedom

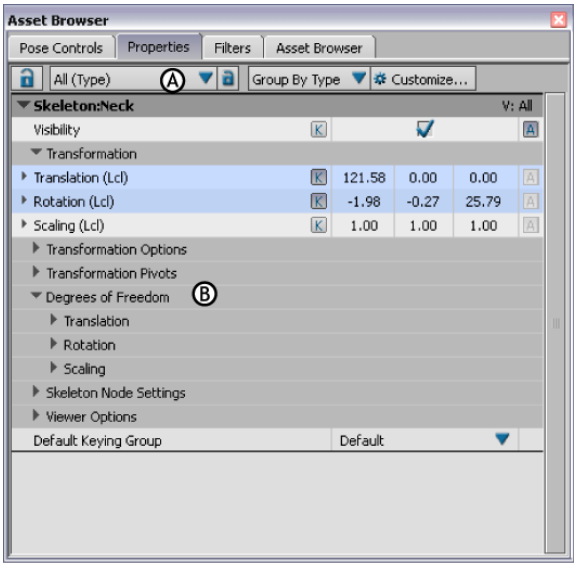
1 Select an object, such as a Skeleton node, and open the Properties window.



Skeleton node properties shown in Asset Browser Properties

2 Select the All (Type) view in the View menu (as shown in the following figure A) so that all available properties display, if it is not already selected.

3 Expand the Degrees of Freedom folder (as shown in the following figure B).



Asset Browser Properties *A.* **View menu All (Type) option** *B.* **Degrees of Freedom properties**

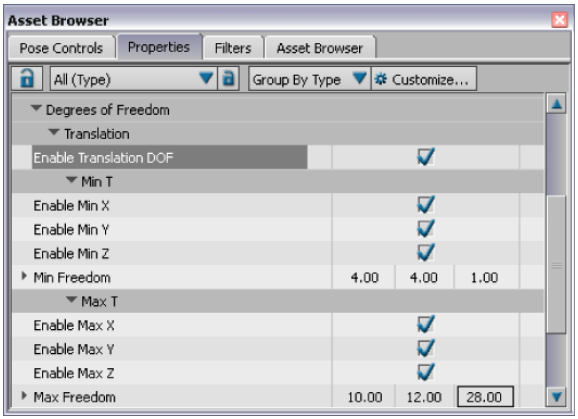
4 Expand the folders under the Degrees of Freedom folder to view and modify the DOF properties for the selected object.

- Degrees of Freedom (DOF) on page 727
- DOF Translation Properties on page 730
- DOF Rotation Properties on page 732
- DOF Scaling Properties on page 737

DOF Translation Properties

The DOF Translation properties let you restrict an object's linear movement between a minimum and maximum translation value.

You can use these properties to limit the movement of various models and prevent them from coming into contact with each other.



Degrees of Freedom Translation properties

Enable Translation DOF

Activates the limits on translation specified for each axis in the Translation Min and Max fields. When DOF translation properties are disabled, the Min T and Max T values are ignored and the object can translate in any direction.

Min T

Contains options that let you activate, disable, and define the minimum limits on translation for each individual axis. The following table illustrates the options found in the Min T group of properties.

Option	Description
Enable Min X, Y, Z	Activate and disable the limits on translation specified for each axis in the Min Freedom fields.
Min Freedom	Sets the minimum translation values the selected object can occupy on each individual axis. If an object tries to move past these values, its translation is constrained by the DOF.

Max T

Contains properties that let you activate, disable, and define the maximum limits on translation for each individual axis. The following table illustrates the options found in the Max T group of properties.

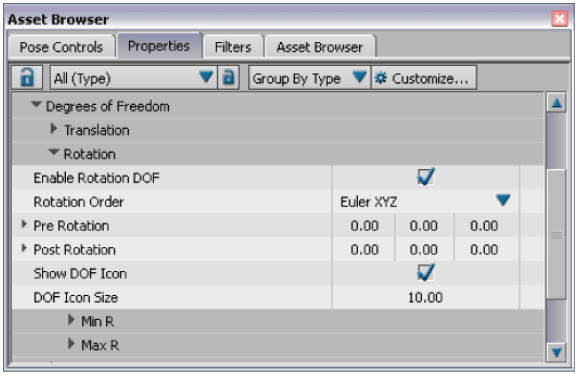
Option	Description
Enable Max X, Y, Z	Activate and disable the limits on translation specified for each axis in the Max Freedom fields.
Max Freedom	Specifies the maximum translation value the selected object can occupy on each individual axis.

■ Degrees of Freedom (DOF) on page 727

DOF Rotation Properties

The DOF Rotation properties let you limit an object's rotational movement.

NOTE The Dof Rotation property option "Enable MB5.5 Limits" is no longer available. As a result, a warning message now appears when you load MotionBuilder scenes that contain a character or characters that use the "Enable MB 5.5 Limits" property option. The recommended workaround for this change is to update the Control rig to remain compatible with MB scene files created in MotionBuilder versions post version 7.5 Extension 2. To update the Control rig, see MotionBuilder 5.5 Limitations.



Degrees of Freedom Rotation properties

Enable Rotation DOF

This option lets you activate or disable the DOF rotation properties. When DOF rotation properties are disabled, the Min R and Max R values are ignored and the object can rotate in any direction. When DOF Rotation properties are active, a wireframe sphere displays on the selected object.

Rotation Order

This menu lets you select the order of calculation for Euler rotations, which can help to prevent gimbal locks. The default Rotation Order is X, Y, Z. These options are useful if you want to change the main axis of a bone after the bone structure has already been created. You can also avoid problems such as gimbal locks by making the middle axis something other than Y

When you select a Rotation Order for a bone, the first axis listed is used as the roll axis for that bone. For example, if you select Euler XYZ, the X-axis is used for the roll axis on that bone.

The Rotation Order you select, and thus the roll axis that is used should be an axis that aligns with the bone, as it allows the bone to rotate, or twist on that axis.

TIP It is highly recommended that you select a Rotation Order and thus a roll axis that points down the bone.

You can view the roll axis defined for each bone by turning on the Show DOF Icon property. The DOF rotational sphere also shows you the roll axis.

The following table illustrates the rotation order options you can choose from.

Rotation Order	Behavior
Euler XYZ	Rotation on the Z-axis is calculated first, Y second, and X last. This is the default Rotation Order.
Euler XZY	Rotation on the Y-axis is calculated first, Z second, and X third.
Euler YZX	Rotation on the X-axis is calculated first, Z second, and Y third.
Euler YXZ	Rotation on the Z-axis is calculated first, X second, and Y third.

Rotation Order	Behavior
Euler ZXY	Rotation on the Y-axis is calculated first, X second, and Z third.
Euler ZYX	Rotation on the X-axis is calculated first, Y second, and Z third.
Spheric XYZ	You can use this option for joints that have a wide area of rotation such as the shoulders.Only use this rotation order if you need to keep Spheric rotation limits created in earlier versions of MotionBuilder. This option is not recommended.

NOTE Spheric XYZ calculations are not supported by any other 3D package, and cannot be exported. Using this option is not recommended if you are exporting your scene to other software packages.

Pre Rotation

These values let you offset the rotation sphere orientation before the limits on rotation are calculated. As you adjust the values in these fields, the rotation sphere in the Viewer window gives you visual feedback.

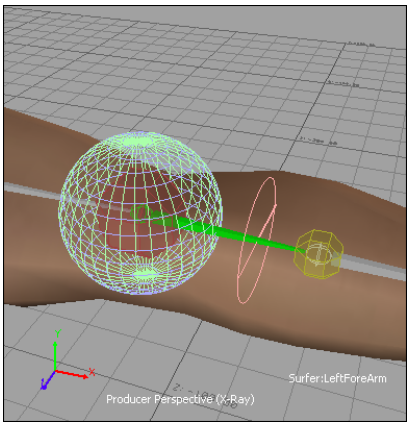
Post Rotation

This option lets you offset the rotation pivot orientation after the limits on rotation are calculated. As you adjust the Post Rotation values, the rotation sphere in the Viewer window gives you visual feedback.

Show DOF Icon

Shows or hides the DOF rotational sphere.

The DOF rotation sphere displays on the selected object in the Viewer window, giving you visual feedback on the limits on rotation you have set, and identifying which is the roll axis for the selected bone.



DOF Rotation sphere displays on the LeftForeArm bone

DOF Icon Size

Defines the size of the DOF rotational sphere that appears in the Viewer window to visually represent the rotational DOF properties. The default size is 10.

Min R

Contains a set of check boxes and fields that let you enable, disable, and define the minimum rotation values allowed per axis for the selected object. The following table describes the options found in the Min R group of properties.

Option	Description
Enable Min X, Y, Z	Activate and disable the limits on rotation specified for each axis in the Min Freedom fields.
Min Freedom	Specifies the minimum value the selected object can rotate to on each individual axis. If an object attempts to rotate past these values, its rotation clamps to the minimum value.

Max R

Contains options that let you activate, disable, and define the maximum rotation values allowed per axis for the selected object. The following table illustrates the options found in the Max R group of properties.

Option	Description
Enable Max X, Y, Z	Activate and disable the limits on rotation specified for each axis in the Max Freedom fields.
Max Freedom	Specifies the maximum values the selected object can rotate to on each individual axis. If an object attempts to rotate past any of these limits, its rotation clamps to the maximum value.

If you load MotionBuilder scenes that contain a character or characters that use the "Enable MB 5.5 Limits" property option, you need to update a Control rig to remain compatible with MotionBuilder scene files created in MotionBuilder versions post version 7.5 Extension 2.

To update a Control rig to remain compatible with older versions:

1. Load in a version of MotionBuilder prior version 2009 your file containing the character that uses the "Enable MB 5.5 Limits" property.
2. Select all the skeleton's bones and open the Properties window.
3. Select the All (Type) view in the View menu to display all available properties.
4. Expand Degrees of Freedom > Rotation > Post Rotation and disable the "Enable MB5.5 Limits" option.

   Once you disable the "Enable MB5.5 Limits" option, you are ready to update the rig.
5. If there is no animation, follow the instructions in steps, 6, 7, and 8. If there is animation, proceed to step 9.
6. Put the character in a T-stance.
7. In the Navigator scene browser, delete the character constraint.
8. From the Asset Browser's *Templates* folder, drag and drop a new Character constraint on your character's bones in the Viewer window and choose Characterize.
9. If there is animation, plot the animation onto the skeleton.

10 In the Character Controls window, put the character in a t-stance.

11 In the Navigator scene browser, delete the character constraint.

12 From the Asset Browser's *Templates* folder, drag and drop a new Character constraint on your character's bones in the Viewer window and choose Characterize.

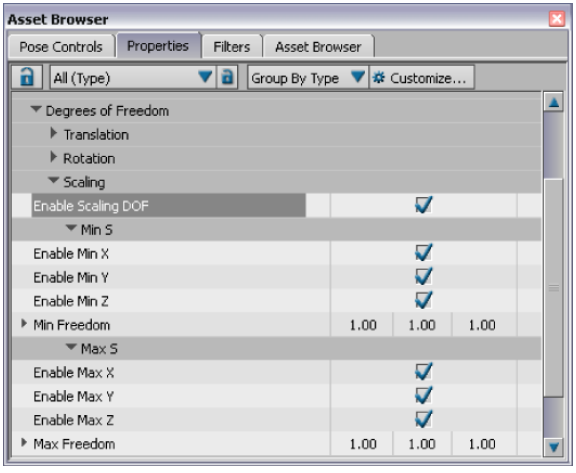
13 Scrub the timeline to verify the animation is still present.

14 Plot animation to a new rig.

- Degrees of Freedom (DOF) on page 727
- Rules for setting rotation DOF on a character on page 738

DOF Scaling Properties

The DOF Scaling properties let you limit the size of an object. For example, you can define the DOF scaling properties so that a selected object cannot be scaled to a negative value.



Degrees of Freedom Scaling properties

Enable Scaling DOF

Activates or disables the Degrees of Freedom allowed for the scaling of the selected object. When DOF scaling properties are disabled, the Min S and Max S values are ignored and the object can be scaled in any direction.

Min S

Contains a set of check boxes and fields for activating, disabling, and defining the minimum scaling values allowed per axis for the selected object. The following table describes the options found in the Min S group of properties.

Option	Description
Enable Min X, Y, Z	Activate and disable the minimum scaling values specified for each axis in the Min Freedom fields.
Min Freedom	Specifies the minimum scaling values the selected object can have on each individual axis. If an object attempts to scale past these limits, its size is constrained by the minimum value.

Max S

Contains options that let you activate, disable, and define the maximum scaling values allowed per axis for the selected object. The following table illustrates the options found in the Max S group of properties.

Option	Description
Enable Max X, Y, Z	Activate and disable the limits on scaling for each axis in the Max Freedom fields.
Max Freedom	Specifies the maximum scaling values allowed for the selected object on each individual axis. If an object attempts to scale past these limits, its size is constrained by the maximum value.

- Degrees of Freedom (DOF) on page 727

Rules for setting rotation DOF on a character

When you limit the rotation of a character's bones using Degrees of Freedom (DOF), those limits always have priority and are always respected during

solving. However, it is important to note that some DOF settings may prevent a character from reaching its goals.

The following set of rules can help you create a character that reaches its goals even with Degrees of Freedom activated on its bones.

Bone	Rule
Arms, legs, and fingers	One axis must be aligned with the bone, and this axis should match the roll axis, which is the first axis of the Rotation order you have selected.
Hips	DOF set on hip bones do not affect the Reach of the hands and feet. However, setting DOF on hip bones is not recommended since the hips are always animated in global space. DOF can be set on all three axes.
Spine	Limiting the DOF on Spine bones does not affect the Reach of the hands, but may prevent Upper Chest Effectors from reaching their goals. This occurs because the first Spine bone is important during IK solving. DOF can be set on all three axes.
Clavicle	Setting DOF on clavicle bones does not affect the Reach of the hands. DOF can be set on all three axes.
Shoulder or hip	Only the roll axis can have DOF limited, and the other two axes should be free. If you limit the DOF for the roll axis, be sure to have an associated roll bone or expect to have DOF on all three axes for the elbow or knee bones.
Elbows and knees	Limiting the DOF for the elbows and knees lets you control the maximum extension angle for the arm or leg. Elbow and knee bones must have at least one axis, other than the roll axis, with no DOF set. It is recommended that the free axis be the last listed in the Rotation Order you have selected, and it should be aligned or close to the natural bending axis of the arm or leg. In addition, if you limit the DOF for the roll axis, be sure to have an associated roll bone or have DOF for all three axes limited on the wrist and ankle.
Wrists and ankles	DOF can only be set for the roll axis. The other two axes must be free.

Bone	Rule
Roll	All roll bones can have DOF. It is recommended that you completely limit the DOF for the last two axes listed in the Rotation Order you have selected, and set no DOF for the first axis.
Fingers and toes	The first bone of each finger and toe should have no DOF on any axis. All other finger and toe bones can have only one axis with no DOF defined. It is recommended that this DOF be the last of the Rotation Order and should be aligned or close to the natural bending axis of the finger or toe.

- DOF Rotation Properties on page 732

Part 6: Basic Keyframe Animation

The animation process is the method by which an animator simulates movement in a sequence by displaying a series of pictures, or frames. Traditional animation and computer-generated 3D animation are similar, but differ in some fundamental ways.

Keyframing is the recording of a parameter's value at a specific moment in time, advancing the time, then recording the value again. The computer determines what has occurred between the recorded values, and fills in the blanks between keyframes.

Animation simulates movement through a sequence of changing images in a scene. The scene holds all the elements of the animation, and can contain one or multiple objects.

Traditional and computer-generated animation

In traditional animation, animators draw or paint individual pictures for the most important actions in a sequence. The action between these key points is filled in with other pictures. The process of filling in the action between key points is referred to as *in-betweening* or *tweening*.

Once all the pictures are added, they are joined together in a sequence to complete the animation. When the animation plays, the viewer sees continuous movement. This is because the eye does not differentiate between the separate images, and sees only one image creating the illusion of continuous motion.

A simple example of one of the oldest forms of animation is the "flip book". The flip book consists of a series of pages, each page containing a picture subtly different from the previous picture.

For example, in the following illustration, each star represents a separate picture. Flipping through the pages creates the illusion of the star moving up and down.

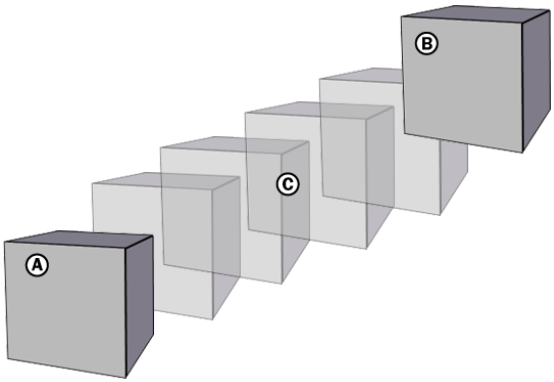
Successive images in a "flip book" animation

Animators using 3D software also emphasize key action points in a sequence at specific points in time (frames) by setting a mark called a *keyframe*.

However, unlike traditional animation, the computer software simplifies the animation process by automatically filling in the action between the keyframes with in-between frames. This process, called *interpolation,* is what lets you perceive smooth, continuous motion when you play your animation.

For example, the following illustration shows the interpolation of a simple animation that starts with only two keyframes. The first keyframe marks the cube's position at the beginning of the animation, and the second keyframe marks the location of the cube at the end of the animation.

The computer program adds the additional frames between the two keyframes to provide the illusion of smooth, continuous motion when the animation plays.



Simple animation *A.* **Keyframe on frame 0** *B.* **Keyframe on frame 10** *C.* **Interpolation adding frames between the keyframes**

In MotionBuilder, you can set keyframes manually, or you can use motion capture data. You can also use poses, constraints and devices to create animation.

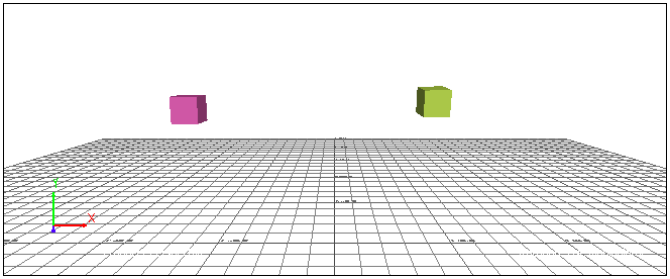
See also:

- Creating a custom keying group on page 839
- Mapping pose and keying group properties on page 748

Animating an object

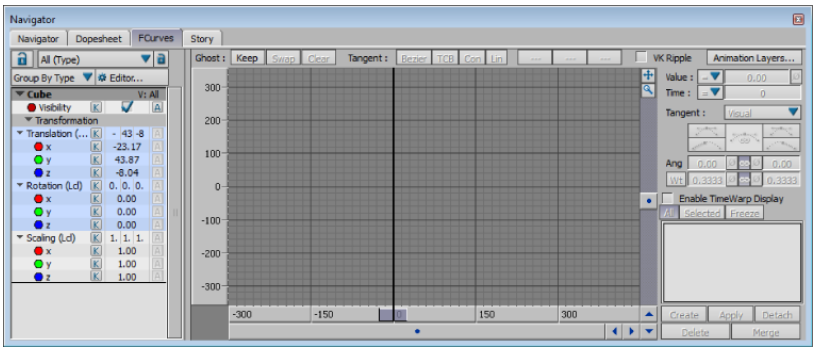
This topic describes the basic procedure to animate a simple cube (available in the Asset browser). While there are many ways to use MotionBuilder as an animation tool, you can use the following procedure as a basic guide and introduction to important tools and windows.

1 Drag two cubes from the Elements folder of the Asset browser into the scene, positioning them similar to the cubes in the following picture.



Optional: You can change the color of the two cubes by adding a material to each, then changing the Diffuse property.

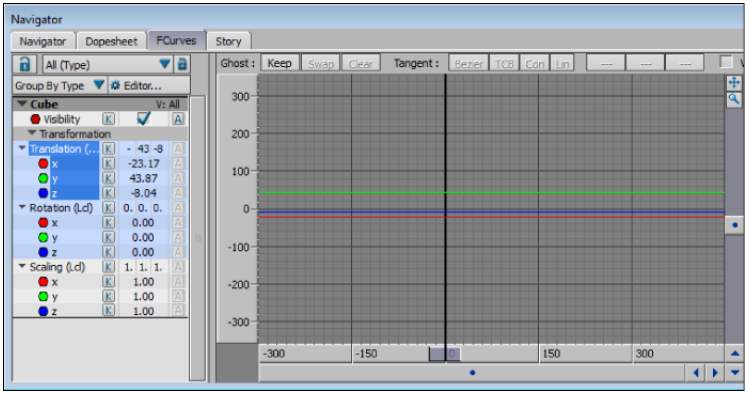
2 Select the cube on the left, then open the FCurves window if it is not already open in the current layout.



FCurves window

The properties of the selected cube display in the FCurves properties pane as well as in the Properties window.

3 In the FCurves window Properties pane, click the Translation (Lcl) header to select the cube's Translation properties.



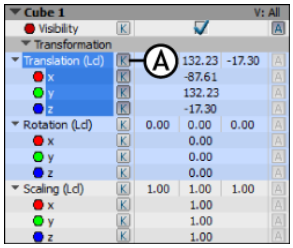
Cube's Translation properties selected, showing the function curves

The cube's translation properties are selected and their representative function curves display. Right now, the function curves are flat because the cube is not yet animated.

The color of the function curves correspond with the color of the axis they represent. By default, the function curve for the X-axis is red, the Y-axis is green, and the Z-axis is blue.

4 With the Translation (Lcl) properties still selected, set a keyframe by doing one of the following:

- In the Properties pane, click the Keyframe (K) button next to the Translation (Lcl) header to set keyframes for the X, Y, and Z translation properties simultaneously.
- Press K on your keyboard.
- Click Key in the Key Controls window. If the Key Controls window is not available in your current layout, click Window > Key Controls in the MotionBuilder menu bar.
- Click the Key (K) buttons in the Properties window.

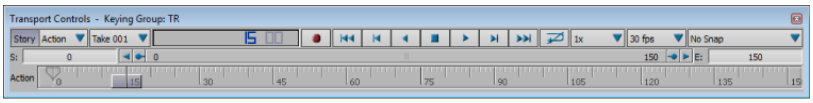


Properties pane *A.* **K button for Translation properties**

One keyframe displays on each function curve. On the Action timeline, one visual keyframe represents all three translation properties.

Now that you've set a keyframe, you can also modify the function curves by manipulating the keyframes on the function curves themselves, or change the time or value in the FCurves Options pane.

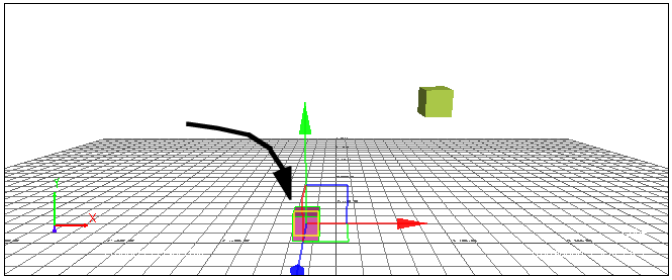
5 Advance the Timeline indicator to frame 15.



Transport Controls window

6 Do one of the following to translate the selected cube higher and to the right:

- Click in the Viewer window and press T to activate Translation mode, then translate the selected cube upward on the Y-axis.

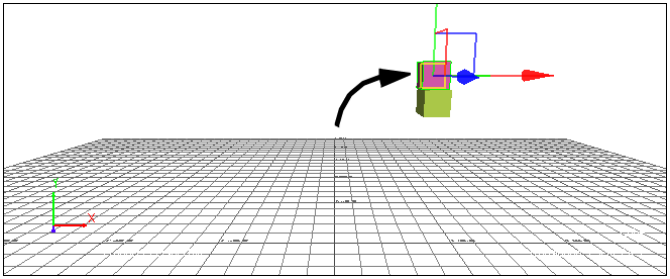


- In the FCurves window, drag in the value fields next to a property in the Properties pane.

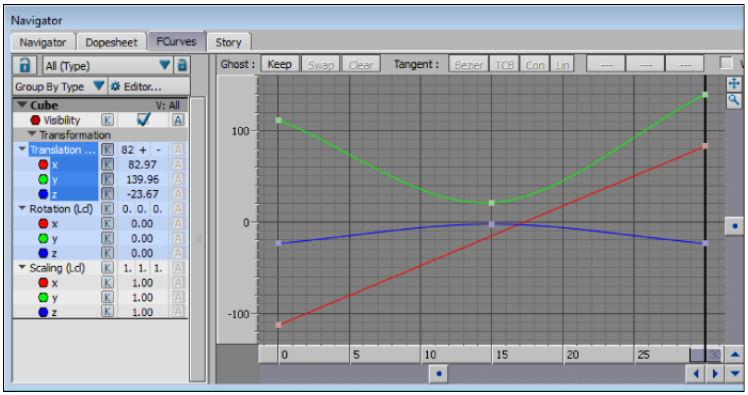
- Translate the first cube higher and to the right.

7 With the Translation properties still selected in the FCurves window, set a keyframe.

8 Go to frame 30 and translate the first cube until it sits on top of the second as shown in the following figure, then set another keyframe.



9 Click in the FCurves pane, then press A to frame the function curves.



Function curves framed

10 Drag around the three keyframes on frame zero to select them.

Tangent handles display on the selected keyframes, and their coordinates display in boxes on the horizontal (time) and vertical (value) axes.

11 In the Transport Controls window, drag the right Stretch handle on the Zoom bar to 60.

This zooms on the animation from frame 0 to 60, adjusting the Action timeline to the length specified by the Zoom time codes.

12 Play your animation using the Transport Controls. See Play Controls on page 803.

Animating with poses

A "pose" is a snapshot of an object (or character) in 3d space in a scene at a specific moment in time. The snapshot will consist of the values recorded for a set of properties (keying mode or group) which is active at the time you create the pose. For example, you can place an object in your scene, transform it (translation, rotation, scale properties) and then create your pose.

See Keying Mode menu on page 853 for information about what the standard keying modes are.

See Creating a custom keying group on page 839 and Mapping pose and keying group properties on page 748 for more information about how you can key properties for objects.

NOTE When you create a pose, the only properties that are recorded are the ones contained in the keying group that was active at the time you captured the pose.

1 Select an object in a scene

2 Choose the keying group of properties you require from the keying mode menu in the Key Controls window

3 Select the Pose Controls tab in the Asset Browser

4 Click Create

- MotionBuilder will take a thumbnail picture of the pose and add the pose to the Pose browser.
- The new pose will take the name of the object on which it was based—and will be numbered incrementally for each pose created for an object. If more than one object is selected for the pose, the names of the objects will be concatenated for the name of the pose.

See Poses on page 1485.

NOTE An object-pose limitation exists around creating an object-pose when you have no object selected. If you have four or more primitives in your scene, and do not have any one of them selected when you try to create a pose, MotionBuilder doesn't know which object on which to base the pose, and so no pose is created.

Object pose workflow

You can apply an existing pose to an object also—the property values from the pose's keying group will be applied to the object(s) selected in the scene.

1. Move the timeline indicator to point when you want to create a keyframe.
2. Select an object in the scene.
3. Select the Pose Controls from the Asset browser.
4. Select a pose from the Pose browser.
5. Click Paste.
6. Press "K" to create a keyframe.

See also

- Creating a ragdoll solve with poses on page 1701

Mapping pose and keying group properties

Use the Connection Editor to map channels between a custom object keying group (either "Object Type" or "Global") and a pose—so that when you apply that particular pose to another object, the only properties that are keyed are the specific ones you've selected. You can create many object poses with the same keying group—and then use the Connection Editor to create a mapping of object keying group properties to pose properties that is unique for each pair (keying group and pose).

This feature is particularly useful if you're keying many different instances of the same type of object or character movement. For example, your scene may have two different gun props in it—each with bolts and triggers. The action (or poses) of each gun may be the same (the bolts and triggers may move the same way), but some properties will be different (textures, rotation and translation may be "local" for each gun). Using the Connection Editor, you can map specific properties that will always be the same for some keying groups and poses, while the gun objects can still have their own local keying groups maintained.

To customize the mapping between keying group properties and a pose:

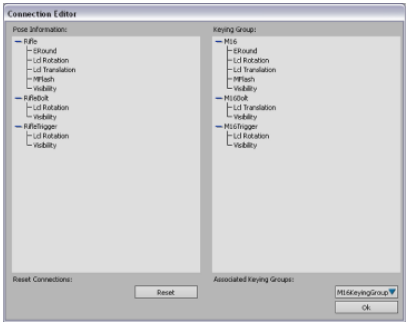
1. Create an Object Keying Group of either "object type" or "global". See Creating a custom keying group on page 839.
2. Create a pose that uses the custom keying group created above.

3 In the Pose Controls window, right-click the new pose in the Pose browser, and select Display Connection Editor.

4 Select a Pose Information property from the left column, and then in the right column, click the Keying Group property you want to map it to.

- You can undo your mappings by clicking Reset. This will restore the default mappings that were created automatically for the pose between corresponding properties.

5 Click OK to close the Connection Editor and save the relationship between the pose and the keying group.



See also:

- Creating a custom keying group on page 839
- Object pose workflow on page 748
- Creating a pose on page 1486

Animating with constraints

You can use constraints to animate in real-time or to create keyframe animation. Constraints let you link an object that is not animated to an object that is animated in order to animate them both.

For example, in the following image, there is a Parent-Child constraint between the soccer ball and Surfer's hands. The soccer ball does not have keyframe animation, but as the Surfer moves, so does the ball. You can also animate the constraint itself, so that the ball follows Surfer's hands only at certain times.

Soccer ball constrained to Surfer's hands

There are many different types of constraints. You can also constrain models to an animation path, or animate using multiple references. See Animating with Constraints on page 1023.

Animation with devices

You can use devices to animate in real-time or to create keyframe animation.

Devices, such as joysticks and mouse, let you animate objects. For example, in the following image, a Mouse device is constrained to Surfer's eyes to make them rotate.

Mouse device constrained to Surfer's eyes

You can use many types of devices. See Animating with Devices on page 1211.

Part 1: Changing properties

Every object in a MotionBuilder scene has transformable properties. Some objects have translation, rotation, and scaling properties, while others have properties for shape, color, intensity, and so on.

For example, you can use the Properties window to make all your Actors look different, customize Control rigs, and change the Fog intensity and Cone angle of lights.

Modifying the properties of one or more selected objects in the Properties window displays the changes in the Viewer window in real time. You can modify the properties of most objects using a combination of value boxes, lists, and sliders.

The Properties window also lets you select properties for keyframing, and you can animate properties in the Properties window for use in Expressions and Relation constraints.

- Properties window on page 765
- Dopesheet window on page 865

Selecting properties for animation

To set keyframes on a specific property, it must be selected.

To select a property in the Properties window:

1. Select an object in the scene (such as a light).
2. In the Properties window, click the name of the property you want to select and animate.

   If the name of the property is highlighted in dark blue, the property is selected and you can animate it. Properties you can animate always have Keyframe (K) and Animate (A) buttons.

If the name of the property is highlighted in dark gray, the property is selected but you cannot animate it.

If a property is highlighted light blue before you click on it, it is already selected for animation and you do not need to click it. See Keying groups on page 837 for more information.

To select a property in the Navigator window:

1. Double-click an object so that it is selected and its settings display in the Navigator window.
2. In the Asset Settings area, click the name of the property to select it.

   If the name of the property is highlighted blue, the property is selected and you can animate it. Properties you can animate always have Keyframe (K) and Animate (A) buttons.

- Keyframe (K) and Animate (A) buttons on page 822
- Properties window on page 765
- Navigator window on page 91

Modifying and animating properties

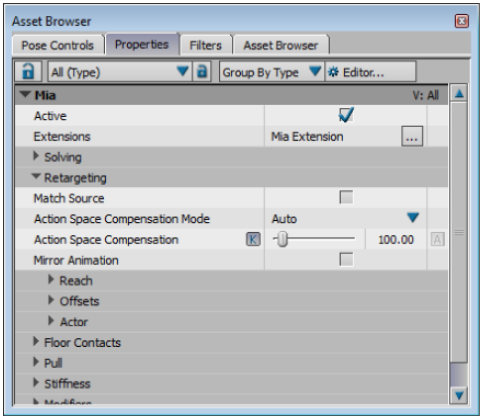
To modify and animate properties:

1. Select the object you want to modify in the Viewer window or Scene browser.
2. Use the Property settings to change the object's property values.

To modify properties on the same types of objects at the same time:

1. In the Properties window, select the Group By Type option in the Group Properties menu.
2. Select the object you want to modify in the Viewer window or Scene browser.
3. Use the Property settings to change the object's property values.

For example, the following figure shows the properties for a selected character, which also appear in the Character settings.



A character's properties display.

To keyframe a property:

1 Select the property in the Property list.

2 Click its Keyframe button.

To keyframe multiple properties:

1 *Ctrl*-click the properties in the Properties window.

2 Press K on the keyboard, or use the Key button in the Key Controls window.

To use a selected property in a constraint without setting a keyframe:

➤ Click the Animate (A) button for the selected property.

- Setting keyframes on page 819
- Keyframe (K) and Animate (A) buttons on page 822
- Viewer window on page 49

Creating a custom view of properties

You can choose which properties display in the Properties window for selected objects.

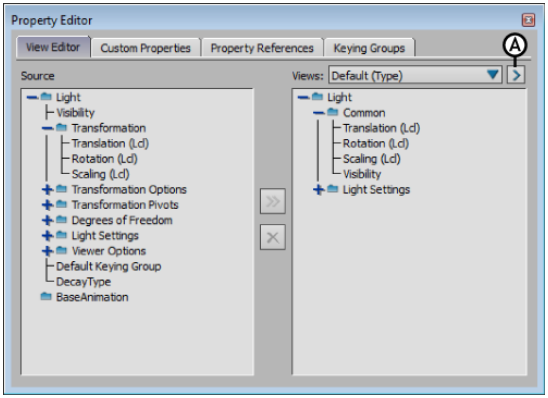
To create a custom view of properties:

1 In the Properties window, click the Editor button.

2 In the Properties Editor that appears, select the View Editor pane.

3 Click the View Options button, and select Create New View as > *x* from the menu, where *x* is Local View, Object Type View, or Global View.

- Select Local View if you want to create a view for the selected object only.
- Select Object Type View if you want to create a view for all objects of the same type as the selected one.
- Select Global View if you want to create a view for all objects.



Property Editor *A.* **View Options button**

4 Click the View Options button again, and select Rename View to give the view a more descriptive name.

5 In the Source area on the left, *Ctrl*-click the properties you want to add to the custom view.

6 Click the Add button in the middle of the pane to add the selected properties to the custom view. You can also click the Remove button to remove properties from the custom view.

7 When you are done, close the window. The custom view is automatically saved and you can select it from the View menu in the Properties window.

To delete a custom view:

1. In the Properties window, click the Editor button and select the View Editor pane in the Properties Editor that appears.
2. In the View menu of the Properties Editor, select the property you want to delete.
3. Click the View Options button and select Delete View.

Creating custom properties

To create a custom property:

1. Select the object to which you want to assign the new property.
2. In the Properties window, click Editor.
3. In the Property Editor that appears, select the Custom Properties pane.
4. Drag a property type from the Add Property area onto an object in the Destination area.

   TIP You can also use the Add button to assign selected property types.

   The custom property is assigned to the selected object.
5. To rename the custom property, select the custom property in the Destination area, double-click in the Name field, type a name and press Enter.
6. When you close the window, the new property displays in the Properties window.
7. In the Properties window, click the custom property's Animate (A) button so that you can use it in constraints.
8. Connect the custom property to objects.

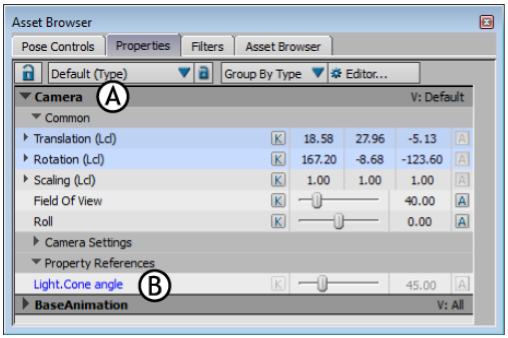
   See Animating with Constraints on page 1023, Mapping pose and keying group properties on page 748, and Creating a custom keying group on page 839.

■ Property Editor on page 775

Property references

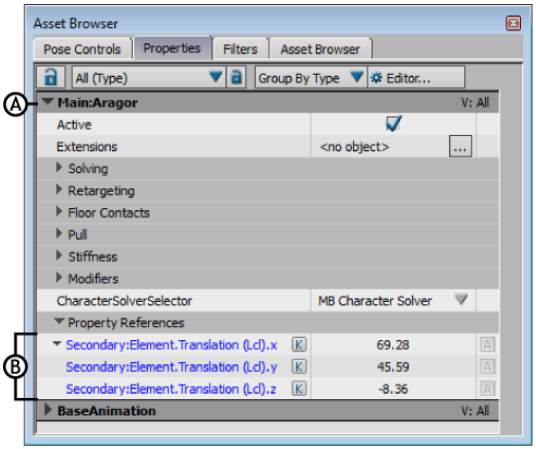
You can associate one element's properties with another element, to let you access an element's properties when it is not selected. For example, you can associate a light's Cone Angle property with a camera. When you select the camera, a "Light.Cone angle" property displays after the Camera's properties.

This "Light.Cone angle" property refers to the light's Cone angle property, and so it is called a *property reference*. The original property still displays with the other light properties when you select the light.



Properties window *A.* The camera is selected but the light is not *B.* The "Light.Cone angle" property reference is blue

Elements' namespaces are also carried over and taken into account as shown in the following Asset browser Properties figure for elements' property references.



Properties window *A.* **Element with prepended namespace** *B.* **Property references showing inherited namespace**

- Creating a property reference on page 759
- Deleting a property reference on page 763
- Property References pane on page 782

Creating a property reference

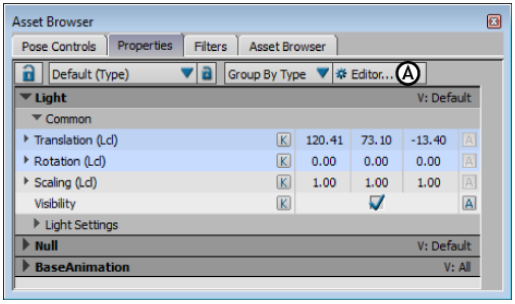
Create property references using the Property Reference pane or the Viewer window.

NOTE Properties and property references take into account inherited namespaces.

A null and light are used as an example in the following steps.

To create a property reference with the Property Reference pane:

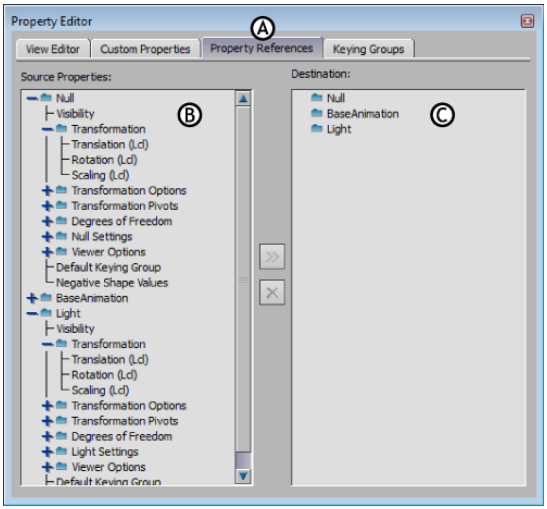
1. From the Asset browser, drag a null and a light into the Viewer window, then select both elements.
2. In the Properties window, click Editor.



Properties window *A.* **Editor button**

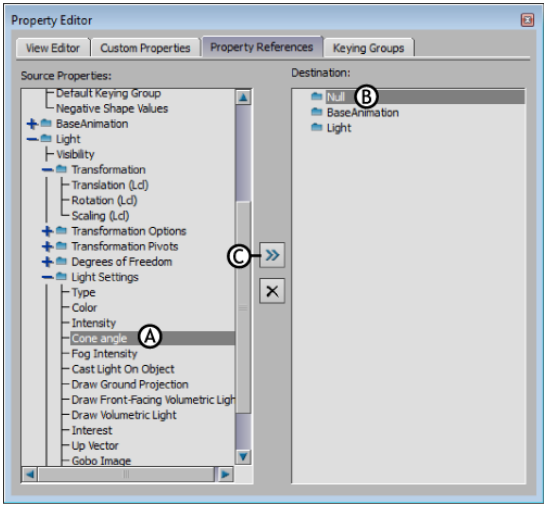
3 In the Property Editor window, select the Property References tab.

The selected null and light's properties display in the Source Properties area and the null and light display in the Destination area.



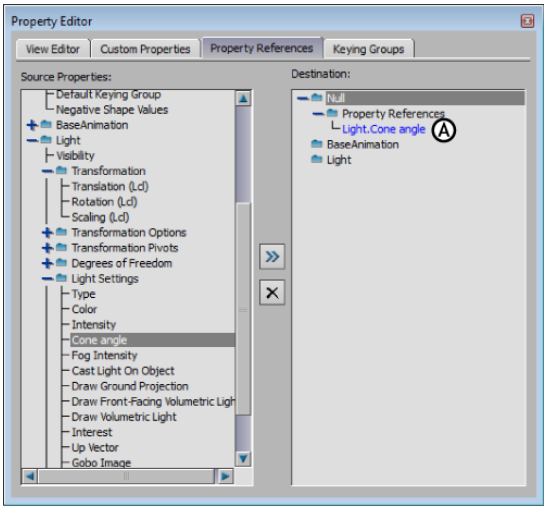
Property Editor *A.* **Property References pane** *B.* **The null and light's properties display in the Source Properties area.** *C.* **The null and light display in the Destination area.**

4 In the Source Area, expand the Light Settings folder and select the Cone Angle property, then select the null in the Destination area.



Property References pane *A.* **Select the Light's Cone Angle property.** *B.* **Select the null.** *C.* **Click the Add button.**

5 Click Add. A Property References folder appears, containing the new property reference.



Property References pane *A.* **Light.Cone angle property reference added to the null.**

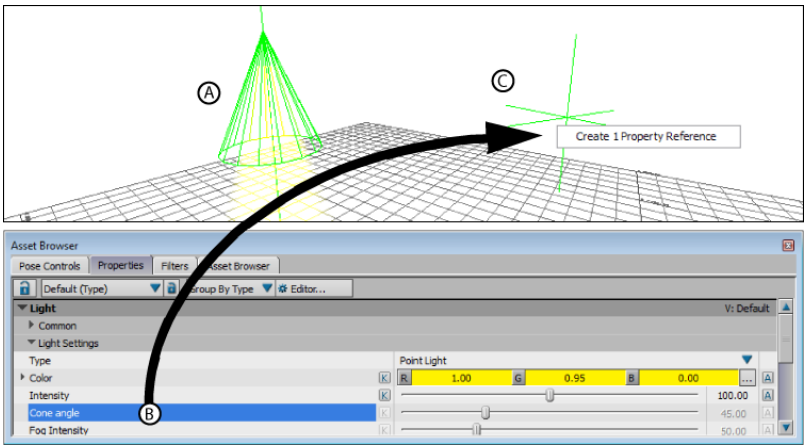
A property reference displays in blue. By default, a property reference name is “x.y”, where x is the source object’s name, and y is the property’s name. In this situation, the property reference is called “Light.Cone angle”.

To create a property reference with the Viewer window:

1 From the Asset browser, drag a null and a light into the Viewer window, then select the light so that its properties display in the Properties window.

2 Drag the Cone angle property from the Properties window and drop it onto the null.

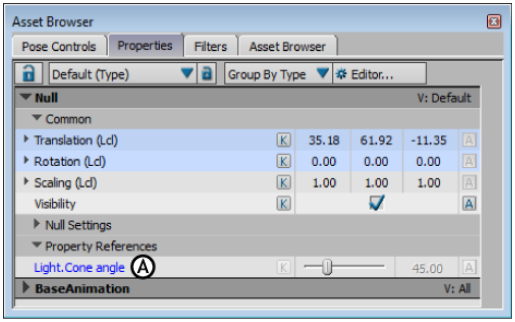
You can drop the property onto the null in the Viewer window, in the Scene browser, or in the Properties window.



Creating a property reference *A.* **Select the Light in the Viewer window.** *B.* **Drag the light’s Cone angle property onto another object, such as the null.** *C.* **Select Create Property References.**

3 Select Create Property Reference from the menu that appears.

The property you dragged displays in the Properties window when the null is selected. However, to indicate that Cone angle is the Light’s property and not the null’s, the referenced property displays with the name of its object. In this example, the Cone angle property displays as “Light.Cone angle” when the null is selected.



Properties window *A.* **When the null is selected, the light's Cone angle property displays with the null's properties.**

If you select the Light again, its Cone angle property still displays in the Properties window. A referenced property works like a shortcut or an alias for an object.

Deleting a property reference

To delete a property reference:

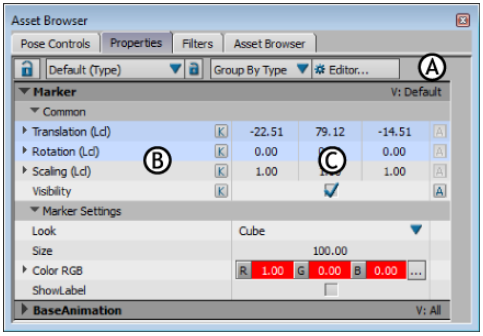
1. Right-click the property reference in the Properties window or in the Property Reference tab.
2. Select Remove Property Reference from the contextual menu.
3. You can also select the property reference in the Property Reference tab and click Remove to delete the reference.

Properties window

45

The Properties window lets you view, modify, and keyframe the properties of selected objects.

To show the Properties window, select Window > Add Property View in the menu bar, or choose a layout that displays the Properties window by default, such as the Editing layout.



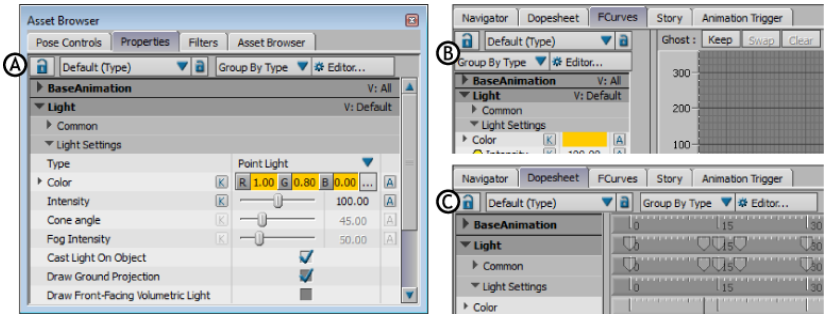
Properties window *A.* **Property options** *B.* **Property list** *C.* **Property settings**

The Properties window consists of the following:

- Property options on page 765
- Property list on page 769
- Property settings on page 772

Property options

The Property options display in the Property, FCurves, and Dopesheet windows.



Property options *A.* **Property options in the Properties window** *B.* **FCurves Property options** *C.* **Dopesheet Property option**

Lock option

Activating the Lock option locks the current object in the Property list. The settings do not change until you disable Lock, regardless of what object you select in the Scene browser or Viewer window.

View menu

The View menu lets you select the custom views you create.

When there are no custom views, the Default (Type) view displays. You can also select the All (Type) view, which includes additional properties of the selected object. When a Character is selected, you can select a number of views specific to Characters, as well as the All (Type) view.

The View menu has a View Lock button that lets you lock the currently selected view. When the Lock View button is activated, the properties for all selected objects display using the locked view, if it is applicable for the selected object. When the Lock View button is disabled, the views change as you select different objects, depending on the last view selected for the object.

For example, if you select a cube and view its properties in the TRS (Type) view, then activate the View Lock button and select a light, the light's properties also display in the TRS (Type) view.

Group Properties menu

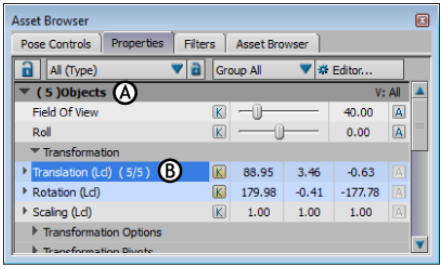
The Group Properties menu lets you group the properties of selected elements. Grouping properties lets you manipulate the properties of many elements at the same time. You can select to group all properties, to group properties by element type, or to keep properties ungrouped.

When elements are grouped, a number in parentheses indicates the number of elements that are grouped under a single label. For example, if six different elements are grouped together, the label would be “(6) Objects”.

Group All

All selected elements are grouped together, letting you modify common properties at the same time for all selected elements.

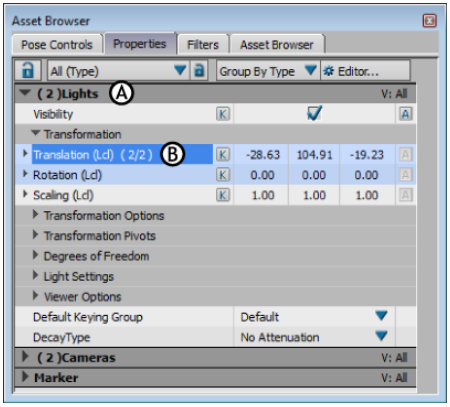
For example, in the following figure, five objects are selected. These five objects are all grouped together under the heading “5 Objects” (A) to indicate that their common properties can be edited together (B).



Properties window *A.* **Grouped objects** *B.* **Grouped objects’ translation properties**

Group By Type

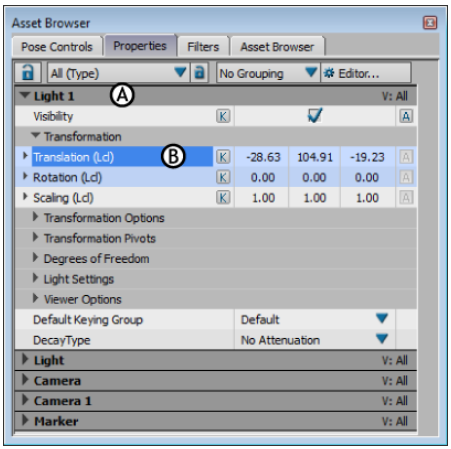
Elements of the same type are grouped together. For example, in the following figure, the lights are grouped (A). You can modify the properties of all models at the same time, but modify the properties of lights separately from models.



Properties window *A.* **Grouped objects of same type** *B.* **Grouped objects' translation properties**

No Grouping

All elements are listed separately, letting you modify each property individually without affecting other elements. For example, in the following figure, all selected objects are listed one after the other.



Properties window *A.* **Light 1 is not part of a group** *B.* **Light 1 translation properties**

Editor button

The Editor button opens the Properties Editor. See Property Editor on page 775 for more information.

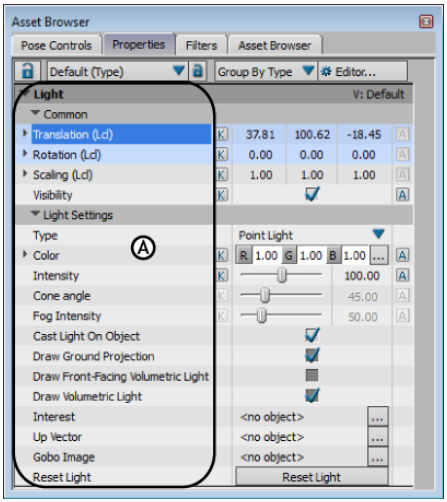
- Properties window on page 765
- Keying Groups pane on page 784

Property list

There is a Property list on the left side of the Properties, FCurves, and Dopesheet windows.

The Property list displays the property names of selected objects in a list structure. What displays also depends on which Property options are active and on which view is selected.

For example, the following figure (A) displays the properties of a selected light in the Property list.



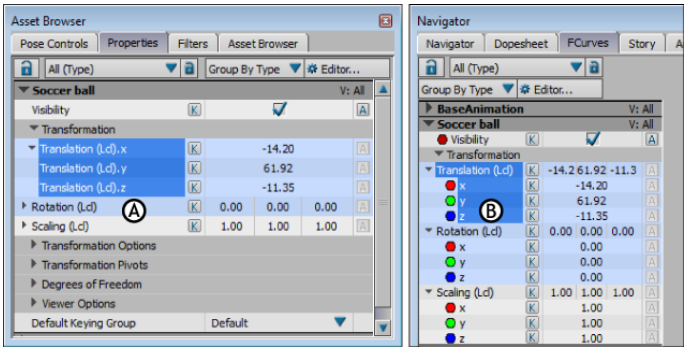
Properties window *A.* **Selected light's properties**

- Properties that display in light blue are currently selected in the Key Controls window's Keying Mode menu and can be keyframed.

- Properties that display in dark blue represent properties that you select in the Properties, FCurves, or Dopesheet windows, and can be keyframed.
- Properties that display in dark gray are currently selected but cannot be keyframed.

FCurves Property list

The Property list in the FCurves window displays properties differently than in the Properties window. In the Properties window, a property's name is listed to the left of its settings.



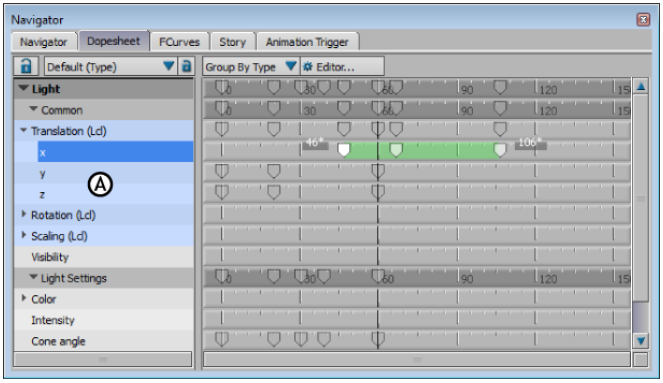
Property lists *A.* **Property list in the Properties window** *B.* **Property list in the FCurves window**

In the FCurves window, each property with a function curve also has a Color button, which indicates the color of the property's function curve.

Dopesheet Property list

The Dopesheet Property list resembles the Property list in the Properties window.

By default, the properties of an object display beneath the object's name in the list. Only the properties that you can animate display. To hide an object's properties, collapse the list by clicking the arrow next to the object's name.



Dopesheet window *A.* **Dopesheet Property list**

When you select an object or property in another window, such as the Properties window, the same object or property is selected in the Dopesheet Property list and the FCurves Property list.

Property contextual menu

Right-clicking properties in the Property list opens a contextual menu whose options are as follows:

Expand Branches	Expands a selected folder and its child folders. You can also expand individual properties by clicking the arrow next to the property name.
Collapse Branches	Collapses a selected folder and its child folders. You can also collapse individual properties by clicking the arrow next to the property name.
Expand All	Expands all branches to display all properties.
Collapse All	Collapses all branches and displays properties.
Select Branch	Selects the entire branch.
Deselect Branch	Deselects the entire branch.
Select All	Selects all the properties.
Deselect All	Deselects all the properties.

Remove Object	Removes the selected object from the Properties list. Does not delete the object.

■ Properties window on page 765

FCurves Property list Contextual Menu

In the FCurves window, to change your selection, and expand or collapse folders, you can right-click the Property list to use the following contextual menu options.

FCurves Property Color options

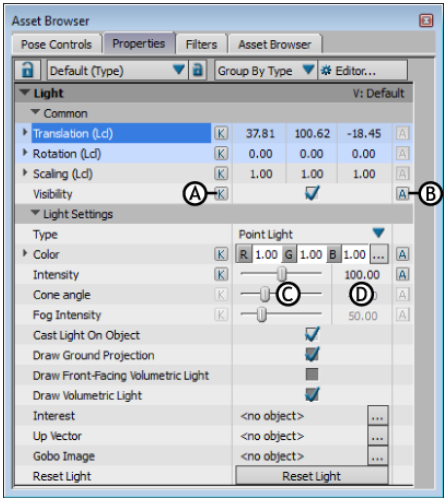
The FCurve Color options in the FCurve Property list contextual menu let you change the colors of FCurves so you can identify them.

Option	Function
Edit Curve Color	Opens the Color window so you can choose a color for the selected FCurve.
Edit All Curve Colors of this Type	Opens the Color window so you can choose a color for the all FCurves of that type.
Reset Curve Color	Returns the FCurve color to its default.
Reset All Curve Colors of this Type	Returns FCurve colors of that type to their default.

Property settings

The Property settings let you modify and animate selected object properties. You can modify the properties of any selected object including Actors, Control rigs, lights, cameras, and so on.

Each property that you can animate has a corresponding Keyframe (K) and Animate (A) button, and a Value field.



Property settings *A.* **Keyframe button** *B.* **Animate button** *C.* **Sliders** *D.* **Value fields**

Keyframe (K) button

Click to set a keyframe on the selected property. To remove a keyframe, click the button again. When the K button is gray, the corresponding property does not have a keyframe at the current time.

Animate (A)

The Animate (A) button lets you animate selected properties and use them in Expressions and Relations constraints.

Value

The Value field displays the current value of a selected property.

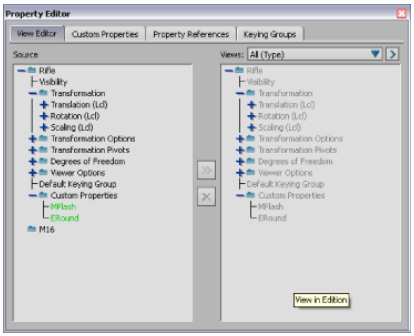
To change a value, drag in the property's Value field, or double-click in the field and type a value. If Key on Edit is active, a keyframe is automatically added at the new value, and the corresponding function curve changes to reflect the new value.

- Properties window on page 765
- Keyframe (K) and Animate (A) buttons on page 822

Property Editor

46

The Property Editor lets you create custom views, custom properties, property references, and custom keying groups. You can access the Property Editor by clicking the Editor button in the Properties window or by going to the Window menu and selecting Add Property Editor.

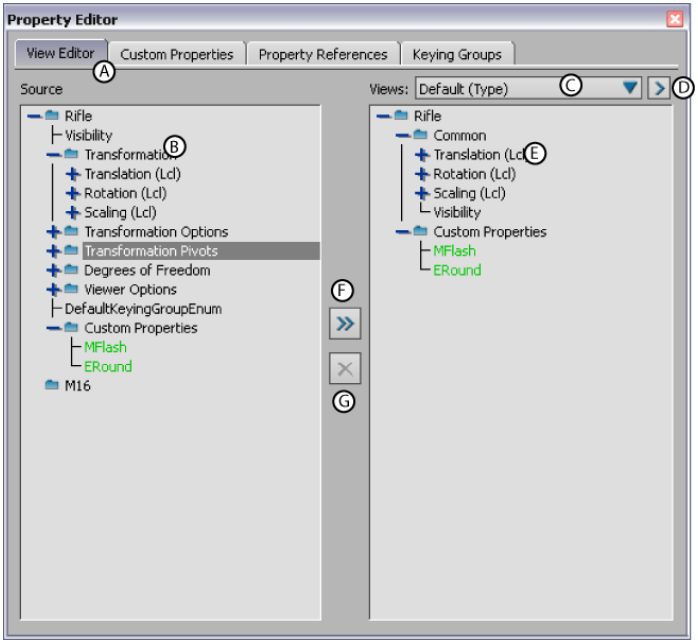


The Property Editor window consists of the following panes:

- View Editor pane on page 775
- Custom Properties pane on page 778
- Property References pane on page 782
- Keying Groups pane on page 784

View Editor pane

The View Editor pane lets you customize the current view for objects in the Properties window, and create multiple custom views of properties for each object type. These views are saved automatically.



Properties Editor *A.* **View Editor pane** *B.* **Source area** *C.* **View menu** *D.* **View Options button** *E.* **View area** *F.* **Add button** *G.* **Remove button**

Source area

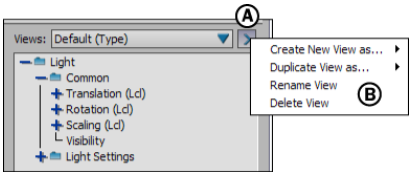
The Source area displays all the properties of selected elements. Properties selected in the Source area can be added to the custom view in the View area, letting you create a custom view.

View menu

The View menu displays the name of the view displayed in the View area and lets you select different views. You use the View menu to select the view you want to modify. When there are no custom views, the default view "x (Type)" displays, where x is the type of object that is selected.

View Options menu

The View Options button opens a menu which contains options that let you create, duplicate, rename, and delete views.



View Editor pane *A.* **View Options button**
B. **View Options menu**

Create New View as

Lets you create a new custom view. You can create three kinds of views. The following table describes the three different kinds of views you can create or duplicate:

Local View	Lets you create or duplicate a custom view only for the selected object.
Object Type View	Lets you create or duplicate a custom view for the type of object that is selected. For example, if you create a custom view for a Light1, all lights you select have the same view.
Global View	Lets you create or duplicate a custom view for all objects. For example, if you create a custom view for Light1, the same view can be used for a selected cube.

Duplicate View as

Duplicates the view selected in the View menu.

Rename View

Lets you rename the custom view selected in the View menu.

Delete View

Deletes the custom view selected in the View menu.

View area

The View area displays the view to be modified. To use this area, you must create a view by selecting Create New View As option from the View Options menu. If you have more than one custom view, select the one you want to modify in the View menu.

Add button

The Add button lets you add selected properties from the Source area to the custom view in the View area.

Remove button

The Remove button lets you remove selected properties from the custom view in the View area.

- Property Editor on page 775
- Properties window on page 765

Custom Properties pane

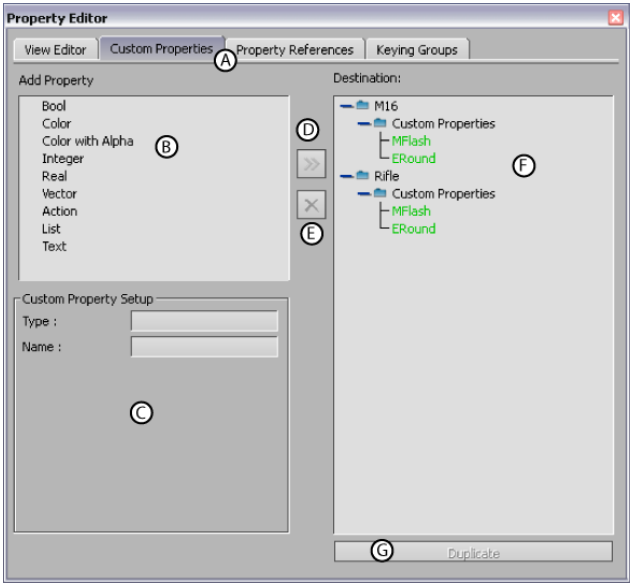
The Custom Properties pane lets you add your own properties to all selected objects in MotionBuilder. You can modify and animate the properties you create just as you would other properties.

For example, you can add check boxes, sliders, and value fields to trigger specific actions, create a custom animation interface, or simply store information you need to export to other software packages. See Custom Properties pane on page 778 for more information.

The Custom Properties pane consists of the following:

- Add Property on page 779
- Custom Properties Setup on page 780
- Add on page 781
- Remove on page 781
- Destination on page 784

■ Duplicate on page 781



Properties Editor *A.* **Custom Properties pane** *B.* **Add Property area** *C.* **Custom Property Setup area** *D.* **Add button** *E.* **Remove button** *F.* **Destination area** *G.* **Duplicate button**

Add Property

The Add Property area contains the list of property types you can add to selected elements. Select a property in the Add Property area, then click then Add button to add the property to a selected element in the Destination area.

You can assign the following property types:

Bool	Creates a check box for the selected object. Use this option to create a property that you can activate or disable.
Color	Creates a set of value fields that represent red, green, and blue color values.
Color with Alpha	Creates a set of value fields that represent red, green, blue, and alpha values.

Integer	Creates a slider and a value field that can contain only integer values. Use the Min and Max fields to define the slider for this property.
Real	Creates a slider and a value field that can contain any real number. Specify the minimum value and the maximum value for the slider using the Min and Max fields.
Vector	Creates a set of value fields that represent a set of X, Y, and Z position values.
Action	Creates a button for the selected object. You can use this Action button to trigger scripts Relations and Expressions constraints.
List	Creates a menu (drop-down list) for the selected object. You can use this menu to trigger scripts or Relations and Expression constraints.

Custom Properties Setup

The Custom Property Setup area displays the settings of custom properties you select in the Destination area. The settings that display correspond to the type of property that is selected. These settings include the following:

Type	Displays the type of property that is selected in the Destination area. This is useful after you have renamed the property.
Name	Lets you rename the property selected in the Destination area.
Minimum Value	Defines the minimum value that can be set for this property using the slider. By default, the minimum value is set to 0. Used for Integer and Real property types.
Maximum Value	Defines the maximum value that can be set for this property using the slider. By

	default, the maximum value is set to 100. Used for Integer and Real property types.
Text field	Lets you write text for the List property selected in the Destination area.

NOTE The Minimum and Maximum fields define the minimum and maximum number that is indicated by the slider. You can enter any number in the value field itself.

Add

The Add button lets you add selected properties from the Add Property area to the element in the Destination area.

When there are multiple elements in the Destination area, select an element there before clicking the Add button. Otherwise, the custom property may not be added to the element you want.

Remove

The Remove button lets you remove selected custom properties from the Destination area.

Destination

The Destination area lists selected elements, and the custom properties you assign to them. The Destination area also lets you rename, delete, and duplicate properties.

To rename a custom property, right-click it in the Destination area, select Rename Custom Property, type in a new name in the dialog box that appears, and click OK to confirm the change.

To delete a custom property, right-click it in the Destination area and select Remove Custom Property.

You can also copy a custom property selecting it in the Destination area, then clicking the Duplicate button.

Duplicate

The Duplicate button lets you copy a custom property selected in the Destination area.

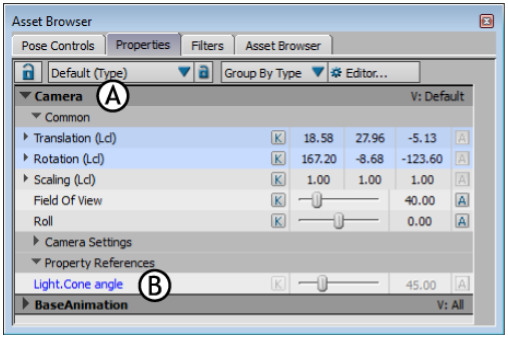
■ Property Editor on page 775

■ Properties window on page 765

Property References pane

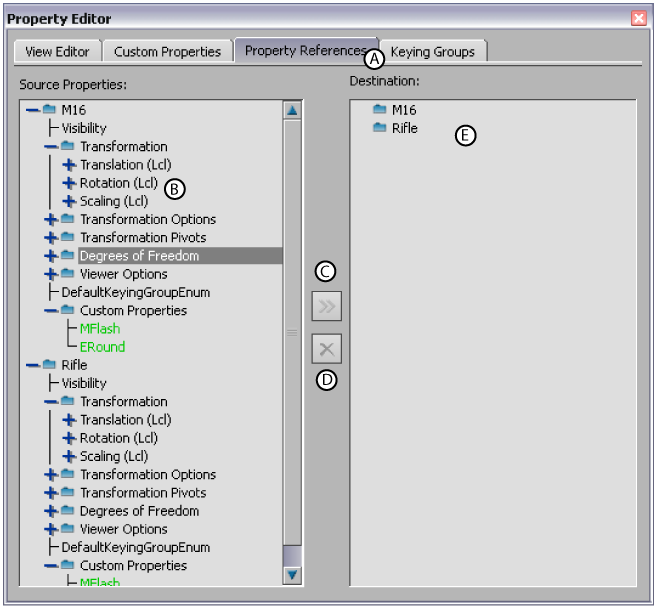
The Property References pane lets you associate one element's properties with another element. For example, you can associate a light's Cone Angle property with a camera. When you select the camera, a "Light.Cone angle" property displays after the camera's properties.

This "Light.Cone angle" property refers to the light's Cone angle property, and so it is called a *property reference*. The original property still displays with the other light properties when you select the light.



Properties window *A.* **The camera is selected but the light is not** *B.* **The "Light.Cone angle" property reference is blue.**

Because property references let you access the properties of any number of objects at once without the need to select each one, they can be especially useful when you animate a complex scene, with many models, submodels, and other elements.



Properties Editor *A.* **Property References pane** *B.* **Source Properties area** *C.* **Add button** *D.* **Remove button** *E.* **Destination area**

The Property References pane consists of a Source Properties area, a Destination area, and Add and Remove buttons.

Source Properties

The Source Properties area displays the selected elements and their properties. If you open the Property Editor before selecting elements, you can *Alt*-drag the elements from the View window into the Source Properties area.

Add

The Add button lets you add properties selected in the Source Properties area to the selected element or elements in the Destination area.

Remove

The Remove button lets you remove custom properties selected in the Destination area.

Destination

The Destination area displays selected elements. You create property references for these properties by adding them from list of properties in the Source Properties area.

If you open the Property Editor before selecting elements, you can *Alt*-drag the elements from the View window into the Destination area.

There are three ways of creating property references:

- With the Property References pane.
- With the Properties window and the Viewer window.
- With the Properties window and the Scene browser.

The rest of this section shows you how to create a property reference from a light's Cone Angle property using the Property Reference and using the Properties window and the View window. Using the Scene browser to create a property reference is similar to using the View window.

- Property references on page 758
- Creating a property reference on page 759
- Creating a property reference on page 759
- Deleting a property reference on page 763
- Property Editor on page 775

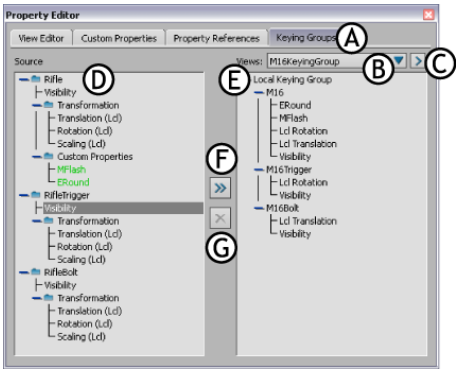
Keying Groups pane

The keying groups pane allows you to create and edit keying groups. A keying group is a set of properties for a character's effector (or for an object) that will be recorded if you create a keyframe. In the Keying Groups pane, you can modify properties in an existing group, duplicate a group or create keying groups.

A custom keying group can be either:

- global (can be applied to any character or object in a scene)
- local (only ever applies to the object(s) that are selected at the time the keying group is created)

- object (can be applied to any object in a scene)



Keying Groups *A.* **Keying Groups pane** *B.* **Views menu** *C.* **View Options button D. Source Properties area** *E.* **Destination area** *F.* **Add button** *G.* **Remove button**

The Keying Groups pane consists of a Source Properties area, a Destination area, and Add and Remove buttons.

Source Properties

The Source Properties area displays the properties of the objects that you have selected and placed there. When you open the Property Editor, the Source Properties list is empty. You can *Alt*-drag the elements from the View window into the Source Properties area, or you can drag objects from the Scene Navigator.

Add

The Add button lets you add properties selected in the Source Properties area to the selected element or elements in the Destination area.

Remove

The Remove button lets you remove properties selected in the Destination area.

Destination

The Destination area displays the properties in the keying group. You can add properties to the keying group by choosing them from list of properties in the Source Properties area.

When you open the Property Editor, the keying group that is selected in the Key Controls Window populates the Destination. You can select a different keying group from the drop-menu (or use the create or duplicate options from the view options menu also).

See also:

- Creating a custom keying group on page 839
- object keying group on page 2010
- global keying group on page 2001
- local keying group on page 2006

Part 2: Selecting time

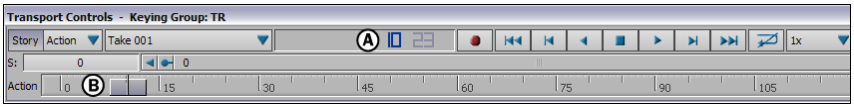
In MotionBuilder, a timeline represents the length of your animation using time codes or frame numbers and has a Timeline indicator that marks the current time. Though the Transport Controls window contains the main timeline options, the Dopesheet, FCurves, and Story windows also display this timeline.

MotionBuilder has two timelines; the Action timeline and the Edit timeline. The Action timeline is the main MotionBuilder timeline, where you create and edit animation. All windows with a timeline use the Action timeline. The Edit timeline is used in the Story window to edit the scene with camera shots and time discontinuity.

Current time

The current time is a point in the take, such as a frame or a second, that is currently selected. In most cases, you set keyframes for selected objects at the current time.

The Timecode field displays the current time. A Timeline indicator along a timeline lets you select the current time.



Transport Controls window *A.* **Current time** *B.* **Timeline indicator**

Related Topics

- Timecode field on page 802
- Timeline indicator on page 805

Related topics include:

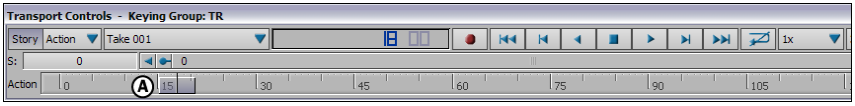
- Timecode field on page 802
- Timeline indicator on page 805

See also:

- Timecode field on page 802
- Timeline indicator on page 788

Timeline indicator

The Timeline indicator indicates the location in the current take and lets you change the current time. When the current take plays, the Timeline indicator moves from left to right along a timeline. You can drag the Timeline indicator along the timeline to change the current time.



Transport Controls *A.* **Timeline indicator**

See also:

- Selecting time on page 787
- Current time on page 787
- Selecting the current time on page 789
- Display on page 810

Edit timeline

The Action timeline represents the same time in every window. However, the Story window and Transport Controls window has a second timeline, referred to as the Edit timeline. Use the Edit timeline for setting up camera shots and time discontinuity in the Story window. See “Understanding Story”.

Objects such as models, cameras, lights, materials, and so on, have different types of properties, depending on the type of object. When you select an

object, each of its properties are listed in the Properties window, the Dopesheet window, and the FCurves window.

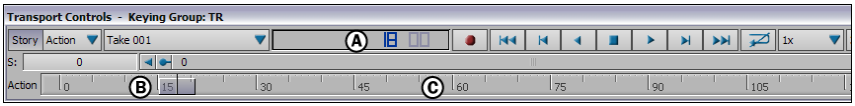
These windows can also list the properties of more than one selected object at a time. A selected object's properties also appear in the Navigator window's Asset Settings area. You can use the Properties window and the Navigator window to change a selected object's values before you set any keyframes.

NOTE If you modify a value of a property without setting a keyframe, the value is not kept if you change the current time.

You can also J-drag left or right in the Viewer window or along any timeline to jog through the animation at varying speeds.

Selecting the current time

In each window with a timeline, a Timeline indicator marks the current time. The current time displays in the Transport Controls window's Timecode field.



Transport Controls (detail) *A.* **Timecode field** *B.* **Timeline indicator at frame 20** *C.* **Action timeline**

To change the current time, do one of the following:

- Double click the Timecode field, enter a number, and press Enter.
- Drag in the Timecode field.
- Drag the Timeline indicator along the timeline.
- *Ctrl*-shift-click on a timeline to move the Timeline indicator to where you click.

See Current time on page 787.

Zooming in on the timeline

In the Transport Controls, the Zoom bar lets you magnify specific segments of the current take's time on the Action timeline, set the zoom length, and stretch and scroll the zoomed area.

Zoom bar *A.* **Zoom Start timecode** *B.* **Zoom End timecode** *C.* **Stretch handle** *D.* **Scroll button**

To zoom in on part of the timeline, use one of the following methods:

- Drag one of the stretch handles to shorten the Zoom bar, then drag the whole Zoom bar left or right.
- Double-click the timecode fields (A and B) and enter start and end values.
- Drag the time codes, then drag the zoom bar left or right.

To move the Zoom bar, do one of the following:

- Drag the Zoom bar left or right.
- Click the left or right Scroll button to move the Zoom bar left or right.

NOTE The Zoom section must be shorter than the total time to move left or right.

To toggle between zoom and current take:

1. Double-click the Zoom bar, or press A to change the zoomed view to the current take.
2. Double-click the Zoom bar again to return to the last zoomed view.

To resize the Zoom bar to frame keyframes:

1. Select the keyframes on which you want to zoom in.
2. Press F.

See Transport Controls on page 801.

Selecting a time format

To display time as frames and subframes:

1. Right-click the Action timeline in the Transport Controls window.

2 Select Time > Show As Frames from the contextual menu.

To display time as a timecode:

1 Right-click the Action timeline in the Transport Controls window.

2 Select Time > Show As Timecode from the contextual menu.

To display Local time:

1 Right-click the Action timeline in the Transport Controls window.

2 Select Time > Show Local Time from the contextual menu.

To display System time:

1 Right-click the Action timeline in the Transport Controls window.

2 Select Time > Show System Time from the contextual menu.

See also:

- Transport Controls on page 801

Resizing the Timeline indicator

Resizing the Timeline indicator lets you see any keyframes hidden beneath it.

To change the size of the Timeline indicator:

1 Right-click the Action timeline in the Transport Controls.

2 Select Display > Small Cursor to make the Timeline indicator bigger or smaller.

A smaller Timeline indicator lets you see any keyframes under it more clearly and does not stretch when you resize the Transport Controls window. See Display on page 810.

See also:

- Transport Controls on page 801

Custom frame rates

When you use the Custom option in the Time format menu to set a custom frame rate, only the following frame rates are allowed. If you enter a frame rate that is not supported, the closest supported frame rate in this list is selected.

Custom frame rates

1	16	75	300
2	20	80	375
3	24	85	400
4	25	86	500
5	30	100	600
6	40	120	750
8	43	125	1200
10	44	150	1500
12	48	200	2000
12.5	50	240	2000
15	60	250	6000

To change the time display, see Selecting a time format on page 790.

Selecting takes

47

A take is a level of animation in your scene. A take's start and end determine when the Timeline indicator starts and stops.

In the Transport Controls, the Action timeline can display the current length of a take, or a zoomed section of the current take. The Start and End fields define the current take length, and the Zoom Start and End time codes define parameters for a zoomed section of a take on the Action timeline. You can also use the Takes settings to manage your takes.

- Takes contextual menu on page 793
- Takes settings on page 794
- Selecting the current take on page 795
- Resizing takes on page 795
- Creating takes on page 796
- Emptying takes on page 797
- Deleting takes on page 797
- Duplicating takes on page 797
- Reordering takes on page 798
- Inserting a take into the Story window on page 798

Takes contextual menu

The Takes contextual menu lets you duplicate, delete, empty, and move takes in your scene.

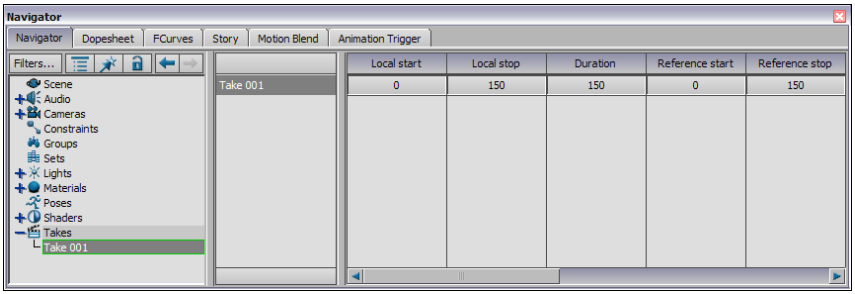
Option	Purpose
Duplicate	To create copies of takes as backups while you apply filtering or adjust keyframes. You can also use duplicate takes in the Motion Blend window to create animation cycles.

Option	Purpose
Delete	To remove a take and all its recorded information.
Empty	To remove a take's data without deleting the take.
Move Down and Move Up	To move a take's row up or down to organize your takes.

Takes settings

The Takes settings show information about your takes, let you delete and rename them, as well as change their length and the order in which they are listed.

Select the Takes root folder in the Scene browser to display the Takes settings in the Navigator window.



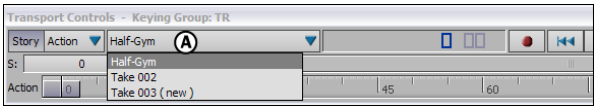
Takes settings

Option	Description
Take list	All of the takes in your scene are listed in the Takes list. There is one row for each take in your scene. See Takes contextual menu on page 793.
Local start	Lets you change the start time of the take in local timecode.
Local stop	Lets you change the stop time of the take in local timecode.
Duration	Displays the duration of each take.
Reference start	Lets you change the start time of each take in reference timecode.

Option	Description
Reference stop	Lets you change the stop time of each take in reference time-code.
Comments	Lets you write and save comments such as director's notes for each take. To insert a comment, click the cell and type your comment.

Selecting the current take

To select the current take, in the Transport Controls window, select a different take from the Current Take menu. See Current Take menu on page 802 for more information.



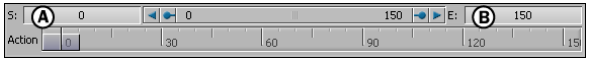
Transport Controls *A.* **The "Half-Gym" take is the current take selected in the Current Take menu.**

Resizing takes

The length of a take may be too long or too short compared to the animation it contains. A take may start playing in the middle of the animation or end before the entire edit finishes playing. This happens because the timeline only plays between the Start and End time codes on the Action timeline. To fix this, you can resize the take.

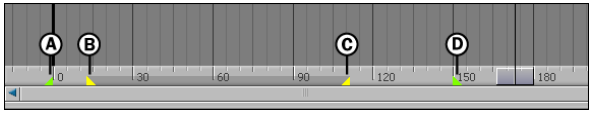
Change the current take's length using one of the following:

- In the Transport Controls, double-click the Start or End fields and type a frame number.
- In the Transport Controls, drag in the Start or End fields to change the frame number.
- In the Transport Controls, right-click the timeline in the Transport Controls, and select Set Start or Set End to set the start or end time. The start or end of the take changes to match the current time.



Action timeline *A.* **Start field** *B.* **End field**

- In the Story window, drag the green markers at the bottom of the Action Track list. The green markers indicate the start and end of the take (A and D) and correspond with the Start and End fields in the Transport Controls window.



Time range *A.* **Start of take** *B.* **Start of zoom bar** *C.* **End of zoom bar** *D.* **End of take**

- In the Motion Blend window, click Adjust Take Start & End in the Motion Blend Options pane.

For more information, see Edit buttons on page 1742.

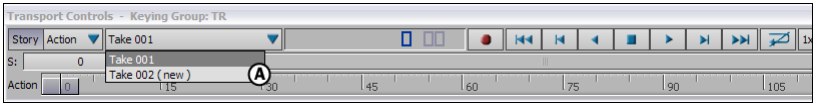
Creating takes

You can select other takes associated with the current scene, or create takes using the Current take menu.

To create a take:

➤ In the Transport Controls, select "Take 00n (new)" from the Current Take menu, where n is the number of the new take.

New takes are numbered in sequential order (for example, Take 002, Take 003, and so on).



Transport Controls *A.* **Select Take 00n (new) in the Current Take menu.**

Emptying takes

You can empty a take to remove its data, without deleting the take.

To empty a take:

1. In the Scene browser, double-click the Takes root folder to display the Take settings.
2. Right-click the take you want to empty.
3. Select Empty from the contextual menu.

All captured and plotted data is removed from the take, but the take is not removed. The take's timecode and duration remain the same.

Deleting takes

You can delete a take to remove the take and all its recorded information.

To delete a take:

1. In the Scene browser, double-click the Takes root folder to display the Take settings.
2. Right-click the take you want to delete.
3. Select Delete from the contextual menu.

NOTE You cannot undo the deletion of a take.

Duplicating takes

You can create copies of takes as backups while you apply filtering or adjust keyframes. You can also use duplicate takes in the Motion Blend window to create animation cycles.

To duplicate a take in the Take settings:

1. In the Scene browser, double-click the Takes root folder to display all the takes in the Takes settings.

2 Right-click the name of the take you want to duplicate and select Duplicate from the contextual menu.

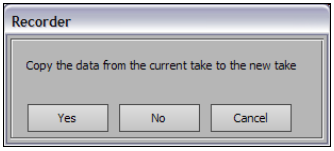
A take is created with the same captured data as the original take. The take is given the same name as the original take, plus a numerical extension. For example, if you duplicate Take 001, its copy is named Take 002.

You can also duplicate takes by selecting a new take from the current take field. MotionBuilder asks you if you want to copy the data from the current take to the new take. Click Yes to copy the data or No to create an empty take. Click Cancel to abort the duplication process.

To duplicate a take in the Transport Controls:

1 In the Transport Controls window, select Take 002 (New) in the Current Take field.

2 Click Yes in the dialog box that appears. You can also click No to create an empty take. Click Cancel to abort the duplication process.



Click Yes in the dialog box to copy the take.

Reordering takes

The Move Down and Move Up options in the contextual menu let you move a take's row up or down to organize your takes. You can also drag a take up or down in the take list to change the order in which they display.

Inserting a take into the Story window

You can transfer keyframe animation from the current take selected in the Transport Controls window to a track in the Story window's Action Track list.

To insert the current take into the Story window:

1. In the Transport Controls' Current Take menu, select the take you want to insert into the Story window.
2. In the Story window, right-click an Animation, Character, or Camera Animation track.
3. Select Insert Current Take from the contextual menu.

To insert the current take via the Scene browser:

1. In the Story window, make sure:
   - there is either an Animation, Character, or Camera Animation track.
   - the track's Animate option is active.
   - the track's content is defined in the Track Content menu.
2. Drag a take from the Scene browser into the track in the Story window.

Transport Controls

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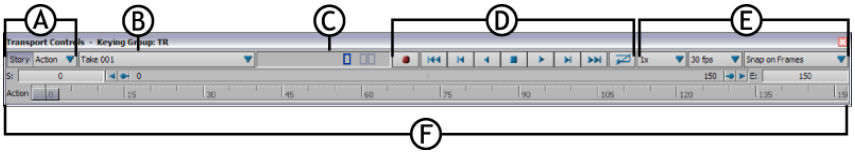
The Transport Controls window lets you create and select takes, play and view the time progression of a scene, set timing, play, and view options, change the start and end of a take, select and view audio tracks on the Action timeline, and manipulate visual keyframes.

The Transport Controls window displays by default in every predefined layout. You can also select Window > Transport Controls in the menu bar.

The Transport Controls window consists of the following:

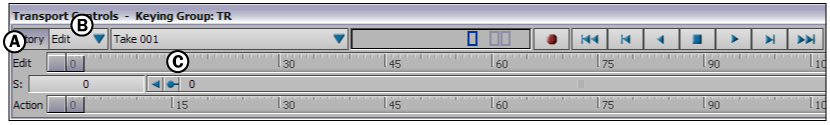
- Story Mode option and menu on page 801
- Current Take menu on page 802
- Timecode field on page 802
- Play Controls on page 803
- Timing Controls on page 804
- Action timeline on page 805
- Transport Controls contextual menu on page 807



Transport Controls window *A.* **Story Mode option and menu** *B.* **Current Take menu** *C.* **Timecode field** *D.* **Play Controls** *E.* **Timing Controls** *F.* **Action timeline**

Story Mode option and menu

The Story Mode option lets you activate and disable the animation in the Story window. The Story Mode menu lets you select between Action and Edit modes, which determines which part of the scene plays.



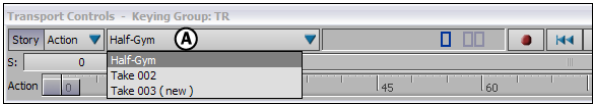
Transport Controls window *A.* **Story Mode option** *B.* **Edit selected in the Story Mode menu** *C.* **Edit timeline displayed**

When Edit is selected in the Story Mode menu, the Edit timeline displays in the Transport Controls window.

The Story Mode menu and option is also in the Story window. See Story Mode option on page 1742.

Current Take menu

The Current Take menu shows the name of the current take.



Transport Controls *A.* **Current Take menu showing "Half-Gym" as the current take**

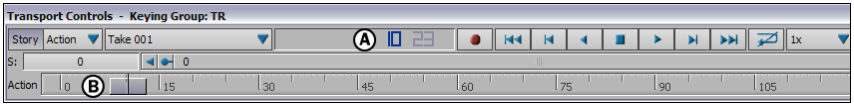
You can select other takes associated with the current scene, or create takes using the Current take menu.

To create a take, select "Take 00n (new)" from the menu, where n is the number of the new take. New takes are numbered in sequential order (for example, Take 002, Take 003, and so on).

To rename a take, select and right-click on the take in the Scene browser, choose Rename from the contextual menu, and type a name.

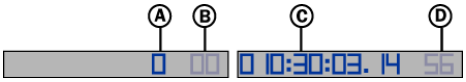
Timecode field

The Timecode field in the Transport Controls shows the take's current time.



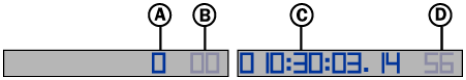
Transport Controls window *A.* **Timecode field displaying current time** *B.* **Timeline indicator at the current time**

The current time can display as either Local time or System time. Local time is the time within the current scene, and displays by default. System time provides a reference point based on your computer system.



Timecode field *A.* **Local time display** *B.* **Local sub-frames** *C.* **System time display** *D.* **System sub-frames**

The Timecode field can also display time as frames or as time codes.



Timecode field *A.* **Frame number** *B.* **Sub-frame number** *C.* **System time display** *D.* **System sub-frames**

To change the time code display, select Show Local Time or Show System Time from the Time menu in the Transport contextual menu (see Time menu on page 813).

Play Controls

The Play Controls in the Transport Controls window let you play and record your takes. The Play Controls are similar to those of a typical cassette recorder.

Play Controls

The following table describes each Play control button and displays its keyboard shortcut in parentheses:

Button	Function
	Records a take or records over the current take. To record, set your Record options, click Record, and then click Play.
	Moves the Timeline indicator to the beginning of the current take (*Ctrl-Home*).
	Moves the Timeline indicator back one frame (*Ctrl*-Left Arrow).

Button	Function
	Plays the take in reverse (*Ctrl*-Down arrow).
	Stops playing or recording (*Ctrl-Spacebar*).
	Plays the take (*Ctrl-Spacebar*).
	Moves the Timeline indicator forward one frame (*Ctrl*-Right arrow).
	Moves the Timeline indicator to the end of the current take (*Ctrl-End*).
	Activates or disables looping when the take is playing. The loop area is the take length. You can set the loop area by changing the Start (S) and End (E) fields, setting a Zoom region using the Zoom Start and End fields, or by using loop marks (see Using marks on page 1912).

Timing Controls

The Timing Controls in the Transport Controls let you select time-related settings such as the play speed, time format, frame rate, and snapping options.

Timing Controls *A.* **Play Speed menu** *B.* **Time Format menu** *C.* **Snap menu**

The Timing Controls consist of the following menus:

- Play speed field on page 814
- Time Format menu on page 815
- Snap menu on page 817

Action timeline

The Action timeline in the Transport Controls consists of the following:

- Timeline indicator on page 805
- Start (S) and End (E) fields on page 806
- Zoom Bar on page 806

Action timeline *A.* **Timeline indicator** *B.* **Take display** *C.* **Audio display** *D.* **Visual keyframe**

Right-click the Action timeline to access the contextual menu. (see Transport Controls contextual menu on page 807).

The following table describes the elements found in the Action timeline.for

Option	Function
Timeline indicator	The Timeline indicator marks the current location in the take along a timeline. See Timeline indicator on page 805.
Start (S) / End (E) fields	The Start (S) and End (E) fields (A and B) reflect the start and end frames of the current take. See Start (S) and End (E) fields for more information.
Zoom bar	The Zoom bar lets you magnify specific segments of the current take's time on the Action timeline, set the zoom length, and stretch and scroll the zoomed area. See Zoom Bar for more information.

Timeline indicator

The Timeline indicator in the Action Timeline marks the current location in the take along a timeline.

You can change the size of the Timeline indicator using the Small Cursor option (see Display on page 810). When the Timeline indicator is smaller, it is easier to view and edit visual keyframes.

See Selecting the current time on page 789 for more information.

Start (S) and End (E) fields

The Action Timeline Start (S) and End (E) fields (A and B) reflect the start and end frames of the current take. When you change the length of the current take, the length of the Action timeline changes to match the current take.

When recording, the Action timeline automatically resizes itself to the length of the recorded take. The Start field reflects where the recorded take begins, and the End field determines where the take ends.

Action timeline *A.* **Start field** *B.* **End field**

To change the current take's length, double-click the Start or End fields and type a frame number, or drag in the fields to change the frame number. See Resizing takes on page 795 for more information.

You can also use the Transport contextual menu to set the start and end time of the current take (Time menu on page 813), as well as use Start and End fields to set the looping area (see Using marks on page 1912). See Story window time range on page 1740 for information on resizing the take in the Story window.

Zoom Bar

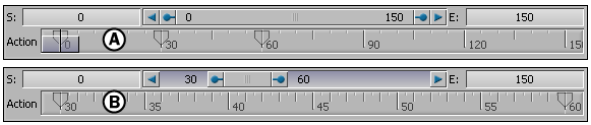
The Action Timeline Zoom bar lets you magnify specific segments of the current take's time on the Action timeline, set the zoom length, and stretch and scroll the zoomed area.

Zoom bar *A.* **Zoom Start time code** *B.* **Zoom End time code** *C.* **Stretch handle** *D.* **Scroll button**

The Zoom Start and End time codes (A, B) define the beginning and end of the zoomed segment of the current take on the Action timeline. These fields are distinct from the Start and End fields that define the entire length of the current take on the Action timeline.

For example, the following figure shows the Zoom feature active and disabled. When Zoom is disabled, the full length of the take that is defined by the Start and End fields (0 to 150) displays on the Action timeline, and the Zoom bar is at full size.

When Zoom is active, a portion of the current take fills the entire space on the Action timeline (30 to 60), which is defined by the values in the Zoom Start and End fields.



Action timeline *A.* Zoom disabled and Action timeline reflects the values in the Start and End fields *B.* Zoom active and Action timeline reflects the values in the Zoom Start and End fields

See Zooming in on the timeline on page 789 for more information.

Transport Controls contextual menu

The Transport Controls contextual menu lets you set various options when working with the Action timeline. To open this menu, right-click the Action timeline.

The options active in the contextual menu may change depending on where you click and what is selected. This section describes all the options in the Transport Controls contextual menu, which consist of the following options:

Cut

Removes a selected visual keyframe and stores it in memory. To cut a keyframe selection, right-click the key or region on the Action timeline and select Cut from the Transport contextual menu. You can also use the keyboard shortcut *Ctrl-X* to cut selected keyframes.

Cutting a keyframe region makes the keyframes that follow the cut move back to fill empty space.

For example, if you have three keyframes that are set at frame 0, 15, and 30, cutting the keyframe region between frame 0 and 15 causes the third keyframe (originally located at frame 30) to move back to frame 15.

Copy

Copies a keyframe selection and stores it in memory for insertion into another location. To copy a keyframe or keyframe region, right-click the key or region on the Action timeline and select Copy from the contextual menu. You can also use the keyboard shortcut *Ctrl-C* to copy selected keyframes.

Paste

Inserts a copied or cut selection into another location. To paste a selection, right-click the Action timeline or a keyframe or keyframe region, and select Paste from the contextual menu. You can also use the keyboard shortcut *Ctrl-V* to paste the copied or cut selection.

Pasting a keyframe on a keyframe region deletes all keys within the region, and replaces the first key of the region with the pasted keyframe. When you paste a keyframe region on a keyframe, the region's first key replaces the original keyframe.

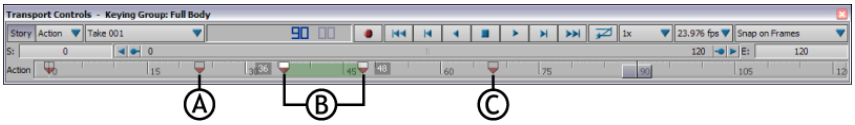
If nothing is selected on the Action timeline when pasting, the selection is pasted at the current time code. To offset keyframes that follow the paste according to the size of the pasted region, activate Paste Ripple.

Paste On Selected IK Objects.

For keyframes on IK effectors, pastes copied Translation values, Rotation values, or both.

Copy Previous Key On Selected IK Objects

For keyframes on IK effectors, copies the Translation values, Rotation values, or both from the previous keyframe to the selected keyframe or keyframe region. See also Cutting, copying, and pasting keyframes on page 830.



Transport Controls *A.* **Previous keyframe** *B.* **Selected keyframes** *C.* **Next keyframe**

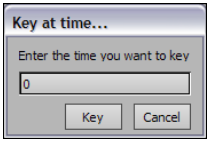
Copy Next Key On Selected IK Objects

For keyframes on IK effectors, copies the Translation values, Rotation values, or both from the next keyframe to the selected keyframe or keyframe region. See Cutting, copying, and pasting keyframes on page 830.

Key at Time

The Key at Time option opens a Key at Time dialog box, which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing *Ctrl-Shift-K*.



Key at Time dialog box

Delete

Deletes keyframe selections. Keyframes following a deleted keyframe selection do not move back to fill empty space.

To delete a selected keyframe or keyframe region, right-click the keyframe or region, and select Delete from the contextual menu. You can also press Delete on the keyboard.

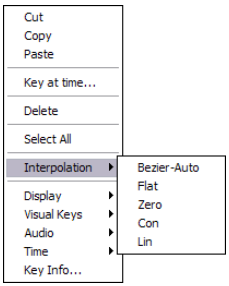
Select All

Choose the Select All option to select all the keyframes on the Action timeline. Selecting more than one keyframe creates a keyframe region.

Interpolation

Changing the interpolation of a selected keyframe affects the shape of the spline between the visual keyframe's associated keys and the next set of keys that follow the selected keyframe. Changing the interpolation of selected keyframes in a region affects the shape of the spline between all keys within the region and the next set of keys that follow the region.

To change the interpolation of a keyframe or keyframe region, right-click the keyframe or region, select Interpolation from the Transport contextual menu, then select an option in the Interpolation menu.



Interpolation menu

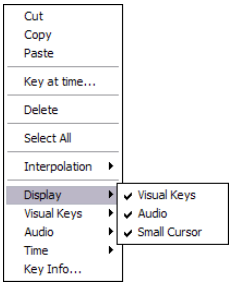
Each option changes the interpolation differently, as described in the following table:

Option	Function
Bezier-Auto	Resets selected keyframes so that they use cubic curves. The tangents of the keyframes are recalculated automatically, based on the surrounding keyframes. Tangents are no longer broken or flattened
Flat	Flattens the tangent handles of selected keyframes.
Zero	Sets the associated keyframe values to 0, and flattens their tangents.
Constant (Con)	Maintains a keyframe's value for each subsequent frame until the next keyframe. There is no slope between keyframes.
LInear (Lin)	Joins keyframes using a straight line, in which the slope between keyframes is constant.

See Interpolation on page 913 for more information.

Display

The Display menu contains options for the display of visual keyframes, audio, and the Timeline indicator.

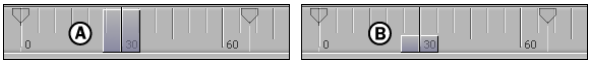


Display menu

The following table describes the Display menu options:

Option	Function
Visual Keys	Shows or hides visual keyframes on the Action timeline. Keyframes are shown by default.

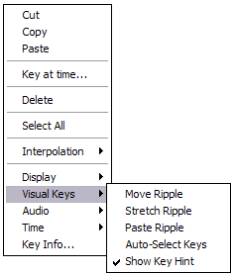
Option	Function
Audio	Shows or hides audio waveforms on the Action timeline. Audio waveforms are shown by default.
Small Cursor	Makes the Timeline indicator smaller and more transparent. This display lets you see keyframes under the Timeline indicator more clearly (see the following figure).



Timeline indicator *A.* **Large cursor** *B.* **Small cursor**

Visual Keys

The Visual Keys menu lets you set options for visual keyframes on the Action timeline.



Visual Keys menu

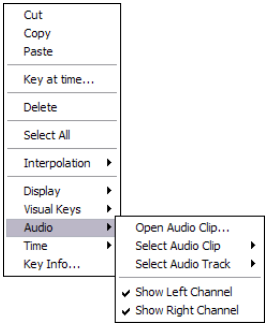
The following table describes the Visual Keys options:

Option	Function
Move Ripple	Pushes deselected keys horizontally when offsetting a keyframe or keyframe region. Disable to keep deselected keys anchored when offsetting (default).
Stretch Ripple	Moves deselected keys horizontally according to the stretch when stretching a keyframe region. Disable to keep deselected keys anchored when stretching (default).

Option	Function
Paste Ripple	Moves deselected keys horizontally when pasting keyframe regions. Disable to keep deselected keys anchored when pasting (default).
Auto-Select Keys	When activated, visual keyframes closest to the current time code are automatically selected.
Show Key Hint	When activated, keys on the transport controls show a different color according to on what property they are set, for example, full body, body part or selection, extension.

Audio

The Audio menu lets you select from various audio options for use with *.wav* files on the Action timeline.



Audio menu

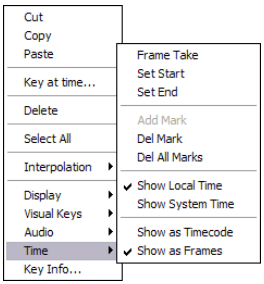
The following table describes the Audio menu options:

Option	Function
Open Audio Clip	Opens a file browser, letting you select a **.wav** audio file to add to the Action timeline.
Select Audio Clip	Lets you select from previously loaded audio clips.
Select Audio Track	Lets you select from available audio tracks that are in the Story window.

Option	Function
Show Left Channel	Shows the left audio channel. Disable to hide the left channel. Both left and right audio channels are active by default.
Show Right Channel	Shows the right audio channel. Disable to hide the right channel.

Time menu

The Time menu lets you select from various time-related options.



Time menu

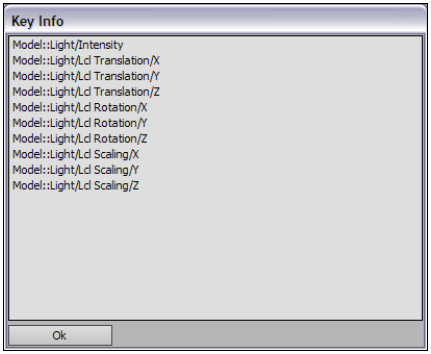
The following table describes the Time menu options:

Option	Function
Frame Take	Frames the start and end of the animation on the current take. You can also use the keyboard shortcut *Ctrl-Shift-A*.
Set Start	Sets the start time of the current take to the position of the Timeline indicator. The Take display updates automatically.
Set End	Sets the end time of the current take to the position of the Timeline indicator. The Take display updates automatically.
Add Mark	Adds a mark on the Action timeline. Double-click a mark to open the Mark dialog box. The Mark dialog box lets you assign a name, change a mark's location on the timeline, or activate a loop. See Mark options.
Del Mark	Deletes the mark on which you right-click.
Del All Marks	Deletes all marks from the Action timeline.

Option	Function
Show Local Time	Displays the local time code (default). This shows the current time of each take.
Show System Time	Displays the time as a reference time code, which provides a reference point for the local time code. The reference time code is based on the clock time of your computer.
Show as Timecode	Changes the display to time code everywhere in MotionBuilder.
Show as Frames	Changes the display to frames everywhere in MotionBuilder.

Key Info

When you right-click a keyframe, the Key Info option displays in the contextual menu and lets you open a Key Info window. The Key Info window displays information about the keyframe you clicked.



Key Info window

■ Transport Controls on page 801

Play speed field

The Timing Controls Play speed field displays the speed at which your takes play in MotionBuilder. By slowing down the play speed, you can analyze model and camera movements more easily. You can also speed up play or draw every frame.

You can select from the following options in the Play speed pull-down menu:

Speed	Description
1/10x	Plays one-tenth slower than real time.
1/5x	Plays one-fifth slower than real time.
1/4x	Plays one-fourth slower than real time.
1/3x	Plays one-third slower than real time.
1/2x	Plays one-half slower than real time.
1x	Plays in real time.
All FR	Plays all frames without skipping any frames. The ALL FR option does not play in real time. The play speed is relative to your computer's speed.
2x	Plays two times faster than real time.
3x	Plays three times faster than real time.
4x	Plays four times faster than real time.
5x	Plays five times faster than real time.
10x	Plays ten times faster than real time.

NOTE To compensate for computer speed, frames may be dropped for playing in real time in all play speeds, excluding the ALL FR option.

See Timing Controls on page 804 for more information on setting play speeds.

Time Format menu

The Timing Controls Time Format menu displays the frame rate by which the timeline is divided. You can select frames-per-second (fps), NTSC, or PAL formats.

NOTE For information on changing the time display, see Selecting a time format on page 790.

By default, the time format displays using a 30 fps time code. You can select other frame rates using the Time Format menu, as follows:

Time Format	Description
120 fps	Displays time with 120 frames in a second. This format is useful when working with motion capture data.
100 fps	Displays time with 100 frames in a second.
60 fps	Displays time with 60 frames in a second.
50 fps	Displays time with 50 frames in a second.
48 fps	Displays time with 48 frames in a second.
30 fps	Displays time with 30 frames in a second (default format).
NTSC Drop	Displays time with 30 drop frames in NTSC format.
NTSC Full	Displays time with 30 frames in NTSC format.
PAL	Displays time with 25 frames in a second, in PAL format.
24 fps	Displays time with 24 frames in a second (film format).
23.976 fps	Displays time with 23.976 frames in a second (video format).
Custom	Lets you select a custom frame rate. See Selecting a time format on page 790 for more information.

When you record data, the data is sampled at a real-time sample rate (in seconds). This means that keyframes can be set between traditional video frames. MotionBuilder sets keyframes between frames to achieve realistic motion.

When you add keyframe animation, keyframes are set at the current time. This can be at a traditional video frame or between frames. The principle behind setting keyframes between frames is the same as capturing data: it results in more realistic data and lets you switch takes between different time formats without affecting the animation.

Changing time formats only changes the unit of measurement that measures the passage of time in MotionBuilder. For example, if you have one second of capture data and you change the time format from 30 fps to 120 fps, you still have one second of capture data.

See Timing Controls on page 804 for more information.

Snap menu

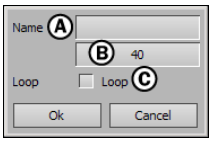
The Timing Controls Snap menu displays the snap method your take uses. Snapping occurs when keyframes or the Timeline indicator move to specific frames, instead of moving between frames. The following table describes the options in the Snap menu:

Option	Function
No Snap	No snapping is applied. You can drag keyframes and key-frame regions to a time between frames.
Snap on Frames	Snaps to an exact frame when the take stops playing. When editing visual keyframes on the Action timeline, the edited keyframes snap onto exact frames. When offsetting keyframe regions, all keyframes in the region snap to frame.
Play on Frames	Plays on exact frames in real time, and does not show any animation in between frames.
Snap and Play on Frames	Plays on exact frames, and snaps to an exact frame when the take stops playing and when you edit keyframes.

See Timing Controls on page 804 for more information.

Mark dialog box

The Mark dialog box appears when you double-click a mark set on the timeline. See Time menu on page 813 for about setting marks.



The Mark dialog box *A.* **Name field** *B.* **Time code field** *C.* **Loop option**

The following table describes the settings in the Mark dialog box:

Setting	Function
Name	Lets you enter a name for the current mark.
Timecode	Lets you enter a time code for the current mark by typing or dragging in the field.
Loop	Loops between the current and previous mark. If there is no previous mark, the Action timeline loops from the beginning of the take to the current mark. When Loop is disabled, the take stops playing at the mark.
Ok	Applies the changes in the Mark dialog box to the current mark.
Cancel	Closes the dialog box without applying changes.

Setting keyframes

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A visual keyframe is a mark on a timeline and represents the time or frame at which you set a key.

When you set a keyframe on a selected property, a visual keyframe displays on the Action timeline in the Transport Controls window at the current timecode, and on the timelines in the Dopesheet window. The Dopesheet window is an expanded view of the Action timeline that lets you edit visual keyframes.

The keyframes that display in the Dopesheet window are associated with selected properties. For example, if you set a keyframe when TRS is selected as the Keying mode in the Key Controls window, one visual keyframe appears on the Action timeline, but three appear on the Dopesheet Timeline area, letting you edit keyframes for translation, rotation, and scaling separately. If you're using a custom keying group, the Dopesheet Timeline will have a key for each property in the keying group.

You can select and edit visual keyframes and visual keyframe regions on the Action timeline. The keyframes at either side of a keyframe region display in white, and the region displays in green.

Action timeline *A.* **Keyframe region**

The keyframes that display on the Action timeline are the keyframes associated with selected properties. When you edit animation by editing the visual keyframes, you also edit the corresponding keys they represent.

For example, if "TRS" is selected in the Keying Mode menu of the Key Controls window, editing a single keyframe on the Action timeline modifies nine different keys simultaneously (the X, Y, and Z values for the selected object's translation, rotation, and scaling curves).

Therefore, it is important that you choose how you want to alter the animation. You may want to use the FCurves window or the Dopesheet window instead of the visual keyframes on the Action timeline.

NOTE Visual keyframes display on the Action timeline by default. To hide visual keyframes, right-click on the Action timeline and disable Visual Keys in the Display menu.

Types of keyframes

There are different kinds of keyframes you can set, depending on how you intend to use them. They include the following:

- Key on page 820
- Zero key on page 820
- Flat key on page 821
- Discontinuity key on page 821
- IK and FK keys on page 822

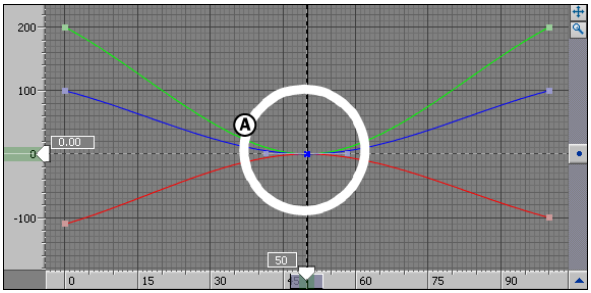
Key

A normal keyframe, often called a *key*, has the interpolation, time, and value that you set for it. It has no additional characteristics.

See Key button on page 858 for more information.

Zero key

A Zero key is a keyframe with a value of zero. A Zero key can have any type of interpolation.



FCurves pane *A.* **A Zero keyframe with Bezier interpolation and flat tangents**

You can use Zero keyframes to define the start and end of an animation. You can also set the effect of a layer to zero at a given time using zero keyframes.

Zero keyframes work on individual or multiple properties. With multiple animation layers, a Zero keyframe means there is no offset on this frame relative to the previous layer.

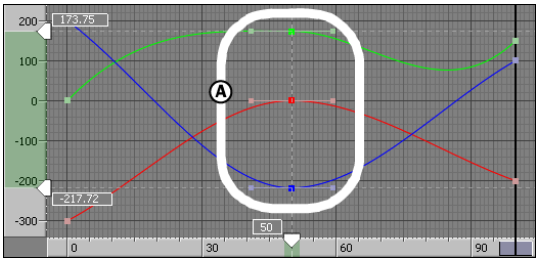
For example, if you have two layers and you do not want the animation from Layer 2 to affect Layer 1, set a Zero keyframe on Layer 2 so that it is not offset from Layer 1.

See Zero button on page 860 for more information.

Flat key

A Flat key is a keyframe with flat tangents and Bezier-User interpolation. In the FCurves window, you can see that a keyframe's tangents are flat when its tangent handles are horizontal.

If your character's feet go through the floor, setting a Flat keyframe at that point prevents the slope of the original animation from overshooting or undershooting.



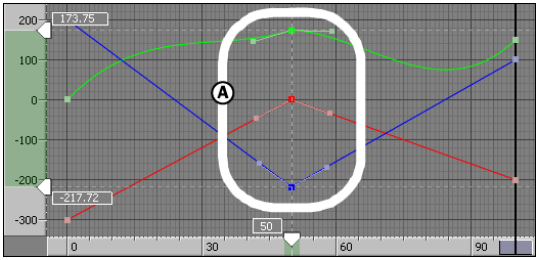
Flat keyframe *A.* **Keyframes with flat tangent handles**

NOTE You can also set Zero, IK, and FK keys with flat tangents.

See Flat button on page 860 for more information.

Discontinuity key

A Discontinuity key is a keyframe with discontinuous tangents and Bezier interpolation. A discontinuous tangent points directly towards or away from the next or previous keyframe.



Discontinuity keyframe *A.* **Discontinuity button** *B.* **Keyframes with discontinuous tangent handles**

See Discontinuity button on page 861 for more information.

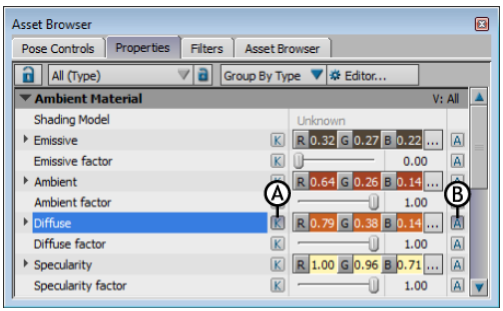
IK and FK keys

When keyframing a Control rig, you can set IK and FK keys. For information on these keys, refer to FK button on page 862 and IK button on page 863.

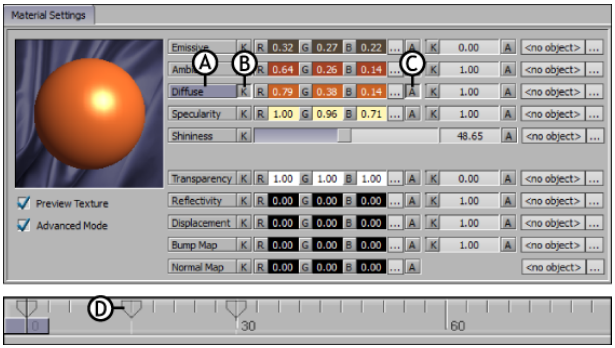
- Keyframe (K) and Animate (A) buttons on page 822
- Setting keyframes on page 819
- Key Controls window on page 843

Keyframe (K) and Animate (A) buttons

Many windows and asset settings in MotionBuilder display properties with corresponding Keyframe (K) and Animate (A) options. For example, the Keyframe and Animate buttons display in the Properties window as shown in the following figure.



Properties window *A.* **Keyframe button** *B.* **Animate button**



Asset Settings area *A.* **Diffuse property selected** *B.* **Keyframe button** *C.* **Animate button** *D.* **Keyframes of Diffuse animation on the Action timeline**

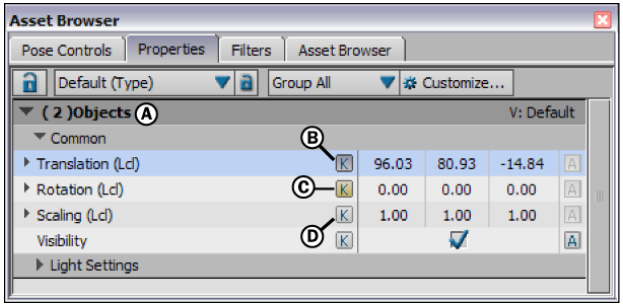
Other places you can find Keyframe and Animate buttons include the FCurves, Dopesheet, and Asset Settings windows, as well as the Character Controls. (See Animate option on page 1762 for information on the Animate button in the Story window.)

When the Animate button of a selected property is active, you can animate that property or use it in a Relations constraint.

The Keyframe button changes color to give you feedback on what is currently keyed in your scene.

The Keyframe (K) options have three states to give you feedback on what is currently keyed in your scene. When a property is keyed at the current time, the Keyframe button displays dark gray. When the property is not keyed at the current time, the Keyframe button is light gray. Keyframe buttons display in yellow when there is partial keyframing at the current time, indicating one of the following states:

- Several objects are selected, but not all are keyframed at the current time
- Not all properties in a collapsed group of properties are keyed at the current time
- The value of a selected property has changed, but it is not yet keyframed



Properties window *A.* Two objects selected *B.* Translation of both objects keyed at the current time *C.* Rotation of one object keyed at the current time *D.* Neither object has a keyframe for scaling at the current time

For example, if you are keyframing the Reach properties for a character's left arm and you key the wrist, then add the un-keyed elbow to your selection, the Reach Keyframe buttons display in yellow to indicate that not all selected objects are currently keyed.

Or, if you key only the X and Y Rotation properties for a selected object, then collapse the Rotation group, the main Rotation Keyframe button displays in yellow to indicate not all the Rotation properties are currently keyed.

When you click a yellow Keyframe button, keys are set on all selected properties, and the Keyframe button changes to dark gray.

■ Setting keyframes on page 819

Setting keyframes

The keyframing process can be broken down into five general steps.

To set a keyframe:

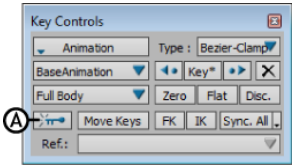
1. Select an object.
2. Change the value of the object's properties.
3. Select the properties you have changed.
4. Select the time at which you want to set a keyframe.

5 To set a keyframe, do one of the following:

- Press K.
- In the Key Controls window, click the Key button.
- In the Properties window, click the Keyframe (K) button next to the selected property.

To set keyframes automatically:

1 Click the Auto Key option (f, A) to activate it.



Key Controls window *A.* **Auto Key button**

2 Change the value of the property you want to animate.

A keyframe is set at the current time.

3 Move the Timeline indicator.

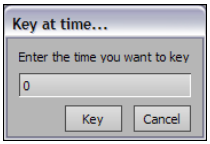
4 Change the value of the property to set a keyframe.

5 When you are finished setting keyframes, click the Auto Key option to disable it.

- Key Controls window on page 843
- Keyframe (K) and Animate (A) buttons on page 822
- Deleting keyframes and keyframe regions on page 833
- Setting many keyframes at once on page 826
- Keying groups on page 837

Setting many keyframes at once

While you usually need to set one keyframe at a time at the current time, the Key at Time dialog box lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time. Setting more than one keyframe at once removes the need to copy and paste keyframes to create loops, for example.



Key at Time dialog box

Besides letting you set multiple keyframes at once, Key at Time is especially useful when you have changed the values of selected properties without first changing the current time. Instead of changing the current time and starting over, you can use Key at Time to set a keyframe at a time other than the current one.

To set a keyframe using Key at Time:

1. Change the values of selected properties, then open the Key at Time dialog box.
2. Enter the frame number at which you want to set a keyframe.
3. Click the Key button or press Enter.

To set multiple keyframes using Key at Time:

1. Change the values of selected properties, then open the Key at Time dialog box.
2. Enter the frame numbers, separating each with a comma () or a slash (/). For example, to set three keyframes at frames 0, 10, and 20, you would type the value “0,10,20” or “0/10/20”.
3. Click the Key button or press Enter.

Selecting and editing keyframes

The following describes methods for selecting, deselecting, and deleting keyframes:

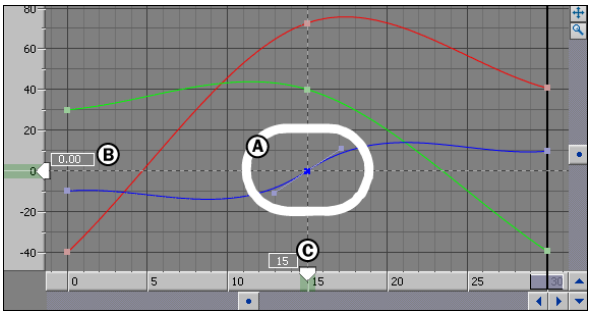
To select keyframes:

1. Click a single keyframe, or click-drag over several keyframes to include them in a keyframe region. You can also right-click and select the Select All or Select Keys in Box options in the contextual menu.
2. *Ctrl*-click additional keyframes to create or expand a keyframe region.

To select a keyframe region:

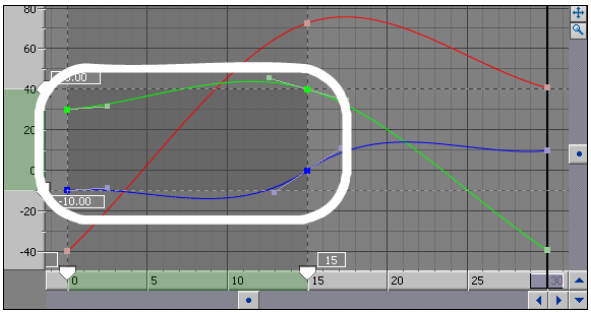
➤ Shift-click the first and last keyframe to select a keyframe range. To expand a selection region, *Ctrl*-click additional keyframes.

In the FCurves window, selected keyframes display with tangent handles by default. The Value display shows the value of a selected property on the vertical axis, and its Time display on the horizontal axis.



A. **Selected keyframe with tangent handles** *B.* **Value (0.00) of selected keyframe displayed in the Value display** *C.* **Time (frame 15) of selected keyframe displayed in the Time display**

When multiple keyframes are selected, a gray box outlines the selection area (as seen in the following figure), and four values display, two on the Vertical axis, and two on the Horizontal axis.



Selected region displays as a gray box

NOTE Selecting and deselecting keyframes on the Dopesheet Timeline area is similar to selecting and deselecting keyframes in the Transport Controls. You can only select one keyframe or keyframe region at a time in the Dopesheet window. When you select a keyframe or keyframe region in the Dopesheet window, it is not selected in the Transport Controls. For example, you can select one keyframe in the Transport Controls window and a separate keyframe regiyjhon in the Dopesheet window. However, the result of any change to the keyframes on the Dopesheet Timeline area appear on the Action timeline, and vice versa.

To deselect keyframes:

➤ Double-click an empty space beside the keyframe, either on the Action timeline or in the FCurves pane.

To deselect a keyframe region, Spacebar-click or double-click an empty space on the Action timeline or on another keyframe.

To delete keyframes:

➤ To delete a keyframe or keyframe region, right-click a selected keyframe or keyframe region and choose Delete from the contextual menu or press the Delete key.

As you can see in the FCurves window, deleting a keyframe removes its associated slope on the function curve and joins the slope between the preceding and following keyframes.

To cut, copy, and paste keyframes:

➤ Right-click the keyframe selection and choose the appropriate option from the Transport contextual menu or use the appropriate keyboard shortcut (see Transport Controls contextual menu on page 807).

To navigate between keyframes:

➤ Use the Back and Forward buttons in the Key Controls window, or the left and right arrows on the keyboard to move between keyframes on the Action timeline.

To offset keyframe selections:

➤ Drag the region or its Time display to a location, or double-click the first Time display, type the frame you want the keyframe to move to, and press Enter. To cancel the offset, click outside of the Time display before pressing Enter.

If the Move Ripple option is activated, keyframes surrounding the region are pushed relative to the offset.

To stretch or shrink keyframe regions:

➤ Drag the region's first or last keyframe or Time display to a location on the Action timeline, or double-click the region's last Time display and enter the precise frame to which you want the region to stretch, then press Enter.

To cancel the stretch, click outside of the Time display before pressing Enter.

If Stretch Ripple is activated, keyframes surrounding the region are offset according to the stretch.

Manipulating keyframe selections

You can translate and scale entire regions, as well as single keyframes within a selection range.

You can also move visual keyframes on the FCurve timeline to move selected keyframes in that region only. This differs from moving visual keyframes on the Action timeline, which moves all the keyframes in that region.

NOTE When you modify function curves, use the Undo (*Ctrl-Z*) and Redo (*Ctrl-Y*) options to cancel the last FCurve operation, such as a deleted keyframe, a change of interpolation, and so on. Redo repeats the last FCurve operation. You can set the default number of undo operations in the menu bar (Settings > Preferences > Undo).

The rest of this section describes methods for manipulating keyframe regions.

Offsetting keyframe selections

Drag the keyframe selection to a location on the FCurve timeline or in the FCurves pane. Any keyframes that are not selected within the region remain in place when the region moves.

To offset keyframes one frame at a time:

1. Drag the first Time display to a location or
2. Double-click the first Time value, enter the frame you want the keyframe to move to, and press Enter.

NOTE To drag a keyframe selection to specific frames, as opposed to between frames, use the options in the Snap menu. See Snap menu on page 817.

To stretch or shrink keyframe selections:

➤ Drag the selection's first or last keyframe.

To stretch the region one frame at a time:

1. Drag the second Time display to a location or double-click the second Time value.
2. Enter the frame where you want the region to move,
3. Press Enter.

Cutting, copying, and pasting keyframes

You can use contextual menu options or keyboard shortcuts to cut, copy, and paste selected keyframes.

To quickly copy-paste a keyframe or keyframe region:

1. Select a keyframe or keyframe region on the Action timeline in the Transport Controls, FCurves, or Dopesheet windows.
2. C-drag the selection along the timeline.

   The keyframe selection is copied and pasted at the new location.

To copy a keyframe or keyframe region:

1. Select a keyframe or a keyframe region on the Action timeline.
2. Right-click the keyframe or region and select Copy from the contextual menu.

   The keyframe selection is copied and stored in memory so that you can paste it in a different location.

   TIP You can also use the keyboard shortcut *Ctrl-C* to copy selected keyframes.

To cut a keyframe or keyframe region:

1. Select a keyframe or a keyframe region on the Action timeline.
2. Right-click the keyframe or region and select Cut from the contextual menu.

   The keyframe selection is removed and stored in memory so that you can paste it in a different location.

   TIP You can also use the keyboard shortcut *Ctrl-X* to cut selected keyframes.

To paste a keyframe or keyframe region:

➤ Right-click a timeline, a keyframe, or keyframe region, and select Paste from the contextual menu.

A copied or cut keyframe selection is inserted where you right-clicked.

TIP You can also use the keyboard shortcut *Ctrl-V* to paste the copied or cut selection.

Pasting a keyframe on a keyframe region deletes all keyframes within the region and replaces the first key of the region with the pasted keyframe. When you paste a keyframe region on a keyframe, the region's first key replaces the original keyframe.

If nothing is selected on the timeline when you paste, the pasted keyframe selection is placed at the current time.

NOTE To push keyframes ahead of pasted keyframes, activate Paste Ripple.

- Copying and pasting values between keyframes on IK effectors on page 832

Copying and pasting values between keyframes on IK effectors

To copy Transformation and Rotation values between keyframes on IK effectors:

1. Select a keyframe or a keyframe region in the Action timeline.
2. Right-click the keyframe or region and choose where you want to copy values from:
   - To copy values from the previous keyframe, select Copy Previous Key on Selected IK Objects.
   - To copy values from the next keyframe, select Copy Next Key on Selected IK Objects.
3. In the menu that appears, select which values you want to copy:
   - To copy Translation values, select T.
   - To copy Rotation values, select R.
   - To copy both Translation and Rotation values, select TR.

   The type of values you have chosen to copy are applied to the keyframe or keyframe region you have selected.

To paste Transformation and Rotation values onto keyframes for IK effectors:

1. Select the keyframe whose values you want to copy, right-click and select Copy.
2. Select a keyframe or keyframe region for an IK effector in the Action timeline.
3. Right-click and select Paste on Selected IK Objects.

4 In the menu that appears, select which values you want to paste:
   - To paste both Translation and Rotation values, select TR.
   - To paste Translation values, select T.
   - To paste Rotation values, select R.

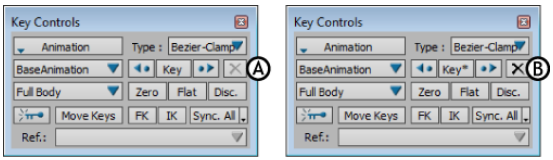
- Cutting, copying, and pasting keyframes on page 830
- Copying and pasting values between keyframes on IK effectors on page 832

Deleting keyframes and keyframe regions

To delete keyframes at the current time:

1 In the Transport Controls window, move the Timeline indicator to the keyframe you want to delete.

2 Click Delete in the Key Controls window.



Keyframe buttons *A.* Delete button unavailable when there is no key at current time *B.* Delete button available

To delete a selected keyframe:

1 Click or drag around a keyframe to select it.

2 Press Delete to delete the selected keyframe.

TIP You can also right-click the timeline and select Delete from the contextual menu.

To delete keyframe regions:

1 *Ctrl*-click multiple keyframes or drag around a number of keyframes to select them.

2 Press Delete to delete the selected keyframe region.

TIP You can also right-click the timeline and select Delete from the contextual menu.

■ Delete button on page 859

Clearing animation

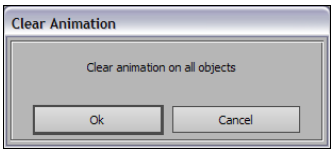
Using a group of options in the Key Controls Animation menu, or the MotionBuilder Animation menu, you can quickly clear all animation from your scene, from selected objects, or from selected properties of selected objects.

To remove animation from all objects:

1 Do one of the following:

- In the Key Controls window, select Clear All (All Properties) from the Animation menu.
- From the MotionBuilder menu bar, select Animation > Clear All (All Properties).

2 Click OK in the Clear Animation dialog box that appears.



Clear animation dialog box

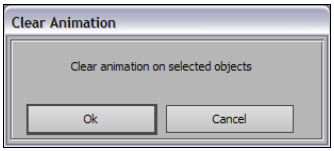
To remove animation from selected objects:

1 Select the objects from which you want to remove animation.

2 Do one of the following:

- In the Key Controls, open the Animation menu and select Clear Selected (All Properties).
- From the MotionBuilder menu bar, select Animation > Clear Selected (All Properties).

3 Click OK in the Clear Animation dialog box that appears.



Clear Animation dialog box

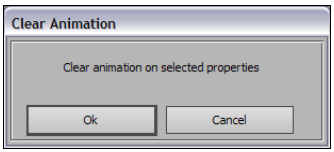
To remove animation from selected properties:

1 Select the objects you want to affect, then select the specific properties you want to clear in the Properties window.

2 Do one of the following:

- In the Key Controls, open the Animation menu and select the Clear Selected (Selected Properties) option.
- From the MotionBuilder menu bar, select Animation > Clear Selected (Selected Properties).

3 Click OK in the Clear Animation dialog box that appears.



Clear Animation dialog box

- Key Controls window on page 843

Visual keyframe feedback

Visual keyframes can display with different colors. They can be completely one color or partly colored.

When keyframes are completely colored, they are related to a clip of the same color in the Story window.

A keyframe with a colored tip indicates that it was set in either the Full Body keying mode, Body Part keying mode, or on a Character Extension. These partly colored keyframes come in three colors, which indicate the following:

Keyframe tip color	Indicates
Red	The keyframe is set in Full Body keying mode. It also indicates that all body parts are keyed at the current time. If you edit a red keyframe, it may turn green.
Green	The keyframe is set in Body Part keying mode on one body part or many body parts.A green-tipped keyframe can also indicate that it is set on Character Extensions and body parts.
Yellow	The keyframe is set on one Character Extension or multiple Character Extensions.

In the Transport Controls window, right-click the timeline and select Visual Keys > Show Key Hint to display or hide color feedback on visual keyframes.

- Showing and hiding visual keyframes on page 836
- Keyframing a Control rig on page 1257

Showing and hiding visual keyframes

Visual keyframes in the Transport Controls can be displayed or hidden at any time. You can also control whether visual keyframes display color-coded feedback.

To display or hide visual keyframes:

1. Select an animated object. Keyframes on objects that are not selected do not display.
2. Right-click the Action timeline in the Transport Controls window.
3. Select Display > Visual Keys to show or hide visual keyframes on the Action timeline. Keyframes are shown by default.

To show color-coding for visual keyframes:

➤ In the Transport Controls, right-click the timeline and select Visual Keys > Show Key Hint.

As you set keyframes on a character for example, the tips of the keyframes are now color-coded to indicate what is keyed.

To hide color-coding for visual keyframes:

➤ In the Transport Controls, right-click the timeline and deselect Visual Keys > Show Key Hint.

All visual keyframes on the timeline now display with no color-coding.

- Visual keyframe feedback on page 835

Keying groups

Whenever you set a keyframe in MotionBuilder, you set it for at least one property of a selected object. For example, if you want to animate a cube moving across the scene, you set keyframes for the cube's translation property.

There are three ways you can choose the properties to be keyframed:

- Select each property from a list of properties.
- Select a keying group (pre-determined groups of properties) in the Key Controls.
- Select keying groups for character animation.
- Create custom keying groups that can be selected from the keying groups list in Key Controls.

Selecting individual properties

You can select any property in the Properties window, the FCurves window, and the Dopesheet window. These windows list all properties of selected objects, such as common properties (translation, rotation, and scaling) and object-specific properties (a Light's color or cone angle). See Property list on page 769.

Selecting keying groups in the Key Controls

Instead of selecting and deselecting frequently used properties one by one, you can select keying groups in the Key Control's Keying Group menu.

Keying groups are pre-determined groups of properties. Selecting a keying group selects specific properties. For example, if you select TRS in the Keying Group menu, keyframes are set for translation, rotation, and scaling properties for the selected object. If you then select the T keying mode, keyframes are set only for the translation property, but not for rotation or scaling.

You can add individual properties to a keying group selection. For example, if TR is the keying group selected in the Key Controls, you can select additional properties in the Properties window. You can also create custom keying groups for objects and characters that let you choose what properties you want to key on. See Selecting keying groups for objects on page 838 or Creating a custom keying group on page 839.

Selecting keying groups for characters

Keyframing a character's Control rig involves selecting many effectors and their properties. The Keying Mode area on page 1569 in the Character Controls lets you do all of following at the same time:

- Select all effectors or the group of effectors you want to animate.
- Select a pre-determined group of properties for animating effectors.
- Affect effector manipulation, to control effector movement.

For more information, see Keying Mode area on page 1569.

Selecting keying groups for objects

Select keying groups to choose the properties you keyframe.

1. Select an object in the scene, such as a light.
2. In the Key Controls window, select a keying group in the Keying Group menu, such as TR to select translation and rotation properties.

   When you set a keyframe, only the properties in the keying group are selected. If TR is the current keying group, only translation and rotation can be animated.

   NOTE Properties that are selected as part of the current keying group display light blue in the Properties, FCurves, and Dopesheet windows.

3 You can add to the keying group selection by clicking additional properties in the Properties window.

   For example, you can select a light's Color property. When TR is the current keying group and the Color property is also selected, you set keyframes for the light's translation, rotation, and color.

See Keying Mode menu on page 853 for more information on the different keying groups, and see Creating a custom keying group on page 839 for more information about how to create a custom keying group for objects or characters.

Creating a custom keying group

You can control an object's animation with keying groups [also called keying modes], and MotionBuilder lets you create custom keying groups for objects. Keying groups contain information about which properties will be captured when you create keyframes.

With any custom keying group, you can also edit relationships between the keying group's properties and an object pose using the Connection Editor.

The types of custom keying groups that can be created are:

- "local" objects—the keying group will only belong to the object or objects selected at the time the keying group is created)
- "object types"—these keying groups can be assigned for objects of the same type which will usually contain the same properties information
- "global"—these keying group can be associated with any object in a scene, but only corresponding properties will be applied

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NOTE MotionBuilder needs to have an object selected as a reference to know what Object Type keying group you want to create. If no object is selected (and there is nothing in the source column) when you create a keying group of Object Type, the keying group created is "Global" instead.

To create a custom keying group:

1 Do one of the following:
   - Select one or more objects in a scene.
   - If you have an object's property view open, select one or more properties from it.

2 Select Window > Add Property Editor.

3 Select the Keying Groups tab.

- If you have selected properties from another object's property view, drop them in the source column of the Keying Groups tab

4 Click the right arrow next to the views menu, and select Create Keying Group as...

5 Choose which type of keying group you want to create (either local, object type or global).

NOTE To create an Object Type keying group, you need to select an object as a reference for MotionBuilder to know what type to create. If no object is selected (and there is nothing in the source column) when you create a keying group of Object Type, the custom keying group will be "Global" instead.

6 Select the properties you want to include from the Source column and either drag them or click >> [Assign] to add them to the keying group.

7 Close the Property Editor when you are finished adding properties to the keying group.

TIP From the Property View you can click Customize to open the Property Editor. The Property Editor will open on the tab you used last, and when you access the Keying Groups tab, it will automatically display the properties of any object(s) that you currently have selected in the Source column.

See Loading custom local keying group data on page 219for more information about how to apply a custom local keying group to many characters in a scene.

Keyframing shortcuts

The following table lists keyboard alternatives to using the Keyframe buttons:

Previous	Press the left arrow key on the keyboard to move the Timeline indicator back to the previous keyframe.
Next	Press the right arrow key on the keyboard to move the Timeline indicator forward to the next keyframe.
Key	Press the *K* key to set a keyframe.

Delete	Press the *Delete* key to delete a selected keyframe.
Zero	Press *Shift-K* on the keyboard to set a Zero keyframe.
Flat	Press *Ctrl-K* to set a flat keyframe.

■ Keyframe buttons on page 857

Key Controls window

50

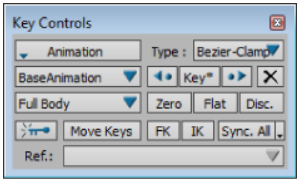
The main window for setting keyframes is the Key Controls window.

The Key Controls display when you select either the Creation, Animation, Editing, or Story layout from the Layout menu.

To open the Key Controls window at any time, you can also select Window > Key Controls from the menu bar.

The Key Controls window includes menus and options that let you do the following:

- select an interpolation mode
- set and delete keyframes
- step through keyframes
- create and select animation layers
- select take options
- select keying groups
- set tangent and interpolation modes
- plot or clear animation



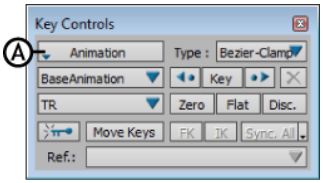
Key Controls window

Once you have modified a selected object's properties, the Key Controls window lets you set different types of keyframes manually. You can also activate the Auto Key option to set keyframes automatically every time you change a selected object's properties.

- Animation menu (Key Controls) on page 844
- Type menu on page 851
- Layer menu on page 852
- Keying Mode menu on page 853
- Keyframe buttons on page 857
- Multi-Referential constraint settings on page 1103

Animation menu (Key Controls)

In the Key Controls, the Animation menu lets you set keyframes, as well as plot and remove animation from all or selected properties. You can also choose take options, or create animation paths.



Key Controls window *A.* **Animation menu**

The Animation menu options consist of the following:

- Key At Time option on page 845
- Dynamic Editor option on page 845
- Plot All and Plot Selected options on page 845
- Clear All and Clear Selected options on page 845
- Take Options menu on page 846
- IK/FK Key Options menu on page 846
- Keying Group Info option on page 850

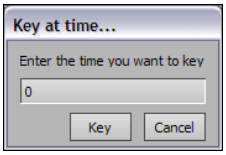
- Display Keying Group option on page 850
- Create Animation Path option on page 851

Key At Time option

The Key at Time option opens a Key at Time dialog box, which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing *Ctrl-Shift-K*. In addition, the Key at Time option is in the contextual menus of the Transport Controls, FCurves, Story, and Dopesheet windows.

See Setting many keyframes at once on page 826.



Key at Time dialog box

Dynamic Editor option

Opens the Dynamic Editor window which lets you edit interpolation. See Dynamic Editor on page 929.

Plot All and Plot Selected options

Selecting Plot All (All Properties), Plot Selected (All Properties), or Plot Selected (Selected Properties) opens the Plot All or Plot Selected window, which lets you set plotting options for plotting takes to models, specifying the frame rate, and selecting filters when plotting.

See Plot Properties window on page 1893 and The plotting process on page 1887 for more information.

Clear All and Clear Selected options

Selecting Clear All (All Properties) removes animation from all objects in the scene, Clear Selected (All Properties) removes animation from only selected objects, and Clear Selected (Selected Properties) clears animation from only the selected properties of selected objects. To select specific properties you want to clear, use the Properties window.

See Clearing animation on page 834.

Take Options menu

The Take Options menu lets you choose Normal or Multi Take modes.

Take Options	Description
Normal	Use Normal to set object behavior based on the previous take. When switching from one take to another in Normal mode, the new take acquires the object transformation based on the location of the object in the previous take.
Multi Take	Use Multi Take when you want to set object behavior for each take. Multi Take works per object transformation, letting you keep an object's transformation on multiple takes without having to set keyframes on each take.

For example, use Normal if you have keyframe animation on a cube on Take 1, switching to another take in which the cube is not animated displays the cube at the last position it held in the previous take.

NOTE Normal is the default behavior for all objects, excluding nulls, markers, models, and skeletons.

If you are working with multiple takes and you do not want to set keyframes for each take, you can select the object, then choose Multi Take. As you switch between takes, the object always remains where it was placed, with or without a keyframe.

NOTE By default, Multi Take applies to objects such as nulls, markers, models, skeletons, and cameras, and excludes lights.

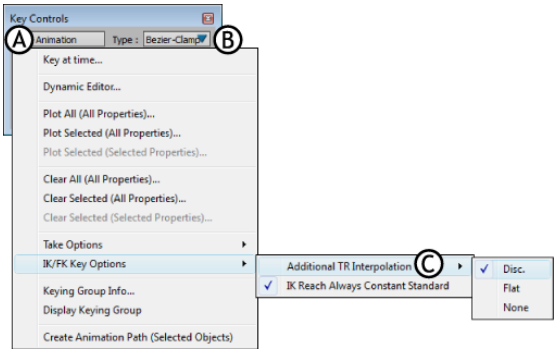
IK/FK Key Options menu

The IK/FK Key Options menu lets you select preferences pertaining to setting IK and FK keyframes. You can choose either Additional TR Interpolation option or IK Reach Always Constant Standard option.

IK/FK Key Options	Description
Additional TR Interpolation	The Additional TR Interpolation option lets you set IK or FK keyframes with flat or discontinuous tangents for Translation and Rotation properties.

IK/FK Key Options	Description
IK Reach Always Constant Standard	When you set an IK or FK keyframe, Translation, Rotation, and Reach properties are keyframed. The interpolation set for Reach is always Constant.

When you choose Additional TR Interpolation option, the results depend on the interpolation type selected in the Type menu of the Key Controls.



Key Controls *A.* **Animation menu** *B.* **Type menu** *C.* **Additional TR Interpolation option**

For a description of the results you can achieve with Additional TR Interpolation options when Bezier and TCB interpolation are selected in the Type menu, refer to the following tables.

Use the Additional TR Interpolation Discontinuity option with the following interpolation types.

Additional TR Interpolation: Discontinuity (Disc.)	
Interpolation Type	**Description**
Bezier-Clamp	Bezier-Clamp interpolation with discontinuous tangents.
Bezier-Auto	Bezier-Auto interpolation with discontinuous tangents.
Bezier-User	Bezier-User interpolation with discontinuous tangents.
TCB	TCB interpolation with Continuity set to a value of -1.

NOTE These options do not affect Constant or Linear interpolation.

Use the Additional TR Interpolation Flat option with the following interpolation types.

Additional TR Interpolation: Flat	
Interpolation Type	**Description**
All Bezier	Bezier-User interpolation with flat tangents.
TCB	TCB interpolation with Tension set to a value of 1.

NOTE These options do not affect Constant or Linear interpolation.

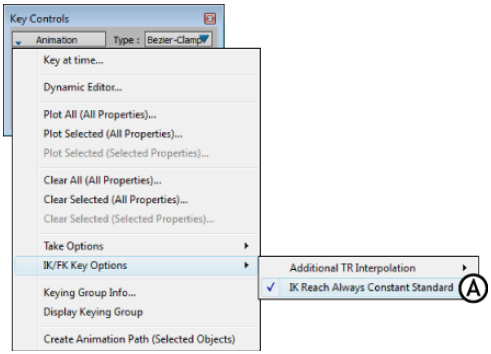
Use the Additional TR Interpolation None option with the following interpolation type.

Additional TR Interpolation: None	
Interpolation Type	**Description**
All Bezier and TCB	Interpolation with tangents that are neither flat nor discontinuous. The interpolation reflects what is selected in the Type menu only.

NOTE These options do not affect Constant or Linear interpolation.

See Flat tangents on page 962 and Discontinuous tangents on page 963 for more information. See FK button on page 862 and IK button on page 863.

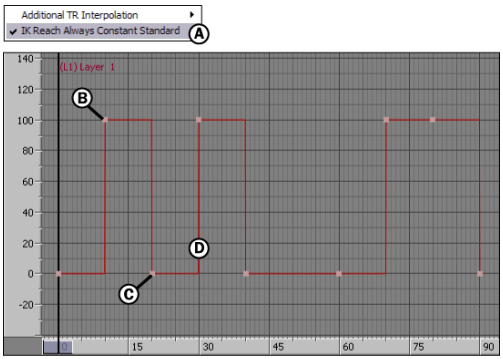
The IK Reach Always Constant Standard option lets you choose whether the interpolation is Constant Standard or Constant Next.



Key Controls *A.* **IK Reach Always Constant Standard**

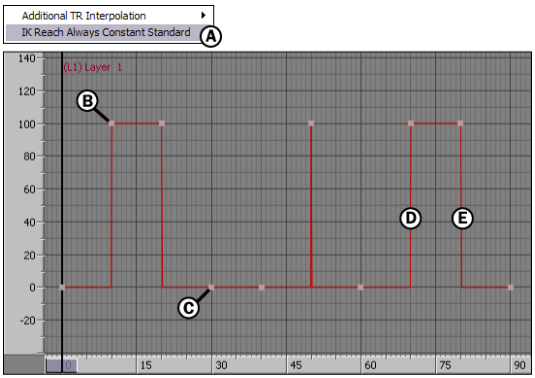
When you set an IK or FK keyframe, Translation, Rotation, and Reach properties are keyframed. The interpolation set for Reach is always Constant.

When the IK Reach Always Constant Standard option is active, any IK or FK keyframe you set always has Constant Standard interpolation for Reach properties. This option is active by default.



Function curve for Reach T property in FCurves window *A.* **Active IK Reach Always Constant Standard** *B.* **IK keyframes show a value of 100** *C.* **FK keyframes show a value of 0** *D.* **All Constant interpolation is always Constant Standard**

When the IK Reach Always Constant Standard option is disabled, the FK keyframes you set have Constant Standard interpolation for Reach properties, but IK keyframes have Constant Next interpolation.



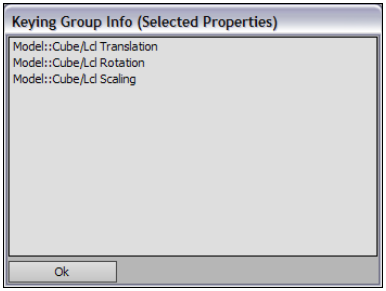
Function curve for Reach T property in FCurves window *A.* **Disabled IK Reach Always Constant Standard** *B.* **IK keyframes show a value of 100** *C.* **FK keyframes show a value of 0** *D.* **Interpolation for FK keyframes is Constant Standard** *E.* **Interpolation for IK keyframes is Constant Next**

NOTE These options do not affect Constant or Linear interpolation.

See FK button on page 862 and IK button on page 863 and Constant interpolation on page 922.

Keying Group Info option

The Keying Group Info option opens the Keying Group Info dialog box, which displays information about the keyframes that are part of the selected keying mode.



Keying Group Info dialog box

Display Keying Group option

A group of properties called Keying Group displays in the Properties, Dopesheet, and FCurves windows when you select one of the following:

- Part of a character's control rig
- The constrained object of a Path constraint
- The constrained object of a Multi-Referential constraint
- Character Extensions

For example, when part of a control rig is selected, the Keying Group consists of properties that affect the translation, rotation, and reach of the selected effector or effectors.

NOTE In the Dopesheet window, more properties display in the Keying Group for a selected control rig than in the Properties or FCurves windows.

The Display Keying Group option in the Animation menu of the Key Controls window lets you show or hide the Keying Group properties in the Properties, Dopesheet, and FCurves windows. By default, the Display Keying Group option is disabled and the Keying Group properties are not shown.

Create Animation Path option

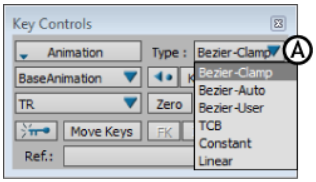
The Create Animation Path option lets you create an editable 3D animation path.

Select an object in the Viewer window, choose Create Animation Path from the Animation menu and set keyframes for it. An editable curve is created as you keyframe, with nodes appearing at every key.

See Creating an animated path with a 3D Curve on page 1113.

Type menu

The Type menu lets you determine the default interpolation of the keyframes you set.



Key Controls window *A.* **Type menu**

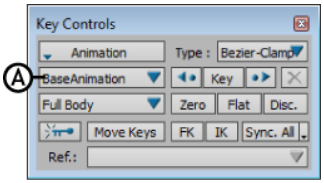
The rest of this section describes the options in the Type menu. Interpolation modes are described in more detail in the Interpolation on page 913.

Option	Function
Bezier-Clamp	Tangents are automatically calculated based on the values of the neighboring keyframes. When you move neighboring keyframes to the same value as a Bezier-Clamp keyframe, the tangents of the Bezier-Clamp keyframe automatically become flat.
Bezier-Auto	Tangents are automatically calculated based on the values of the neighboring keyframes.
Bezier-User	Tangents are not influenced by the neighboring keyframes.
TCB	Joins each keyframe using a Hermite-type curve, but the slope on either side of a tangent handle is changed using the TCB (Tension/Continuity/Bias) values.

Option	Function
Constant	Maintains the same keyframe value between keyframes, with no slope between them.
Linear	Joins keyframes using straight lines, and a constant slope between keyframes.

Layer menu

The Layer menu in the Key Controls window lets you select the animation layer that receives keyframes, and lets you create layers. You can select the BaseAnimation layer, or any number of separate layers on which to animate. To select, manage, and merge many layers, use the Animation Layer editor. See Animating on Layers on page 873.



Key Controls window *A.* **Layer menu**

NOTE The layer selected in the Layer menu is often referred to as the *current layer*, to differentiate it from other layers that may also be selected in the Animation Layer editor. See Current layer on page 878.

BaseAnimation layer

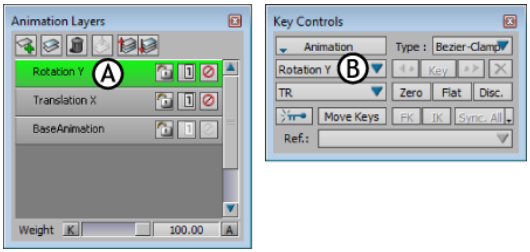
The BaseAnimation layer is the default animation layer. While you can use any number of layers when animating, plotting your animation merges all layers to the BaseAnimation layer. See BaseAnimation layer on page 874.

AnimLayer1

AnimLayer1 displays in the menu by default. Select AnimLayer1 from the menu to set keyframes on this layer. Selecting “(New Layer)” from the menu creates a layer called AnimLayer2. Subsequent layers you create are sequential, such as AnimLayer3, AnimLayer4, and so on.

You can also use the Animation Layer editor to create layers, and to manage, parent, and merge layers. When you select a layer in the Layer menu of the

Key Controls window, the layer displays bright green in the Animation Layer editor to indicate that this is the layer that receives keyframes.

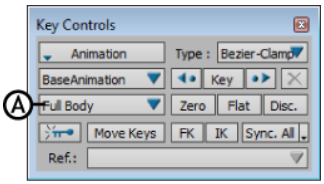


Renamed layer *A.* **"Rotation Y" layer selected in the Animation Layer editor** *B.* **Selected layer displayed in the Layer field**

See Animating on Layers on page 873.

Keying Mode menu

The Keying Modes menu in the Key Controls window determines which properties of selected objects receive keyframes.



Key Controls window *A.* **Keying Mode menu**

For example, selecting the T option in the Keying Mode menu displays the visual keyframes only for a selected object's translation curves on the Action timeline. This lets you add, edit, or delete keyframes on the object's translation curves.

The items in the menu may change, depending on what you are doing in MotionBuilder (and depending on whether you have created custom keying groups which get added to the menu—see Creating a custom keying group on page 839). For example, working with certain windows and settings can influence the keyframing options in the Key Controls (see Contextual keying modes on page 854).

The following table describes the default Keying modes:

Keying Mode	Description
T	Displays keyframes associated with the selected object's translation (T) curve. Select T to add a keyframe to the translation at the current timecode.
R	Displays keyframes associated with the selected object's rotation curve. Select R to add a keyframe to the rotation properties at the current timecode.
S	Displays keyframes associated with the selected object's scaling (S) curve. Select S to add a keyframe to the scaling properties at the current timecode.
TR	Displays keyframes associated with the selected object's translation and rotation curves. Select TR to add a keyframe to the translation and rotation properties at the current timecode. Any change in scale is not keyframed.
TRS	Displays keyframes associated with the selected object's translation, rotation, and scaling curves. Select TRS to add a keyframe to the translation, rotation, and scaling properties at the current timecode.
Current Camera	Adds a keyframe to the current camera's translation, rotation, field of view and roll properties. The camera does not need to be selected, as long as it is the current camera. Select this group when you want to create camera animation (such as a walk-through). Keys are set for Translation (T), Rotation (R), Field of View, and Roll.
Selected Properties	Adds a keyframe to the selected properties only. You can select properties in the Properties, FCurves, and Dopesheet windows, as well as in an object's settings, such as Light settings.

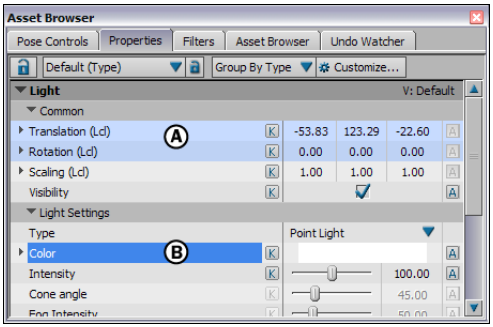
Contextual keying modes

Certain windows and settings influence the keying mode [also called keying group] in the Key Controls window. These settings can be grouped by the degree of influence each has over the Key Controls window.

You can select additional properties on top of other static keying modes such as Full Body, Body Parts, TR, T, R, S, and TRS.

Static keying groups display the properties that they keyframe in light blue. Those properties receive a keyframe when you click the Key button or press the K keyboard shortcut, but they are not selected.

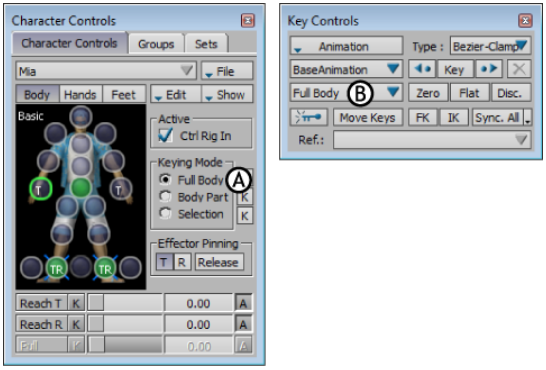
Selected properties display in dark blue. Selected properties are also keyframed when you click Key.



Contextual Keying Modes *A.* **Light-blue properties receive keyframes.** *B.* **Color property is selected and can also receive keyframes**

Keying modes in the Character Controls

When working with Control rigs, keyframing is relative to the selected keying mode in the Character Controls.



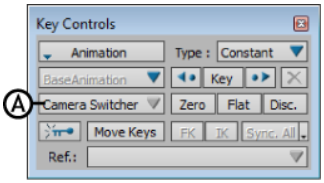
A. **Full Body is the Keying group in the Character Controls window**
B. **Full Body displays in the Key Controls window**

Depending on the selection, setting a keyframe applies to either the full body (Full Body mode), the selected body part (Body Parts mode), or the selected effector (Selection mode).

In Full Body or Body Parts mode, keyframes are applied to the translation and rotation nodes included in the full body or selected body parts by default.

Camera Switcher

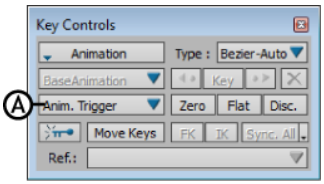
When working with the Camera Switcher, the Key Controls are contextual to the Camera Switcher, letting you keyframe only with the Camera Switcher. See Camera switcher on page 483.



Key Controls window *A.* **Camera Switcher is active and receives keyframes.**

Motion Blend, Animation Trigger, and Optical Settings

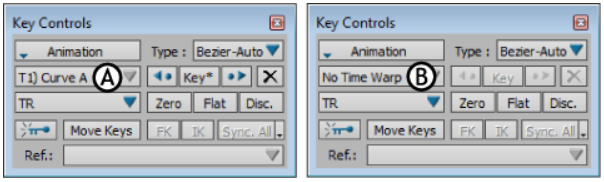
When using the Motion Blend, Animation Trigger, or Optical settings, the name of the window or settings appears in the Keying Group menu and all the options in the Key Controls are unavailable.



Key Controls window *A.* **The words "Anim. Trigger" appear in the Keying Mode menu when the Animation Trigger window is open.**

TimeWarp Curves

When the TimeWarp pane is active in the FCurves window, TimeWarp is the active Keying group, and the keying options are contextual to the selected object's TimeWarp curve.



Key Controls window *A.* **TimeWarp curve name.** *B.* **TimeWarp is active, but there is no TimeWarp curve.**

If the TimeWarp pane is active but there is no TimeWarp curve, No Time Warp displays in the Key Controls window, and the Keyframe buttons are not available.

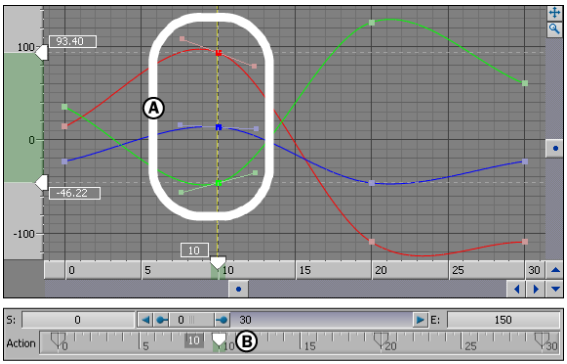
For more information, see TimeWarp pane on page 993.

Keyframe buttons

The Keyframe buttons in the Key Controls window let you set, delete, and navigate through different types of keyframes. You can set keyframes on an object's translation, rotation, and scaling properties, or for other properties such as a light's cone angle. You can also set keyframes that have zero, flat, or discontinuous values, or keyframes specifically for Control rigs.

When you select an object and set a keyframe, a visual keyframe appears on the Action timeline in the Transport Controls at the current time.

For example, setting a keyframe on a selected cube with "T" as the Keying Group adds a keyframe to the object's X, Y, and Z translation curves. If you delete any keyframes in the FCurves window, the remaining keys are still represented by visual keyframes.



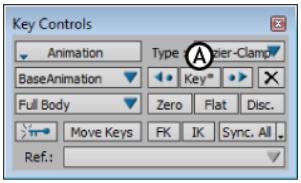
A. **Keyframes added to the selected object's X, Y, and Z translation curves in the FCurves window** *B.* **A visual keyframe representing the three keys in the Transport Controls**

The keyframe buttons consist of the following:

- Key button on page 858
- Previous and Next buttons on page 858
- Delete button on page 859
- Zero button on page 860
- Flat button on page 860
- Discontinuity button on page 861
- Auto Key option on page 861
- Move Keys on page 862
- FK button on page 862
- IK button on page 863
- Sync and Sync All on page 864

Key button

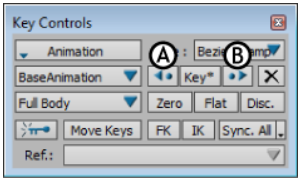
The Key button lets you set a keyframe to the selection at the current timecode. You can also press K to set keyframes. An asterisk indicates a keyframe at the current time.



Keyframe buttons *A.* **Key button with an asterisk indicates a key at the current time**

Previous and Next buttons

The Previous and Next buttons let you move between the keyframes that are part of the current keying group.



Key buttons *A.* **Previous button** *B.* **Next button**

To go back in the current take to previous keyframes, click the Previous button. To move forward to keyframes in the current take, click the Next button.

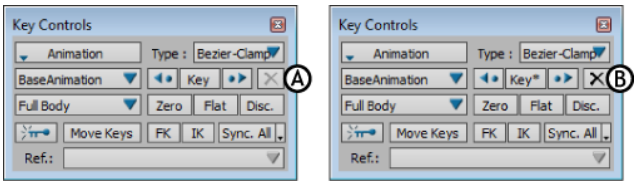
When using the Previous or Next buttons, the Timeline indicator moves to the position of the previous or next keyframe on the Action timeline in the Transport Controls and Dopesheet windows. If there is no animation, Previous and Next are not available.

Delete button

The Delete button removes the keyframe at the current timecode for the selected object, function curve, and property.

For example, if the selected object has a keyframe for the Scale property's X value at the current timecode, clicking Delete with Translation as the Keying Group deletes a keyframe from the selected object's Translation curve. The keyframe for the Scale property's X value is left untouched.

When there is keyframe animation in a scene but not at the current timecode, Delete is unavailable. If the selected object does not contain a keyframe for the selected curve and property, Delete does nothing.



Keyframe buttons *A.* **Delete button not available** *B.* **Delete button available**

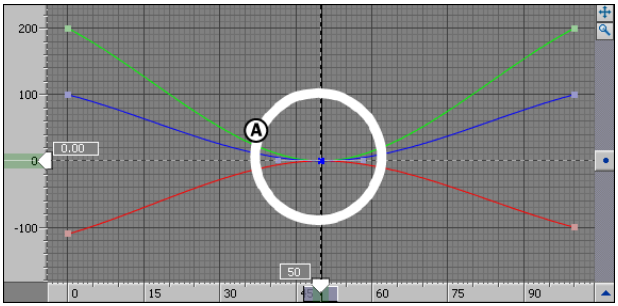
You can also delete keyframes using the Delete option in the Transport Controls contextual menu.

To delete a selected keyframe or keyframe region, right-click the keyframe or region, and select Delete from the contextual menu. You can also press Delete on the keyboard. See Deleting keyframes and keyframe regions on page 833.

Zero button

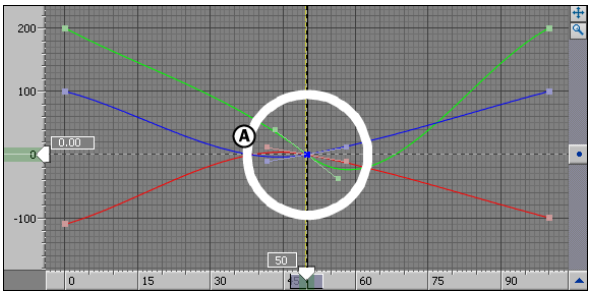
The Zero button lets you set a keyframe with a zero value for selected properties.

Clicking the Zero button sets a keyframe with a zero value and flat tangents for the selected properties.



FCurves pane *A.* **A Zero keyframe with flat tangents**

Right-clicking the Zero button sets a keyframe with a zero value for selected properties, but the tangent is not flattened.

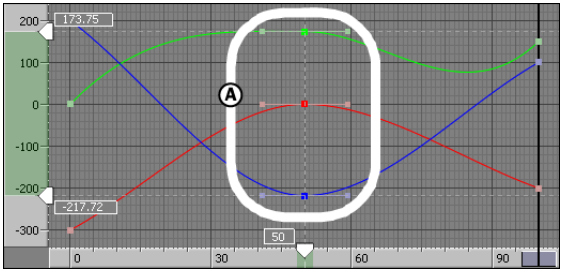


FCurves pane *A.* **Right-click the Zero button to set keyframes with a value of 0 and tangents that are not flat.**

Flat button

The Flat button lets you set a keyframe with flat tangents and Bezier-User interpolation. In the FCurves window, you can see that a keyframe's tangents are flat when its tangent handles are horizontal.

If your character's feet go through the floor, setting a Flat keyframe at that point prevents the slope of the original animation from overshooting or undershooting.



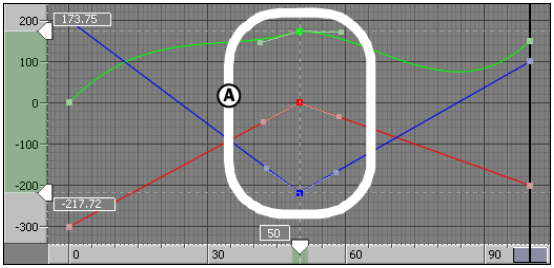
FCurves pane *A.* **Keyframes with flat tangent handles.**

You can also set Zero, IK, and FK keyframes with flat tangents. See Flat key on page 821.

Discontinuity button

The Discontinuity (Disc.) button lets you set a keyframe with discontinuous tangents.

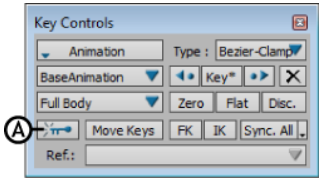
In the FCurves window, you can see that the keyframe's tangent handles point directly at the previous and next keyframes.



FCurves pane *A.* **Keyframes with discontinuous tangent handles.**

Auto Key option

The Auto Key option lets you set keyframes automatically when it is active.



Key Controls window *A.* **Auto Key option**

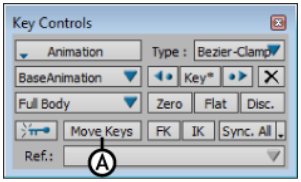
When Auto Key is active, changing a value in the Properties window or transforming in the Viewer window automatically adds a keyframe at the current timecode for the edited value.

When Auto Key is disabled, you can manually add keyframes by changing the value of the selected property and clicking the Keyframe button.

Move Keys

The Move Keys button lets you change the translation and rotation values of keyframes you have already set. For example, you can take a character's walk-cycle in which the character walks in a straight line and change the animation so that the character turns part-way throughout the animation.

The Move Keys button is disabled when the Auto Key option is active (see Auto Key option on page 861).



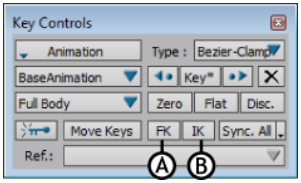
Key Controls window *A.* **Move Keys button**

FK button

When you select a Control rig effector or Auxiliary object, the FK button lets you make many changes and set keyframes with a single click.

NOTE The FK button is only available when a Control rig object is selected.

When you create walk cycles or other character animation, setting keyframes at a single point in time can mean changing Reach values, interpolation, and tangent angles for different effectors to attain the effect you want. Using the FK button lets you make all these changes and set keyframes with a single click.



Key Controls window *A.* **FK button** *B.* **IK button**

Generally, the FK button lets you change Reach properties of a body part to a value of 0. Specifically, when part of a Control rig is selected, clicking the FK button does the following:

- Sets the Reach properties to a value of 0 for all effectors and Auxiliary objects within the body part of the selected object. This occurs no matter which keying group (Full Body or Body Parts) is selected.
- Sets a keyframe with Constant interpolation for Reach properties, no matter what interpolation is selected in the Type menu.
- Sets a keyframe with the type of interpolation selected in the Type menu. If Full Body keying group is selected, the keyframe is set on every part of the Control rig. If Body Parts keying group is selected, the keyframe is set on the body part containing the selected effector, Auxiliary effector, or Auxiliary pivot.
- Sets a keyframe with discontinuous tangents for Translation and Rotation for selected effectors and for any of their Auxiliary objects.
  You can also choose to set a keyframe with Flat tangents, or no additional tangent behavior. See IK/FK Key Options menu on page 846.

IK button

Similar to the FK button, the IK button lets you make a number of changes and set different types of keyframes with one click, simplifying the character animation process.

Generally, the IK button lets you determine a Master pivot for body parts in a Control rig. Specifically, when part of a Control rig is selected, clicking the IK button does the following:

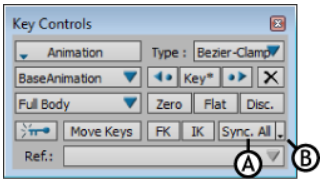
- Sets the Reach properties to a value of 100 for a selected effector, Auxiliary effector, or Auxiliary pivot, and sets the Reach properties to a value of 0 for the rest of the select object's body part. This occurs no matter which keying group (Full Body or Body Parts) is selected.
- Sets a keyframe with Constant interpolation for Reach properties, no matter what interpolation is selected in the Type menu.
- Sets a keyframe with the type of interpolation selected in the Type menu. If Full Body keying group is selected, the keyframe is set on every part of the Control rig. If Body Parts keying group is selected, the keyframe is set on the body part containing the selected effector or Auxiliary object.
- Sets a keyframe with discontinuous tangents for Translation and Rotation for selected effectors and for any of their Auxiliary objects.

You can also choose to set a keyframe with Flat tangents, or no additional tangent behavior. See IK/FK Key Options menu on page 846.

Sync and Sync All

The Sync menu lets you select between Sync and Sync All options. Selecting one of these options changes the behavior of the Sync button.

The Sync button is used for resolving the de-synchronization of keyframe animation for both Control rigs and Multi-Referential constraints.



Key Controls window *A.* **Sync button** *B.* **Sync menu**

When the Sync option is selected in the Sync menu, use the Sync button when a switch between different references in a scene creates “jumps” in the animation.

In situations where there is a reference change, such as from FK to IK solving on a character, or in a scene with a character moving from a car to the street, then to an elevator with a Multi-Referential constraint, “jumps” are created when you change the timing or values of the keys of one of the references.

The Sync button tracks all the reference changes in the animation, correcting any inconsistencies by synchronizing the previous reference to the new one.

When the Sync All option is selected in the Sync menu, use the Sync button to correct any inconsistencies in all keyframes, not just those with different references.

See also:

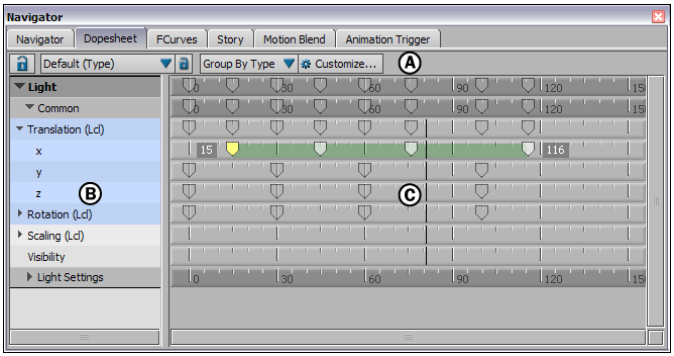
- Multi-Referential constraint on page 1099

Dopesheet window

51

The Dopesheet window lets you view all keyframe animation for selected objects in the current scene, and edit animation by moving, copying, cutting, and pasting keyframes.

The Dopesheet window is an exploded view of the Action timeline in the Transport Controls, letting you view keyframes for every animated property of selected objects.

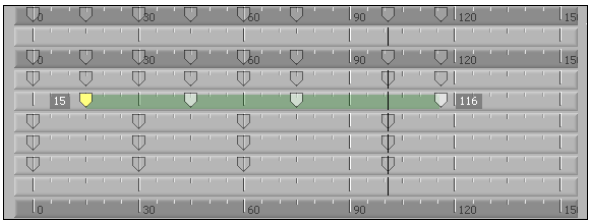


Dopesheet window *A.* **Dopesheet Property options** *B.* **Dopesheet Property list** *C.* **Dopesheet Timeline area**

To open the Dopesheet window, select Window > Dopesheet from the menu bar.

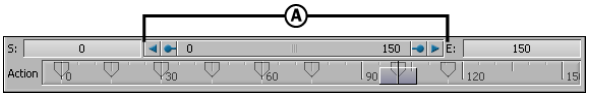
Dopesheet timeline

The Dopesheet Timeline area is an exploded view of the Action timeline in the Transport Controls window. In other words, keyframes set for different properties display separately in the Dopesheet window. When you edit visual keyframes on a Dopesheet timeline, the changes display on the Action timeline.



Dopesheet Timeline area

To zoom or magnify specific segments of the Dopesheet timeline, use the Zoom bar in the Transport Controls. The Zoom bar affects the Dopesheet timeline as well as the Action timeline.



Transport Controls window timeline *A.* **Zoom bar**

The Play Controls, Timing Controls, and the Start and End fields of the Transport Controls also affect the Dopesheet.

The Dopesheet Timeline area lets you:

- Set keyframes
- Select and deselect keyframes and keyframe regions
- Edit keyframes and keyframe regions

Dopesheet contextual menu

The Dopesheet contextual menu is similar to the Transport Controls contextual menu. It lets you cut, copy, and paste keyframes and regions, select all keyframes of a property, and set interpolation and visual key options.

To open this menu, right-click on the part of the Dopesheet timeline you want to affect. For example, if you right-click on the Rotation timeline to paste a keyframe, the keyframe is pasted on that timeline.

Cut

Removes a selected visual keyframe and stores it in memory. To cut a keyframe selection, right-click the key or region and select Cut from the Dopesheet

contextual menu. You can also use the keyboard shortcut Ctrl-X to cut selected keyframes.

Copy

Copies a keyframe selection and stores it in memory so that you can paste it in a different location. To copy a keyframe or keyframe region, right-click the key or region on the Action timeline and select Copy from the contextual menu. You can also use the keyboard shortcut Ctrl-C to copy selected keyframes.

Paste

Inserts a copied or cut selection into another location. To paste a selection, right-click on a property's Dopesheet timeline or on an existing keyframe or keyframe region, and select Paste from the contextual menu. You can also use the keyboard shortcut Ctrl-V to paste the copied or cut selection.

Pasting a keyframe on a keyframe region deletes all keyframes within the region, and replaces the first key of the region with the pasted keyframe. When you paste a keyframe region on a keyframe, the region's first key replaces the original keyframe.

If nothing is selected on the Dopesheet timeline when pasting, the paste is placed at the current time.

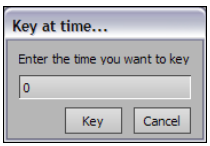
To offset keyframes that follow the paste according to the size of the pasted region, activate Paste Ripple.

Key At Time

The Key at Time option opens a Key at Time dialog box, which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing Ctrl-Shift-K.

See Setting many keyframes at once on page 826.



Key at Time dialog box

Delete

Deletes keyframe selections. When you delete a keyframe, the previous and next keyframes do not move to fill the empty space.

To delete a selected keyframe or keyframe region, right-click the keyframe or region, and select Delete from the contextual menu. You can also press Delete on the keyboard.

Select All

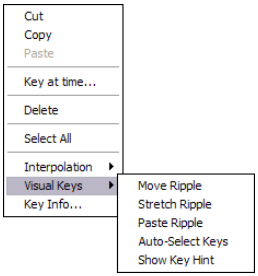
Choose the Select All option to select all the visual keyframes for one property. This creates a keyframe region.

Interpolation

The Interpolation options let you change the interpolation of a selected keyframe or keyframe region. See Interpolation on page 913, about the same option in the Transport Controls contextual menu. See Type menu on page 851 for information on selecting interpolation before setting a keyframe.

Visual Keys

The options in the Visual Keys menu let you set options for visual keyframes on the Dopesheet timeline and the Action timeline.



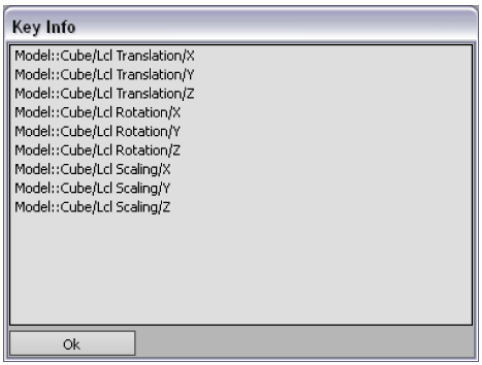
Visual Keys menu

Option	Description
Move Ripple	Pushes deselected keys horizontally when offsetting a keyframe or keyframe region. Disable to keep deselected keys anchored when offsetting (default).

Option	Description
Stretch Ripple	Moves deselected keys horizontally according to the stretch when stretching a keyframe region. Disable to keep deselected keys anchored when stretching (default).
Paste Ripple	Moves deselected keys horizontally when pasting keyframe regions. Disable to keep deselected keys anchored when pasting (default).
Auto-Select Keys	When activated, visual keyframes closest to the current time-code are automatically selected.
Show Key Hint	When activated, certain keyframes display with color. Keyframes set in the Full Body character keying mode display with a red tip. Keyframes set in the Body Part character keying mode display with a green tip. Keyframes set in the Selection character keying mode do not have a color. See Keyframing a Control rig on page 1257. When disabled, all keyframes look the same, except for keyframes set in the Story window. Note: Keyframes that are completely colored are related to clips in the Story window.

Key Info

When you right-click a keyframe, the Key Info option displays in the contextual menu, letting you open a Key Info window. The Key Info window displays information about the selected keyframe.



Key Info window

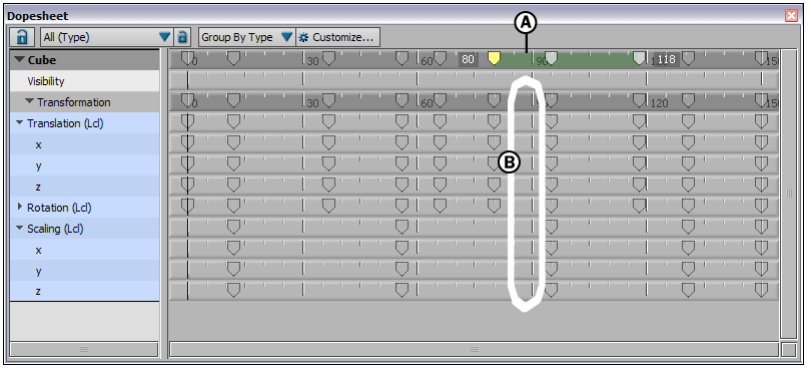
Editing keyframes in the Dopesheet window

The Dopesheet window is an exploded view of the Transport Controls timeline, meaning that you can see and manipulate keyframes for every animated property along multiple timelines. This lets you edit the timing of keyframes without the need to manipulate function curves.

In the Dopesheet window, keyframe manipulation follows the hierarchy of properties as they are displayed in the Properties pane.

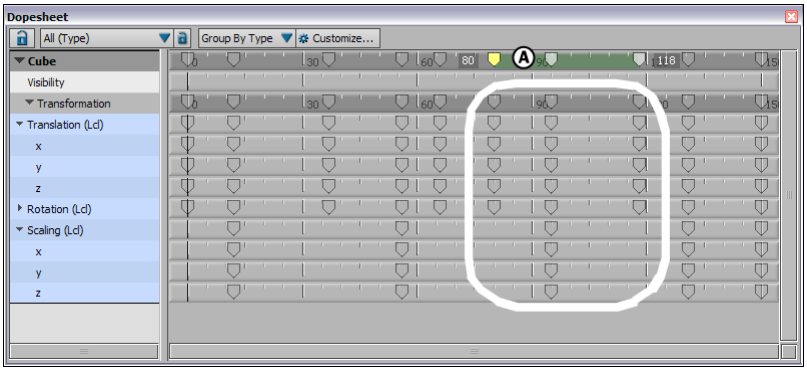
To move many keyframes:

1 To move all keyframes set on one frame, drag the topmost keyframe. Keyframes for all animated properties set on the same frame move with it. This is the same as moving one keyframe in the Transport Controls window.



Dopesheet window *A.* **Drag the topmost keyframe.** *B.* **All keyframes set at the same frame move with the keyframe you drag.**

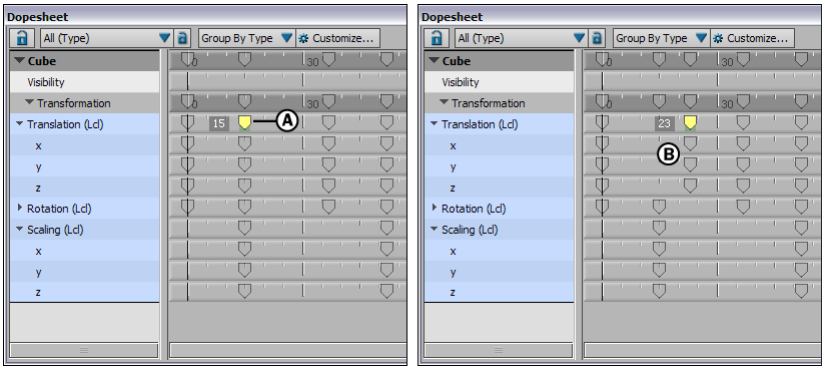
2 You can also select a keyframe region to move even more keyframes.



Dopesheet window *A.* **Drag a keyframe region to offset a greater number of keyframes.**

To move keyframes for specific properties:

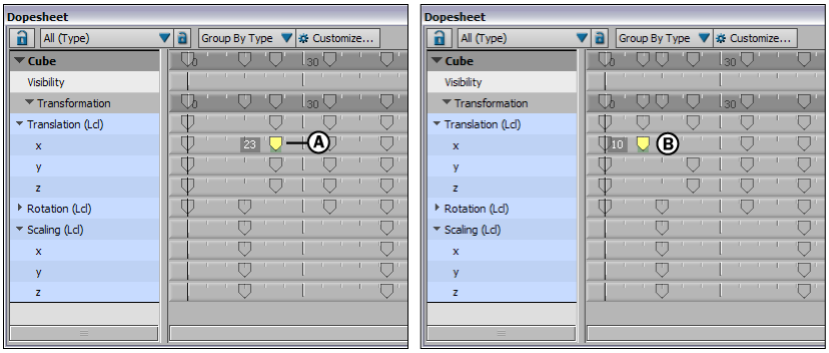
1 Drag a keyframe on the timeline corresponding to the property's name.



Dopesheet window *A.* **Drag the keyframe for Translation.** *B.* **Only the keyframes for the Translation property move.**

This moves all keyframes for that property set on the same frame.

2 Drag a keyframe on a timeline corresponding to part of the main property, such as Translation *x*.



Dopesheet window *A.* **Drag the keyframe for Translation x.** *B.* **Only the keyframes for the Translation property move.**

Only the timing for the keyframe set on the Translation *x* property changes.

Animating on Layers

52

Create and blend multiple layers of animation in a scene. You can create layers to organize keyframe animation, or to keyframe on top of animation without overwriting the original curves.

Animation layers hold animation in your scene, with each layer containing the keyframes you set. The animation layers appear stacked in the Animation Layer editor, and depending on various settings, blend to create the result animation that plays in your scene.

For example, you might load an animation sequence with a character running and jumping, then create an animation layer on top to experiment with modifications to the jumping action. You can watch the original animation to identify a point where you want to exaggerate the character's movements on the Y-axis, then set keys on the new layer to see how changing the translation along the Y-axis affect the jump. If you like the modified jump motion, you can choose to merge the animation layers. If you decide to leave your original animation unchanged, you can discard the layer.

MotionBuilder animation layers let you:

- Modify animation without overwriting original keyframes
- Set whether layers override those that are lower in the stack
- Make incremental changes, and compare and preview the results on different layers

The Animation Layer editor lets you do the following:

- Change the order of layers
- Parent layers to one another
- Mute, solo, and weight the effect of each layer
- Compare animation using a combination of layer parenting, Override layers, and muting features
- Merge layers

See also:

- Creating animation layers on page 884
- Setting keyframes on layers on page 888
- Layer animation workflows on page 900
- Merging on page 233

About layered animation

When you create animation on multiple layers, it is important to understand how the layers blend animation to create the result animation in your scene.

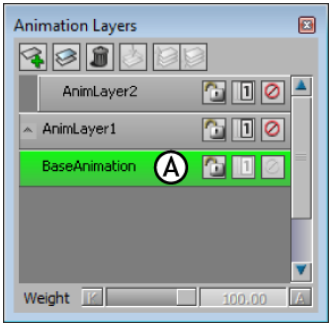
The sections in this topic introduce you to the various animation layer concepts, options, and settings that affect the result animation.

- BaseAnimation layer on page 874
- Animation layer stack on page 875
- Animation layer weight on page 879
- Result animation on page 880
- Animation layer modes on page 881
- Accumulation modes on page 883

BaseAnimation layer

Keyframes are set on the current take's BaseAnimation layer when you do not set keyframes on multiple layers.

Duplicate the BaseAnimation layer's animation to create another layer with the original animation, or modify the original animation with new layers and merge them later.



Animation Layer editor *A.* **BaseAnimation layer**

When your workflow involves setting keyframes on layers to modify the animation on the BaseAnimation layer, you can lock the BaseAnimation layer to prevent it from receiving keyframes as you set keyframes on other layers. See Muting, Soloing, and Locking animation layers on page 890 and Setting keyframes on layers on page 888.

The animation on the BaseAnimation layer is always part of the result animation. Though the BaseAnimation layer can be locked, it cannot be muted, soloed, or parented to layers. See Muting the BaseAnimation on page 891 and Result animation on page 880.

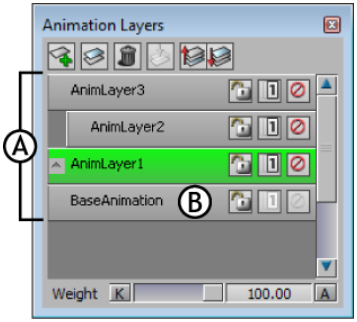
Unlike other animation layers in the Animation Layer editor, the BaseAnimation layer cannot be reordered or deleted. It is always at the bottom of the stack, with animation from the other layers added on top of it.

Animation layer stack

When you create an animation layer, it is placed on top of all the other layers in the Animation Layer editor. This collection of layers is referred to as a stack.

NOTE The BaseAnimation layer is always at the bottom of the layer stack.

You can lock, mute, and solo the layers in the stack. You can also re-organize and parent layers.



Animation Layer editor *A.* **Animation layer stack** *B.* **BaseAnimation layer**

Locked layer

You cannot set, delete, move, or otherwise modify keyframes on a locked layer. Locking a layer is useful when you want to avoid overwriting its animation while you set keyframes on other layers.

NOTE When a layer is locked, its name displays in italics.

See Muting, Soloing, and Locking animation layers on page 890 and Animation Layer buttons on page 907.

Muted layer

When a layer is muted, its animation is not part of the result animation. Muting is useful when you want to compare two layers that modify the result animation. See Muting, Soloing, and Locking animation layers on page 890 and Animation Layer buttons on page 907.

You cannot mute the BaseAnimation layer, but can duplicate the animation on the BaseAnimation layer to work around this. See Muting the BaseAnimation on page 891.

Soloed layer

When you solo a layer, it becomes the only active layer at its level of the hierarchy. Other layers at the same level in the hierarchy and their children

are muted. The children of the soloed layer and layers higher in the hierarchy are not muted.

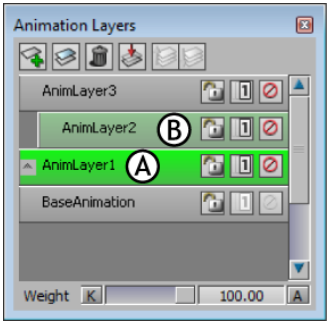
See Muting, Soloing, and Locking animation layers on page 890 and Animation Layer buttons on page 907.

Parent and child layers

Parenting is a way of linking layers in a hierarchy. Linking layers in this way is called parenting, because the source layer is considered a “parent” and the target, or subordinate, layer is called a “child”. Manipulating a parent layer can affect its child layers.

You can parent and unparent animation layers to organize and group your animation layers. See Parenting and unparenting animation layers on page 893, Organizing animation layers on page 893, and Comparing animation on different layers on page 901.

NOTE The order of layers and their location in the hierarchy can affect the result animation. See Result animation on page 880.



Animation Layer editor *A.* **Parent layer** *B.* **Child of AnimLayer1**

Layer hierarchy

When a layer is parented to another layer, the relationship is called a hierarchy. In a hierarchy, multiple layers can be parented to a single layer, which in turn can also be parented.

If you organize your layers into hierarchies, it is important to note that the state of the parent layer can affect the child layer when you mute, weight, and select layers.

Muting layers in a hierarchy

Muting a parent layer mutes its child layers. Child layers cannot be unmuted when their parent is muted, although they can be muted independently of their parent. See Muted layer on page 876.

Weighting layers in a hierarchy

A layer's weight determines to what degree its animation plays in the result animation. See Animation layer weight on page 879.

The child layer's weight is affected by its parent's weight. The child's weight in the result animation is calculated by multiplying its own Weight value by its parent's Weight value, then dividing by 100.

For example, take a child layer's Weight set to 90 and its parent layer's Weight set to 50. Multiply 90 by 50, then divide by 100. When you play the result animation, the weight of the child layer is 45.

TIP If you use parent layers only to organize groups of child layers, you can leave the parent layers empty and keep their Weight value set to 100. This avoids any issues with multiplying parent and child weights. See Comparing animation on different layers on page 901.

Selecting layers in a hierarchy

A child layer is deselected if its parent layer is collapsed and deselected. If a collapsed parent is selected, its child layer is not necessarily selected.

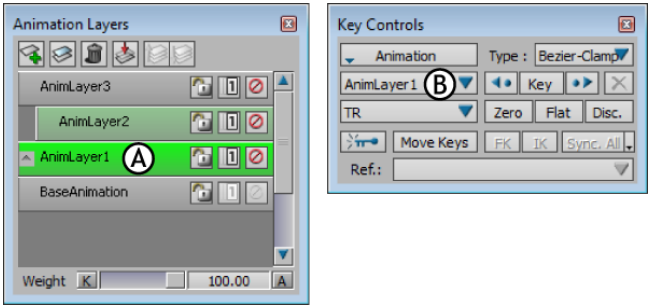
As long as a child layer is the current layer, it can still receive keyframes even if its parent layer is collapsed and deselected.

See Selecting layers on page 888.

Current layer

The animation layer that receives keyframes is referred to as the current layer. The current layer displays bright green in the Animation Layer editor and is selected in the Key Controls' Layer menu. There can only be one current layer; you can set keyframes on only one layer at the same time. See Selecting layers on page 888.

NOTE A locked layer cannot receive keyframes. See Locked layer on page 876.

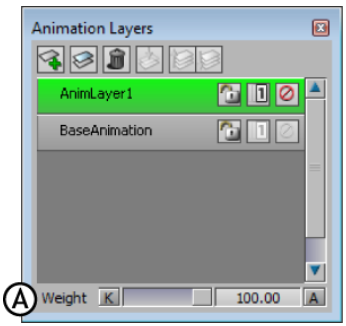


Current layer *A.* **Selected in Animation Layer editor** *B.* **Selected in Key Controls window**

Animation layer weight

Each animation layer has a Weight value that determines how much of its animation plays in the result animation. (See Result animation on page 880.)

When the Weight is set to 100, all of the layer's animation plays in the result. A Weight value of 0 means none of the layer's animation plays in the result.



Animation Layer editor *A.* **Weight slider**

As the result animation is calculated, the properties of the animation layer are multiplied by the layer's Weight value. For example, if you animate a bouncing ball along the Y-axis on AnimLayer1, then decrease the Weight value to 50, the ball only bounces half as high when you playback the animation of AnimLayer1.

When layers are parented, the child layer is affected by the weight of the parent layer. See Weighting layers in a hierarchy on page 878.

If you are working with a layer in Override-Passthrough mode, the Weight value also lets you control the opacity of the Override layer. See Override-Passthrough mode on page 882.

You can animate a selected layer's Weight property from the FCurves, Properties, and Dopesheet windows as well as from the Animation Layer editor. See Keyframing the weight of animation layers on page 892.

Result animation

The result animation is the animation you see in the Viewer window when you click Play in the Transport Controls. It is the combination of animation set on all the layers in the stack.

The result animation depends on the order of layers in the stack, the layer hierarchy, and a number of layer settings.

Muted layers

When a layer is mute, its animation is not included in the result animation. The BaseAnimation layer cannot be muted. See Animation layer stack on page 875 and Muting, Soloing, and Locking animation layers on page 890.

Layer weight

A layer's Weight value determines how much of its animation plays in the result animation. See Animation layer weight on page 879.

Order of evaluation

You can reorganize layers by changing the order of the layers in the stack (see Reordering animation layers on page 893). However, it is important to first understand how re-ordering layers can change the result animation.

First consider which properties are animated on each layer, then consider each layer's Animation layer mode and Accumulation mode.

For example, if none of your layers share animation of the same properties, the order of evaluation does not matter and re-ordering the layers has no impact on the result animation.

If you have keyframed the same properties on more than one layer, there are two settings that can affect your result animation when you re-order the layers: Animation layer modes and Accumulation modes.

Animation layer modes

Animation layers in Override mode block the animation from any preceding layer with shared properties. Changing the position of an Override layer changes which layers it overrides.

NOTE Changing the order of layers in Additive mode does not change the result, no matter what type of property is animated. Unlike in Maya, MotionBuilder calculates all properties animated on Additive layers in Additive mode, including boolean properties (such as Visibility) and Enum type properties (such as Layer Accumulation).

See Animation layer modes on page 881.

Accumulation modes

For layers with rotation properties, re-ordering layers only affects the result if you set the Accumulation option to Per Layer. Re-ordering does not affect the result if you use Per Channel.

See Animation layer modes on page 881.

Animation layer hierarchy

Like re-ordering layers, parenting layers that contain animation for the same properties can affect your result animation.

See Parent and child layers on page 877 and Parenting and unparenting animation layers on page 893.

Animation layer modes

There are two modes for animation layers that affect how layers blend animation: Additive and Override. Additionally, Override has a Passthrough mode that can be turned on or off.

See Result animation on page 880 and Setting the animation layer modes on page 886.

Additive mode

When in Additive mode, an animation layer “adds” its animation to layers that precede it in the stack and affect the same properties.

For example, if AnimLayer1 and AnimLayer2 both contain keyframes for a sphere's Translation property, the resulting Translation value for the sphere is the sum of the Translation values on both layers.

NOTE In MotionBuilder, animation set on an Additive layer is always calculated as Additive, no matter what type of property is animated. Unlike in Maya, MotionBuilder calculates all properties animated on Additive layers in Additive mode, including boolean properties (such as Visibility) and Enum type properties (such as Layer Accumulation).

See Setting the animation layer modes on page 886.

Override mode

When in Override mode, an animation layer overrides the animation of layers that share the same properties and precedes it in the stack.

For example: AnimLayer1 and AnimLayer2 are both in Override mode. A sphere's Translation value along the X-axis is 10 on AnimLayer1, and 15 on AnimLayer2. In the result animation the sphere will have a Translation value of 15 for the X-axis.

You can modify the opacity of Override layers by turning on the Passthrough option and animating the Weight value. See Override-Passthrough mode on page 882, Setting the animation layer modes on page 886, and Keyframing the weight of animation layers on page 892.

NOTE When a layer is set to Override mode, its name displays in bold text.

Override-Passthrough mode

Passthrough lets you turn the opacity of Override layers on and off. You can turn on the Passthrough option when an animation layer is in Override mode (See Setting the animation layer modes on page 886).

NOTE When a layer is set to Override mode, its name displays in bold text.

When Passthrough is off, the layer is always completely opaque, blocking all animation from the preceding layers with shared attributes. When Passthrough is on, you can modify the layer's opacity to control how much animation from preceding layers is allowed to play in the result.

If you think of Override layers like a gate in the animation layer stack, the Passthrough option controls whether the gate is locked or unlocked. When Passthrough is off, the gate is shut and no animation from preceding layers can get through. When Passthrough is on, the gate can open, and its is possible for other animation to get through.

With Passthrough on, you control the opacity of the layer by animating its Weight value. The gate is unlocked, and the Weight value determines how far it will swing open.

When Passthrough is on and the Weight value is set to 100, the layer is completely opaque and its full animation plays in the result, mixed with half the animation from preceding layers. If the Weight is 0, the layer is completely transparent. None of its animation plays in the result, and the full animation from the preceding layers plays.

When Passthrough is off the layer is completely opaque, blocking all animation from preceding layers. Animating the Weight value still controls how much of the layer's animation plays in the result.

Accumulation modes

There are two modes for animation layers that affect how MotionBuilder calculates Rotation animation: Per Layer and Per Channel. See also Setting the animation layer modes on page 886.

When you animate an object's rotation, you set keyframes for three properties; Rotation X, Rotation Y, and Rotation Z. The Layer Accumulation modes let you choose in which order MotionBuilder calculates these properties, as shown in the following table.

NOTE The Layer Accumulation mode you select can change the result animation. See Result animation on page 880.

Option	Description
Per Layer	The keyframes set for rotation are calculated according to layer first, and property second. MotionBuilder calculates all the keyframes set for these three properties (Rotation XYZ) on the first layer before calculating the next layer, and so on.
Per Channel	The keyframes set for rotation are calculated according to property first, and layer second. All keyframes set for Rotation X are calculated first for every layer, then all keyframes set for Rotation Y on all layers are

Option	Description
	calculated, and finally all keyframes set for Rotation Z on all layers are calculated.

NOTE MotionBuilder and Maya use different Layer Accumulation modes by default. In MotionBuilder, Per Layer (known as Quaternion Rotation Accumulation mode in Maya) is the default. In Maya, Per Channel (known as Euler Rotation Accumulation mode) is the default.

NOTE MotionBuilder does not support layers that use the Scale Additive Accumulation mode. A dialog warning appears when you import a scene that uses this type of layer. You can either use Scale Multiply Accumulation mode in Maya and export the file again or you can bake your layers to retain the visual fidelity of your animation.

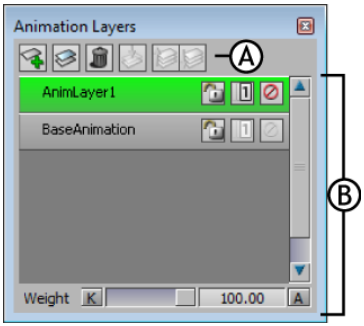
Creating animation layers

Create multiple animation layers using the Animation Layer editor. Once you have created a layer, you can select its layer mode and layer accumulation mode.

Accessing the Animation Layer editor

You can access the Animation Layer editor:

- In the main menu bar, select Layout > Animation or Layout > Editing
- In the main menu bar, select Window > Animation Layers
- In the FCurves window, click the Animation Layers button



Animation Layer editor *A.* **Animation Layer toolbar** *B.* **Animation Layer pane**

Creating an animation layer

There are two basic methods to choose from when creating animation layers. You can create a layer, or you can duplicate a layer that already contains animation.

To create a layer:

Do one of the following:

- Click the New Layer button in the Animation Layer editor.
- Right-click in the Animation Layer editor and select New Layer from the contextual menu.
- In the Key Controls window, select New Layer from the Layer menu.

NOTE New layers are set to Additive mode by default.

To duplicate a layer:

1. Select the layer you want to copy.
2. Do one of the following:
   - Select the layer you want to copy, then click the Duplicate Layer button.
   - Right-click on the layer and use the Copy and Paste options in the contextual menu.

- Select the layer, then press Ctrl-C followed by Ctrl-P to copy and paste it. You can also select Edit > Copy, then Edit > Paste from the main menu.
-

See Animation Layer toolbar on page 903.

Setting the animation layer modes

Once you have created or duplicated a layer, you can set its animation layer mode and accumulation mode. See also Animation layer modes on page 881 and Accumulation modes on page 883.

To set an animation layer to Additive mode:

Do one of the following:

- Right-click the layer and select Layer Mode > Additive from the contextual menu.
- Select the layer, then in the Properties window select Additive from the Layer Mode menu.

NOTE A new layer is set to Additive mode by default.

To set an animation layer to Override mode:

Do one of the following:

- Right-click the layer and select Layer Mode > Override from the contextual menu.
- Select the layer, then in the Properties window select Override from the Layer Mode menu.

The layer is in Override mode and its name displays in bold text.

NOTE When you first set a layer to Override mode, the Passthrough option is active by default and the layer's Weight is set at 100.

To set the Passthrough mode:

Do one of the following:

- Right-click a layer in Override mode and select Layer Mode > Passthrough from the contextual menu.
- Select the layer, then in the Properties window select Passthrough from the Layer Mode menu.

NOTE When Passthrough is selected in the Properties window, the layer is automatically in Override-Passthrough mode.

To set the layer Accumulation modes:

- Right-click on the layer in the Animation Layer and select either Layer Accumulation > Per Channel or Layer Accumulation > Per Layer.

NOTE You can also select the Layer Accumulation mode in the Properties window.

The Layer Accumulation modes affect how MotionBuilder calculates Rotation animation, as shown in the following table. See also Accumulation modes on page 883.

NOTE The Layer Accumulation mode you select can change the result animation. See Result animation on page 880.

Option	Description
Per Layer	The keyframes set for rotation are calculated according to layer first, and property second. MotionBuilder calculates all the keyframes set for these three properties (Rotation XYZ) on the first layer before calculating the next layer, and so on.
Per Channel	The keyframes set for rotation are calculated according to property first, and layer second. All keyframes set for Rotation X are calculated first for every layer, then all keyframes set for Rotation Y on all layers are calculated, and finally all keyframes set for Rotation Z on all layers are calculated.

NOTE MotionBuilder and Maya use different Layer Accumulation modes by default. In MotionBuilder, Per Layer (known as Quaternion Rotation Accumulation mode in Maya) is the default. In Maya, Per Channel (known as Euler Rotation Accumulation mode) is the default.

NOTE MotionBuilder does not support layers that use the Scale Additive Accumulation mode. A dialog warning appears when you import a scene that uses this type of layer. You can either use Scale Multiply Accumulation mode in Maya and export the file again or you can bake your layers to retain the visual fidelity of your animation.

Setting keyframes on layers

Once you have created multiple layers, you can select which layer receives keyframes and set keyframes. Affect the result animation by muting and soloing layers, and by animating a layer's weight. You can also lock a layer to make sure it does not receive keyframes as you animate.

Selecting layers

While you can select multiple layers in the Animation Layer editor, you can only set keyframes on one layer at a time. The layer that receives keyframes is the current layer.

NOTE The current layer is always selected in the Key Control's Layer menu, and displays bright green in the Animation Layer editor.

Select multiple layers when you want to see the keyframes set on them at the same time, or when you want to re-organize the layers in the Animation Layer editor.

To select one layer:

- Click it in the Animation Layer editor.
  The selected layer becomes bright green because it is also the current layer.

To select multiple layers:

Do one of the following in the Animation Layer editor:

- Ctrl-click the layers.

- Shift-click the layers.
  The selected layers that are not the current layer are a soft green in the Animation Layer editor.

To select the current layer:

Do one of the following:

- Click it in the Animation Layer editor. This deselects all other layers.
- In the Key Controls window, select a layer from the Layer menu.
  The current layer is a bright green in the Animation Layer editor.

Keyframing objects on animation layers

Setting keyframes on animation layers is nearly the same as regular keyframing. After you have created and selected the current layer, you can keyframe in your scene as usual.

As you manipulate layers in the Animation Layer Editor, some color and font changes show you their status. A layer that is selected is highlighted in light green. A layer that is muted displays dark gray. Similarly, if you solo a layer, other layers are muted and become dark gray. When a layer is locked, its name displays in italics. The layer that receives keyframes is bright green in the Animation Layer editor and is selected in the Key Control's Layer menu.

To keyframe on animation layers:

1. Select the model or asset you want to animate.
2. Select the property or properties you want to animate. For example, from the Key Controls window, you can select the TRS keying mode to set keyframes for translation, rotation, and scaling properties.
3. In the Animation Layer editor, click the AnimLayer1 to make it current.

   The current layer displays bright green and can receive keyframes.

4. **TIP** To make a layer current, you can also select it from the Layer menu in the Key Controls window.

5. Manipulate and keyframe objects and properties in your scene as usual. See Animating an object on page 743.

NOTE As you animate, create as many layers as you need. See Creating animation layers on page 884.

Setting Zero Keys

Zero keys let you define a point in time where you want the layer's animation to have no offset from the original animation. Using Zero keys, you can demarcate the time range where you want a layer's animation to start and end.

For example, if you have an animation sequence of 50 frames and you only want to modify the animation between frames 20 and 30, set Zero keys at frames 20 and 30 to bracket that part of the timeline. Create your modified animation between frames 20 and 30, then play your result animation. The original animation plays fully before frame 20 and after frame 30, with your modified animation playing fully in between.

Set a Zero key by clicking the Zero button in the Key Controls window. See Zero key on page 820.

NOTE When you set a Zero key, the object(s) you are keyframing may move if it is not at its "zero" position from the original animation.

Muting, Soloing, and Locking animation layers

You can use the Animation Layer buttons to mute, solo, and lock individual animation layers. When you mute a layer, its keyframes do not affect the result animation. Soloing a layer is a quick way to mute other layers. Locking a layer keeps it from receiving keyframes. Managing layers in this way affects the result animation and your workflow.

TIP You can also turn a layer's Mute, Solo, and Lock properties on and off from the Properties window, or from the Properties pan in the FCurves window.

To mute a layer:

- Click the Mute button next to the layer name in the Animation Layer editor.
  The muted layer turns a darker gray.

  NOTE When you mute a parent layer, its child layers are also muted.

To solo a layer:

- Click the solo button next to the layer name in the Animation Layer editor. When you solo one or more animation layers, the Mute option for all the other layers is automatically activated, so that only the animation from the soloed layers is played back.

  NOTE When you solo a layer, you mute other layers that are at the same level in the hierarchy and their children. The children of the muted layer and layers higher in the hierarchy are not muted.

To lock a layer:

- Click the Lock button next to the layer name in the Animation Layer editor.
  The layer is locked and can not receive keyframes. When a layer is locked, its name displays in italics.

Muting the BaseAnimation

The animation on a BaseAnimation layer is always part of the result animation. Though the BaseAnimation layer can be locked, it cannot be muted, soloed, or parented to other layers. You can take the following steps to work around this.

To mute BaseAnimation layer:

1. Select the BaseAnimation layer, then click the Duplicate Layer button in the Animation Layer toolbar.

   A new layer appears containing the same animation as the BaseAnimation layer.

2. Right-click the BaseAnimation layer and select Clear Animation on Layer from the contextual menu.

   The keyframes on the BaseAnimation layer are deleted. The animation is still part of the result animation however, because you copied it the other layer.

3. Click the duplicated layer's Mute button.

   The animation that was originally set on the BaseAnimation layer no longer plays in the result animation.

Keyframing the weight of animation layers

The Weight property of each animation layer determines how much of its animation plays in your scene.

Keyframing the Weight property of animation layers lets you blend the effect of the layer in and out, animating how much the layer influences the result animation at any given time.

You can set the weight of animation layers using the Weight slider at the bottom of the Animation Layer editor, or the Weight property in the Properties, FCurves, or Dopesheet windows when a layer is selected.

NOTE The Weight property of parent layers affects child layers. For child layers, the final value of the Weight property is determined by multiplying the child's Weight by its parent's Weight, then dividing by 100.

To keyframe the weight of animation layers:

1. Click the animation layer whose weight you want to animate.
2. Place the Timeline indicator where you want to set a keyframe.
3. In the Properties window, select the Weight property. The keyframes you set for Weight only display when the property is selected.
4. Set the Weight value using the Weight slider at the bottom of the Animation Layer editor. You can also change its value using the Weight property in the Properties window.
5. Set a keyframe by doing one of the following:

- Click one of the Keyframe buttons in the Key Controls window.
- Click the Keyframe (K) option of the Weight slider in the Animation Layer editor
- Click the Keyframe (K) button of the Weight property in the Properties window.

NOTE When you animate a layer's Weight property, the keyframes are always set on that same layer. For example, if you animate the weight of AnimLayer1, the keyframes for the Weight property can only be set on AnimLayer1.

You can use the Transport Controls, FCurves window, or Dopesheet window to view and edit the keyframes you set for the Weight property of animation layers.

Organizing animation layers

Use the Animation Layer editor to re-organize and parent animation layers. Reorganizing and parenting layers can affect the result animation, depending on each layer's Animation Layer mode and Layer Accumulation settings. See Result animation on page 880 and Setting the animation layer modes on page 886.

Reordering animation layers

The order of animation layers in the Animation Layer editor stack is important because it can affect how the result animation is calculated. See Result animation on page 880.

To reorder layers:

1. Select the animation layer you want to reorder.
2. Do one of the following:

- Drag the animation layer to a new location in the stack.

  NOTE Using this method, you can reorder and parent layers at the same time.

  As you drag, a black line or a rectangular outline appears to indicate where the layer will be placed. If the layer will be placed between two layers, a single black line appears. If the layer will be parented, a rectangular outline displays around the layer that will become its parent.

- Click the Move selection up in list and Move selection down in list buttons to move the layer within the stack, or within its own layer hierarchy.

Parenting and unparenting animation layers

You can parent animation layers to create hierarchical relationships in the Animation Layer editor. See Parent and child layers on page 877.

To parent an animation layer:

1. Select the animation layer you want to make the child of another layer.
2. Drag and drop the layer onto its parent layer.

   The selected layer becomes a child of the layer onto which you dragged it.

TIP If the parent layer already has other child layers, you can expand the parent layer and drop the new child layer into any position within the hierarchy. If you drop the new child layer onto a collapsed parent, it is placed last among the child layers in the hierarchy.

To unparent an animation layer:

1. Select the child animation layer you want to unparent.
2. Drag and drop the layer into any position at the top level of the stack.

   The selected layer is no longer a child layer.

Viewing layered animation

Once you have animation in the scene, it is important to know how to display the keyframes or function curves. Use the Animation Layer editor to view animation created on a single layer or on multiple layers. You can also view the keyframes that animate a layer's weight, or view the trajectory of objects in the result animation.

Viewing non-layered animation

When you load animation that was not created on multiple layers, you can display its keyframes by selecting the BaseAnimation layer in the Animation Layer editor.

To view non-layered animation:

1. Load a scene with existing animation.
2. Select the animated object.
3. In the Animation Layer editor, click BaseAnimation layer.

The BaseAnimation layer is the default layer of every take. Keyframes set on the BaseAnimation layer are always part of the result animation.

When you select the BaseAnimation layer, the keyframes set for the animated object display in the Transport Controls.

4 To display the animation in the FCurves window as well, select animated properties, such as Translation or Rotation.

5 (Optional) If you want to make sure that your original non-layered animation does not receive keys as you work on other layers, click the BaseAnimation layer's Lock button.

The BaseAnimation layer can be locked, but because it is the take's default and bottom-most layer, it cannot be muted, soloed, or parented to other layers. To mute or solo the animation set on the BaseAnimation layer, duplicate the BaseAnimation layer. See Copying animation layers on page 896.

Viewing layer weight animation

You can view and edit the animatable properties of animation layers themselves (such as Weight) in the Properties window, the FCurves window, and the Dopesheet window. First select the layer whose animation you want to view, then open the window in which you want to view its properties.

To view the layer's Weight animation in the Properties window:

1 Select the layer from either the Animation Layer editor or from the Key Controls window.

2 In the Properties window, select the Weight property.

As with other animatable properties, the Weight property's Keyframe (K) and Animate (A) options can give you feedback as to whether there is a keyframe at the current time. See Keyframe (K) and Animate (A) buttons on page 822.

To view the layer's Weight animation in the FCurves window:

1 Select the layer from either the Animation Layer editor or from the Key Controls window.

2 In the FCurves window, select the layer's Weight property in the FCurves Properties pane.

The Weight property's function curves display in the FCurves pane, where you can edit them.

To view the layer's Weight animation in the Dopesheet window:

1. Select the layer from either the Animation Layer editor or from the Key Controls window.
2. In the Dopesheet window, select the layer's Weight property in the Dopesheet Property list.

   Keyframes set for the layer's Weight property display in the Dopesheet Timeline area.

Displaying trajectories for layered animation

You can view the trajectory of a selected object in the Viewer window when you set keyframes for the Translation property. When you set keyframes on multiple layers, the trajectory shows the combined result of all active layers. To see the trajectory for a single layer, mute all the other layers.

NOTE The trajectory always includes Translation animation set on the BaseAnimation layer because this layer cannot be muted or soloed.

See Motion trajectories settings on page 1122.

Manipulating animation layers

Use the Animation Layer editor to duplicate, delete, clear, and merge layers and the keyframes they contain. You can also save animation layers as part of their take.

Copying animation layers

You can choose to copy an animation layer using the Duplicate button, the contextual menu options, or the keyboard shortcuts.

To copy the animation layer using Duplicate:

1. Select the animation layers you want to copy.

2 In the Key Controls window, select a layer from the Layer menu to make it current. The current layer displays bright green in the Animation Layer editor.

3 Click the Duplicate button in the Animation Layer editor toolbar.

The newly-duplicated layers appear above the current layer in the stack and contain the keyframes of the layers you copied.

To copy and paste the using the contextual menu:

1 Select the layers you want to copy.

2 Right-click one of the selected layers, then select Copy from the contextual menu. You can also select the layer and press Ctrl-C to copy it.

3 Right-click on the layer above which you want the new layer to appear, and select Paste from the contextual menu. You can also click a layer and press Ctrl-V to paste the new layer above it.

The pasted layers appear above the current layer and contain the keyframes of the layer you copied.

Deleting or emptying animation layers

You can delete all the keyframes from selected layers, or simply delete one layer or multiple layers at a time.

NOTE You can select multiple layers at a time by Ctrl-clicking each one or by Shift-clicking a range of layers.

To delete all keyframes from an animation layer:

1 Select the layer or layers with keys you want to delete.

2 Right-click one of the selected layers, then select Clear Animation on Layer from the contextual menu.

The layers no longer contain animation.

To delete selected animation layers:

1 Select the layer you want to delete. You can also Ctrl-click to select multiple layers.

2 Click the Delete button in the Animation Layer editor toolbar.

You can also right-click on one of the selected layers and select Delete from the contextual menu.

All selected layers are removed from the scene.

Merging animation layers

When you are finished working with animation on multiple layers and you want to keep the final result in a single layer, you can merge selected layers into a single layer. You can also merge layers to filter the animation onto different layers.

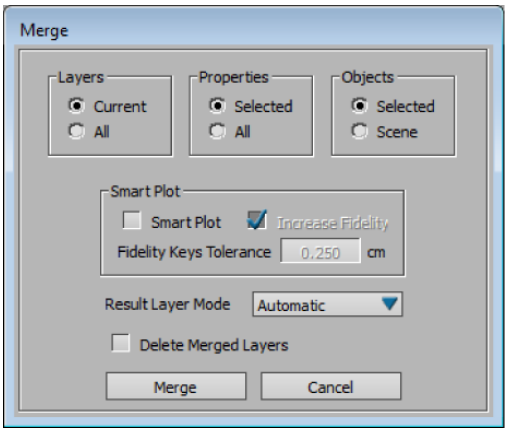
Use the Merge dialog settings to specify how you want the merge to occur. See Merge dialog box on page 904.

See Merging on page 233 for information on what happens to animation layers when you merge scenes.

To merge layers:

1. In the Animation Layer editor, Ctrl-click the layers you want to merge to select them.
2. Click the Merge button in the Animation Layer toolbar.

   You can also right-click on one of the selected layers and select Merge from the contextual menu.
3. In the Merge dialog box that appears, set the merge options. For information on these options, see Merge dialog box on page 904.



Merge dialog box

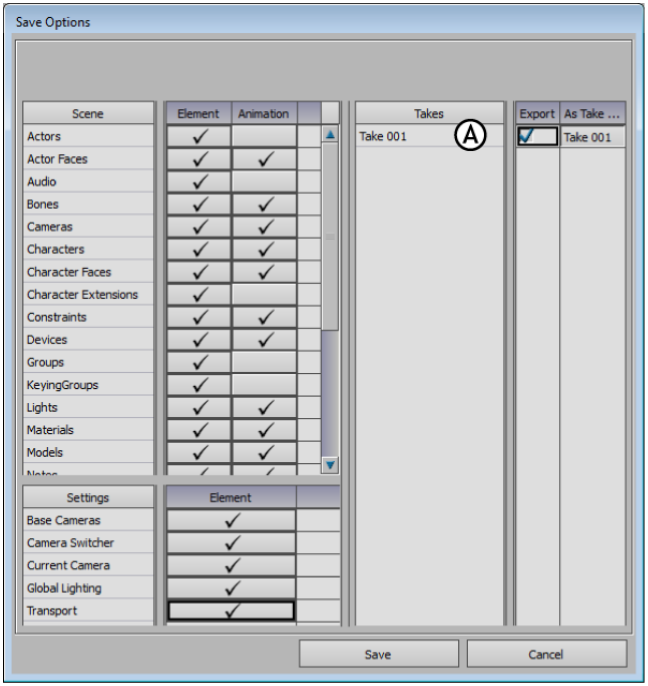
Depending on what you selected in the Merge dialog box, the animation from the selected layers are either merged onto a new layer or to the BaseAnimation layer. All of the merged properties display with keyframes on the BaseAnimation layer.

Saving and exporting animation layers

Animation layers are part of a take. By default, you create animation layers and set keyframes in Take 001, but you can create multiple takes that each contain a separate hierarchy of animation layers.

When you save or export a scene, you can choose which takes to include or exclude. To make sure that a take is saved or exported with the scene, make sure that the option in the Export column is active. Disable this option if you do not want to save or export a specific take. When you save or export a take in a scene, all the animation layers contained in that take are saved or exported.

See Managing Files on page 193.



Save Options dialog box *A.* **Take 001 is selected to be saved**

Layer animation workflows

This topic describes some sample workflows using animation layers.

Modifying animation

Animation layers make it easy to exaggerate, lessen, or otherwise edit animation, without the risk of losing your original work.

For example, if your production pipeline requires that you have rough animation sequences signed off before you complete detail work, you can use animation layers to keep your approved animation separate and locked from editing as you continue to add detail on another layer.

The following steps describe a general workflow using animation layers to modify animation.

To modify animation:

1. Load a scene with your animation and assets. This animation is contained in the BaseAnimation layer.
2. In the Animation Layer editor, select AnimLayer1, which is an empty layer already in your scene by default, or create another layer.

   The new layer appears above the BaseAnimation layer.
3. Select the keying mode in the Key Controls and the properties you want to animate.

   For example, you if you plan to modify only the object's Translation property, you can select the T keying mode from the Key Controls window.
4. Select the object in your scene whose animation you want to modify.

   If the original animation was never set on multiple layers, its keyframes display in the Transport Controls when you select the BaseAnimation layer in the Animation Layer editor.
5. Select the layer on which you want to set keyframes.

   NOTE By default, a layer is set to the Additive layer mode. Layer modes affect how the keyframes set on layers affect the original animation on the BaseAnimation layer. You can either select the Layer mode you want at this point, or change it layer. See Animation layer modes on page 881.

6 Animate the object as you would normally. See Animating an object on page 743.

As you keyframe, the new keyframes are set on the animation layer.

7 Select the Layer mode you need to get the animation result you want. See Animation layer modes on page 881.

8 Play the result animation in your scene, viewing the effect of your modified animation from the layer.

9 Us e the animation layer controls to compare the result with and without your modified animation. For example, toggle the layer's Mute button. See Muting, Soloing, and Locking animation layers on page 890.

10 (Optional) If you are satisfied with the modified animation, you can merge your layered animation with the original animation on the BaseAnimation layer, and save the result. See Merging animation layers on page 898 and Saving and exporting animation layers on page 899.

Comparing animation on different layers

You can think of layers like folders that contain and organize parcels of animation. You can use layers like folders to compare variations of animation.

NOTE When renaming layers, do not use spaces if you plan to export your animation to other software such as Autodesk Maya.

To use layers to compare variations of animation:

1 Create a layer and rename it Folder1.

2 In the Animation Layer editor, right-click new layer and select Layer Mode > Override from the contextual menu. (See also Creating animation layers on page 884).

In Override mode, the name of the layer displays in bold.

By default, when you the Override layer mode for a new layer, the Passthrough option is active and the layer is actually set to the Override-Passthrough layer mode.

3 Create a new layer and rename it "Folder2_Layer1". This layer is in Additive mode by default.

4 Drag Folder2_Layer1 onto the Folder1 layer.

This sets up a layer hierarchy with Folder2_Layer1 parented to Folder1. (See also Parenting and unparenting animation layers on page 893).

5 Select Folder2_Layer1, and animation the object. See Keyframing objects on animation layers on page 889.

6 Repeat steps 3 to 5 to create and animate on as many layers as you need for Folder1.

7 Set up your second "folder" layer by repeating steps 1 to 6. This time, name your Override layer "Folder2", and the Additive child layers "Folder2_Layer1" and so on.

   You now have two sibling layer hierarchies in your animation layer stack, one for Folder1 and one for Take2.

8 Play the animation.

   Notice that only the animation you created in the Folder2 hierarchy of layers plays in the scene. Since both the Folder1 and Folder2 parent layers are in Override mode, and Folder2 is higher in the stack, the animation from Folder 2 overrides the animation from Folder1.

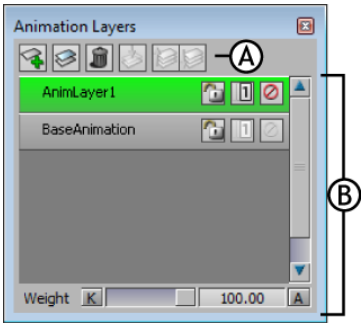
9 To view the Folder1 animation (and compare it to Folder2), click the Solo button for the Folder1 layer, then play your animation.

   The Folder2 layer and its children are automatically muted when you Solo Folder1, letting you view only the animation from Folder1 in your scene.

Animation Layer editor

The Animation Layer editor lets you manipulate animation layers and change the way they blend together to create your result animation.

You can open the Animation Layer editor by selecting Window > Animation Layers from the main menu bar. See Accessing the Animation Layer editor on page 884.



Animation Layer editor *A.* **Animation Layer toolbar** *B.* **Animation Layer pane**

The topics in this section describe the options, controls, and contextual menu of the Animation Layer editor.

- Animation Layer toolbar on page 903
- Animation Layer pane on page 906
- Animation Layer contextual menu on page 908
- Animation Layer properties on page 910

Animation Layer toolbar

The following table describes the buttons found in the Animation Layer editor toolbar.

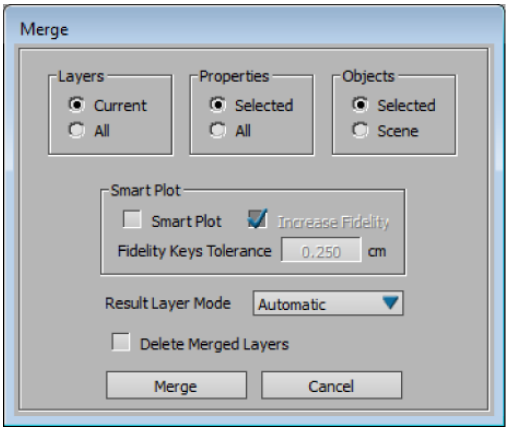
Button	Name	Function
	New Layer	Creates an empty animation layer. See Creating an animation layer on page 885.
	Duplicate Layer	Creates an animation layer that contains all of the selected layer's keyframes.
	Delete Layer	Deletes the selected layer(s).

Button	Name	Function
	Merge Layer	Opens the Merge dialog box, which lets you merge animation to a new layer or to the BaseAnimation layer. See Merging animation layers on page 898.
	Move selection up in list	Moves the selected layer up in the Animation Layer pane. See Reordering animation layers on page 893.
	Move selection down in list	Moves the selected layer down in the Animation Layer pane. See Reordering animation layers on page 893.

Merge dialog box

The Merge dialog appears when you click the Merge button in the Animation Layer toolbar or when you right-click in the Animation Layer editor and select Merge from the contextual menu.

You can merge selected layers to a new layer, or merge all layers to the BaseAnimation layer.



Merge dialog box

Layers area

Activate the Current option to merge the animation of selected layers onto a new layer. This new layer is named Merged Layer.

Activate the All option to merge animation on all layers with the BaseAnimation layer.

NOTE If you select the BaseAnimation layer as well as other animation layers, then activate the Current option, the animation is merged to the BaseAnimation layer, not to a new layer.

Properties area

Activate the Selected option to merge only selected properties with the new merged layer. Activate the All option to merge all properties with the new merged layer.

Objects area

Activate the Selected option to merge only the selected objects to the new merged layer. Activate the Scene option to merge all objects in the scene to the BaseAnimation layer.

NOTE If no objects in the scene are selected, only the Scene option is available and animation from all objects in the scene will be merged.

Smart Plot area

The Smart Plot option lets you merge layers without adding keyframes. For example, when two function curves with three keyframes each are merged onto one layer using Smart Plot, the resulting function curve has no more than six keyframes. The options in this area are the same as the options in the Plot Properties window.

Result Layer Mode

The Result Layer Mode menu lets you select the Layer mode for the new merged layer.

Select Additive to set the new layer to Additive, or select Override to set the new layer to Override.

When you select Automatic, the merged layer is set to either Additive or Override. If any of the selected layers is set to Override, the new merged layer is set to Override. If all selected layers are in Additive mode, the new merged layer is set to Additive.

Delete Merged Layers

Activate the Delete Merged Layers option to remove the newly-emptied layers from the Animation Layer stack.

Disable this option if you want to keep the layers in the stack. When the animation is merged onto a new layer or to the BaseAnimation layer, the original layers are empty of animation.

The Delete Merge Layers option only deletes selected layers when they are empty. For example, if a sphere and a cube both have keyframes on AnimLayer1, but only the cube is selected to be merged, then AnimLayer1 is not deleted because the sphere's animation remains.

Merge button

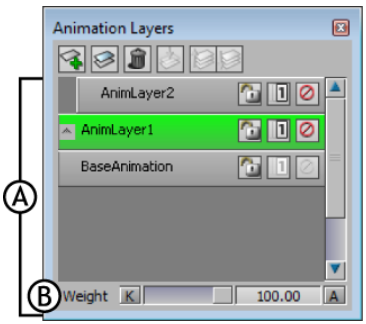
Click Merge to combine the selected layers, properties, and objects onto a new merged layer or with the BaseAnimation layer.

Cancel button

Click to stop the Merge operation.

Animation Layer pane

The Animation Layer pane is where your stack of animation layers displays. See Animation layer stack on page 875.



Animation Layer editor *A.* **Animation Layer pane** *B.* **Weight slider**

The Animation Layer pane has two main components that affect each animation layer in the stack:

- Animation Layer buttons on page 907

- Weight slider on page 908

You can use the Animation Layer pane to re-order animation layers or to parent and unparent animation layers. See Organizing animation layers on page 893.

Animation Layer buttons

The Animation Layer buttons appear next to each animation layer in the stack. You can use these controls to lock, mute, or solo each animation layer.

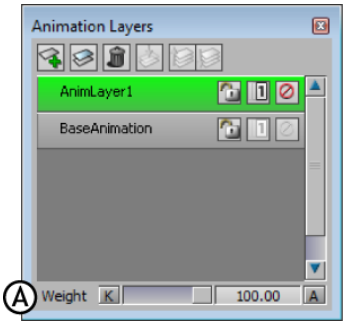
The Animation Layer buttons include the following:

Button	Name	Function
	Lock	Locks the animation layer so that it does not receive keyframes. This lets you set keyframes on a layer that is lower in the stack without having to mute all of the layers about it. When an animation layer is locked its keys continue to contribute to the result animation, but it cannot receive new keys. **NOTE** When a layer is locked, its name displays in italics.
	Solo	When an animation layer is soloed, it becomes the only active layer at its level of the hierarchy. This means it is the only layer that can be keyframes, and the only layer whose animation plays back in the result. All other layers at the same level of the hierarchy and their child layers are muted. Soloing a parent layer does not affect the soloing or muting of child layers. **NOTE** Multiple layers can be soloed at the same time.
	Mute	When on, the animation layer is muted. Muting an animation layer is like making it transparent; you no longer see its effect in the Viewer window. Muted layers become inactive, so their animation is not evaluated in the final result. **NOTE** If a muted animation layer is parented to other layers, the child layers are also muted, however child layers can be muted independently from their parents.

Weight slider

The Weight slider lets you control how much of the layer's animation plays in the result. The weight of selected layers also display in the Properties, FCurves, and Dopesheet windows.

By default, the Weight value for animation layers is set to 100, meaning the animation from the layer plays fully in the result. Setting the Weight value to 0 effectively mutes the layer, so none of its animation plays in the scene.



Animation Layer editor *A.* **Weight slider**

See Animation layer weight on page 879 and Weighting layers in a hierarchy on page 878.

Animation Layer contextual menu

Right-clicking a layer in the Animation Layer editor displays a contextual menu with the following options:

Option	Function
New Layer	Creates an empty animation layer. See Creating an animation layer on page 885.
Mute	Mutes the selected layer so that its animation does not play in the result. See Muting, Soloing, and Locking animation layers on page 890.
Solo	Mutes other layers at the same level in the hierarchy, so that only the selected layer plays in the result animation. See Muting, Soloing, and Locking animation layers on page 890.

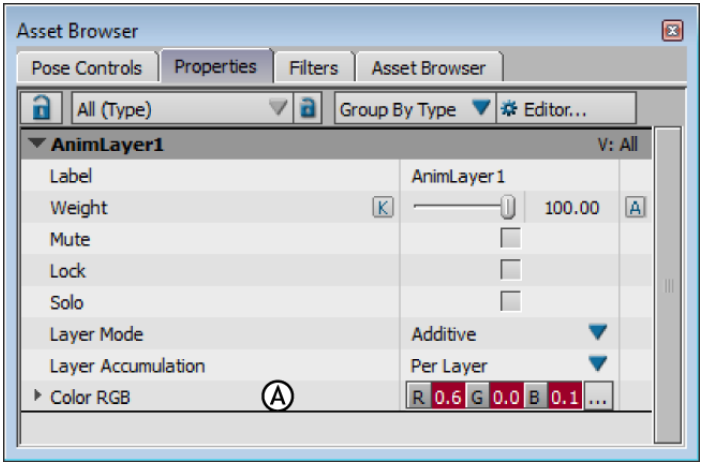
Option	Function
Lock	Locks the layer so that it cannot receive keyframes. See Muting, Soloing, and Locking animation layers on page 890.
Rename	Lets you rename the selected layer. You can also rename a selected layer using the Label property in the Properties window. **NOTE** When renaming layers, do not use spaces if you plan to export your animation to other software such as Autodesk Maya.
Cut	Removes selected layer(s) from the layer stack, and stores them in memory. You can also use the keyboard shortcut Ctrl-X to cut selected layer(s).
Copy	Copies the selected layer(s) and stores them in memory. You can also use the keyboard shortcut Ctrl-C to copy selected layer(s). See Copying animation layers on page 896.
Paste	Inserts cut or copied layer(s) above the current layer. You can also use the keyboard shortcut Ctrl-V to paste layers.
Delete	Deletes the selected layer(s). See Deleting or emptying animation layers on page 897. **NOTE** The BaseAnimation layer cannot be deleted.
Merge	Opens the Merge dialog box, which lets you merge animation to a new layer or to the BaseAnimation layer. See Merging animation layers on page 898.
Clear Animation on Layer	Deletes all the keyframes on selected layer(s). See Deleting or emptying animation layers on page 897.
Layer Mode	Lets you set the layer to Additive, Override, or Override-Passthrough blending modes. See Setting the animation layer modes on page 886 and Animation layer modes on page 881.
Layer Accumulation	Lets you set the layer to Per Layer or Per Channel accumulation modes. The Layer Accumulation modes affect how MotionBuilder calculates Rotation animation and the one you select can change the result animation. When you select Per Layer, the keyframes set for rotation are calculated according to layer first, and property second. When you select Per Channel, the keyframes set for rotation are calculated according to

Option	Function
	property first, and layer second. See Accumulation modes on page 883 and Setting the animation layer modes on page 886.

Animation Layer properties

All of an animation layer's properties that are available in the Animation Layer editor also display in the Properties window when a layer is selected. Additionally, the Properties window displays the Color RGB property.

You can open the Properties window by selecting Window > Add Property View from the main menu bar. See Properties window on page 765.



Properties window *A.* **Color RGB property**

Color RGB

Animation created in Autodesk Maya may contain additional data, such as ghost color. When you import layered animation created in Maya, the Color RGB property in MotionBuilder displays the color of the selected layer's ghost. You can use Color RGB to modify the ghost's color in MotionBuilder before exporting the layered animation back to Maya.

NOTE Animation layer ghosts do not display in MotionBuilder.

Part 7: Refining Animation

Once you have set keyframes or opened a file containing motion capture data, you can continue to refine your animation. You can edit keyframe animation by manipulating function curves and modifying interpolation. You can also use filters to clean, manipulate, and modify animation.

Following are the topics included in this chapter.

- Interpolation on page 913
- Dynamic Editor on page 929
- Function curves on page 953
- FCurves window on page 971
- Filters window on page 1003
- Filtering on page 1009

Interpolation

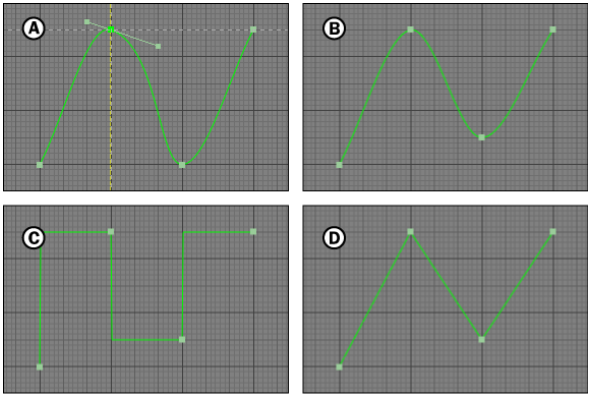
53

When you set multiple keyframes for a property, MotionBuilder automatically interpolates the animation between the keyframes. You can see a graphical representation of this interpolation in the FCurves window on page 971.

To edit animation, you can create, view, and modify function curves in various ways. For example, you can control the type of interpolation between keyframes, the curve's extrapolation, and the value and time of the function curve.

Each type of interpolation creates different animation. For example, a model animated along the Y axis with Bezier interpolation would move up and down gradually, while the same model animated with Constant interpolation would suddenly appear in different locations at each keyframe.

The following figure shows the graphical representation of each interpolation type.



FCurves window *A.* **Bezier interpolation** *B.* **TCB interpolation** *C.* **Constant interpolation** *D.* **Linear interpolation**

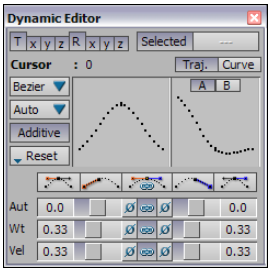
You can set the type of interpolation before you set keyframes in the Key Controls window, or you can change the interpolation for keyframes using the FCurves window and the Dynamic Editor.

In the FCurves window, you can select keyframes and change their interpolation type, but you can also manipulate a function curve directly to alter the interpolation.

The slope of a function curve determines the speed at which the values change between keyframes. A steep slope means the value changes quickly, and a gradual slope means the value changes more slowly over a longer period of time.

While the FCurves window lets you modify the function curve of one selected keyframe at a time, the Dynamic Editor lets you simultaneously modify multiple function curves. You can edit the interpolation of selected keyframes or of keyframes at the current time.

The Dynamic Editor also lets you quickly alter the velocity of animation without changing its trajectory through space. It also lets you modify many function curves simultaneously. See Dynamic Editor on page 929.



Dynamic Editor

Types of interpolation

MotionBuilder offers four different types of interpolation:

- Bezier interpolation on page 914
- TCB interpolation on page 919
- Constant interpolation on page 922
- Linear interpolation on page 925

Bezier interpolation

Bezier interpolation is a cubic curve which you can modify using tangent handles or angle and weight settings. When editing Bezier interpolation, you can work in three modes—Clamp, Auto and User (also referred to as Bezier-Clamp, Bezier-Auto, and Bezier-User).

Bezier-Clamp

Bezier-Clamp interpolation is a cubic curve whose slopes are automatically calculated based on the values of the neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-Clamp keyframe change. Tangents of Bezier-Clamp keyframes flatten automatically when you move neighboring keyframes to the same value. Use Bezier-Clamp to avoid overshooting and undershooting interpolation.

See Type menu on page 851, Tangent options on page 975, and Bezier interpolation settings on page 937 for setting keyframes with Bezier-Clamp interpolation.

To edit keyframes in Clamp mode:

- Select the keyframes you want to edit, then click the Bezier and Clamp options at the top of the FCurves window.
  When you edit neighboring keyframes so that they have nearly the same value, the tangents of these keyframes in Clamp mode are set to Flat to avoid over- and under-shooting.

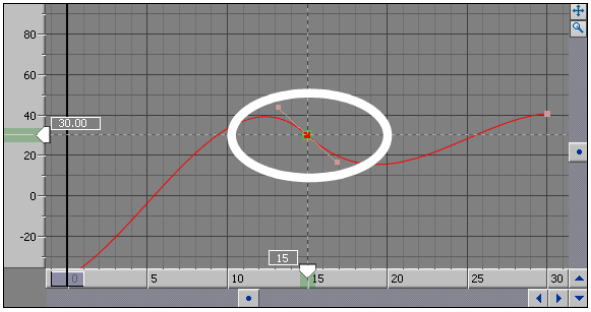
Bezier-Auto

Bezier-Auto interpolation is a cubic curve whose slopes are automatically calculated based on the values of the neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-Auto keyframe change. Unlike Clamp, tangents of Bezier-Auto keyframes do not automatically flatten.

Bezier-User

Bezier-User interpolation is a cubic curve whose slopes are not influenced by neighboring keyframes. When you edit neighboring keyframes, the tangents of a Bezier-User keyframe do not change.

In User mode, moving one tangent handle moves the other tangent equally, as shown in the following figure.



- Creating Bezier interpolation on page 916
- Editing Bezier interpolation on page 918

Creating Bezier interpolation

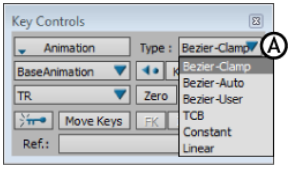
You can set keyframes with Bezier interpolation or change a keyframe's interpolation after the keyframe is already set.

To set keyframes with Bezier interpolation:

1 In the Key Controls window, select one of the interpolation types from the Type menu:

- Bezier-Clamp (the default interpolation type)
- Bezier-Auto
- Bezier-User

These options let you set keyframes with Bezier interpolation, each with a different behavior. See Bezier interpolation on page 914.



Key Controls *A.* **Type menu**

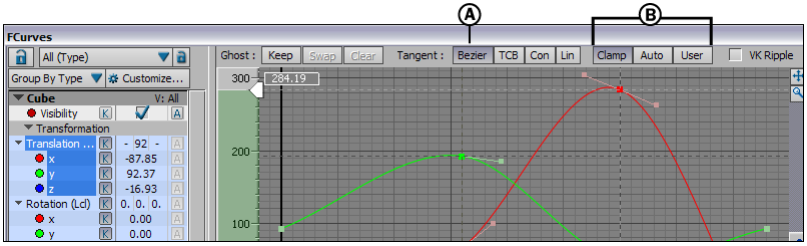
2 Set keyframes (see Setting keyframes on page 819).

NOTE The keyframes you set have the type of Bezier interpolation you selected, until you select different interpolation.

To change the interpolation of a keyframe to Bezier:

1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.

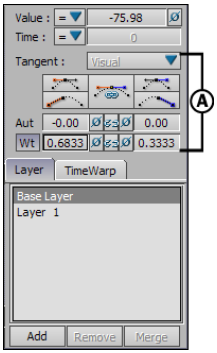
2 In the Tangent options, select Bezier to set the interpolation type.



FCurves window *A.* **Bezier interpolation type selected for the Translation keyframes** *B.* **Clamp, Auto, and User modes**

3 Select either Clamp, Auto, or User modes, which affect the way Bezier interpolation behaves when you edit keyframes. See Bezier interpolation on page 914.

4 Edit the interpolation by dragging each tangent handle, or by using the settings in the Tangent area. These settings let you change the behavior, angle, and weight of tangents. See Tangent area on page 983.



FCurves window *A.* **Tangent area settings**

Related topics

- Dynamic Editor on page 929

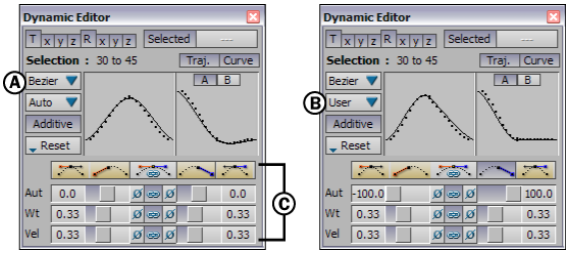
Editing Bezier interpolation

To edit Bezier interpolation:

1. Move the Timeline indicator to the animation you want to edit or select a range of keyframes.

2. In the Dynamic Editor, select Bezier in the Interpolation Mode menu.

   The selected animation has Bezier interpolation, and the Bezier interpolation settings display in the settings area.



Dynamic Editor *A.* **Interpolation Mode menu** *B.* **Interpolation Options menu** *C.* **Interpolation settings**

3. In the Interpolation Options menu, select either Clamp, Auto, or User. Bezier-Clamp is the default.

   NOTE Two options in the FCurve contextual menu affect your use of Clamp, Auto, and User modes during editing.

   See Switch to User on Edit on page 1001 and Reset Tangents on Switch to Auto on page 1001.

4. Select Flat, Discontinuity, Break, and Link options to affect the behavior of tangents.

   See Bezier interpolation settings on page 937.

5. Change the values of the Auto, Weight, and Velocity settings to edit the interpolation.

   See Dynamic Editor on page 929.

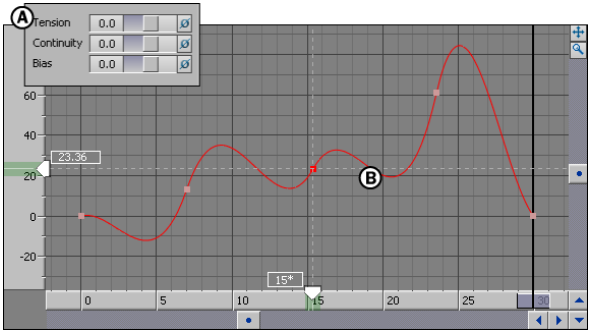
Related topics

- Creating Bezier interpolation on page 916
- Dynamic Editor on page 929

TCB interpolation

TCB interpolation joins each keyframe using a Hermite-type curve. The slope on either side of a keyframe is changed using the TCB (Tension/Continuity/Bias) values.

To set the slope of a tangent, select TCB and change the values in the TCB fields. Each field in the vector changes a different part of the tangent. The TCB fields are only visible in the FCurves Options pane when a keyframe or keyframes with TCB interpolation are selected.



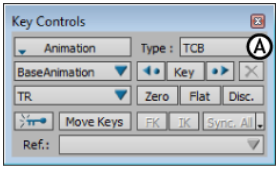
A. **TCB settings in the FCurve Options pane** *B.* **TCB curves**

Creating TCB interpolation

You can set keyframes with TCB interpolation, or you can change keyframes to use TCB interpolation.

To set keyframes with TCB interpolation:

1 In the Key Controls window, select TCB from the Type menu.



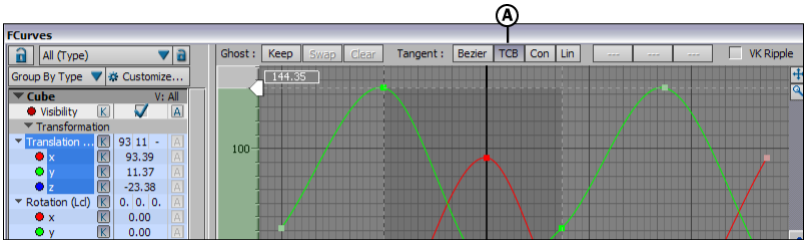
Key Controls *A.* **TCB interpolation type selected**

2 Set keyframes (see Setting keyframes on page 819). The keyframes you set have TCB interpolation until you select a different type of interpolation.

To change the interpolation of a keyframe to TCB:

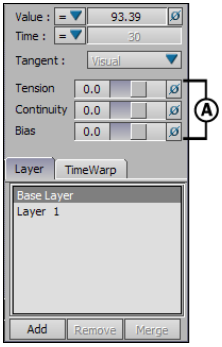
1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.

2 In the Tangent options, select TCB to set the interpolation type.



FCurves window *A.* **TCB interpolation type selected for the keyframe selection**

3 Edit the TCB interpolation by changing the value of the settings in the Tangent area. These settings let you change the tension, continuity, and bias of tangents. See Tangent area on page 983 for more information.



FCurves window *A.* **Tangent area settings**

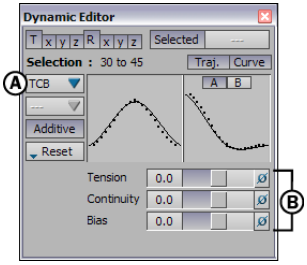
- TCB interpolation on page 919

Editing TCB interpolation

To edit TCB interpolation:

1. Move the Timeline indicator to the animation you want to edit or select a range of keyframes.
2. In the Dynamic Editor, select TCB in the Interpolation Mode menu.

   The selected animation has TCB interpolation, and the TCB settings display in the settings area.



Dynamic Editor *A.* **TCB Interpolation Mode selected** *B.* **TCB interpolation settings**

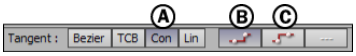
3 Change the values of the Tension, Continuity, and Bias settings to edit the interpolation.

See TCB interpolation on page 919 for more information.

Constant interpolation

The Constant interpolation maintains the same keyframe value between keyframes. There is no slope between keyframes. For example, the curve in has four keyframes with a Constant interpolation method.

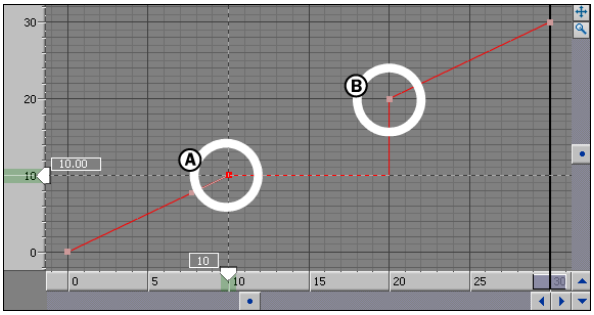
When you click the Constant option in the FCurves window, the Standard and Next options appear.



Tangent options *A.* **Active Constant option** *B.* **Standard option** *C.* **Next option**

Standard

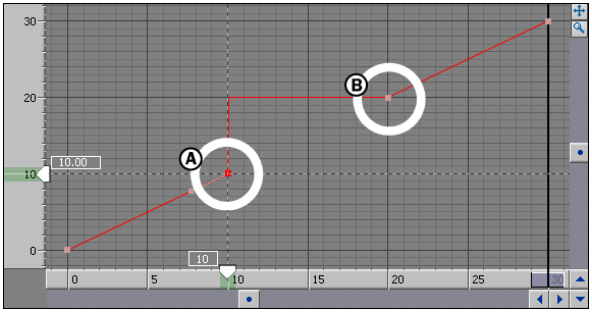
When the Standard option is active, the constant interpolation maintains the selected keyframe's value until the next keyframe.



Standard constant interpolation *A.* **Selected keyframe** *B.* **Next keyframe**

Next

When the Next option is active, the constant interpolation maintains the next keyframe's value until the next keyframe.



Next constant interpolation *A.* **Selected keyframe** *B.* **Next keyframe**

NOTE

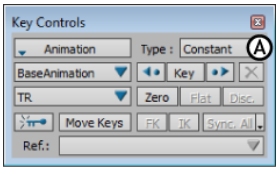
The Constant Next interpolation is useful for marking the end of a referential when using the Multi-Referential constraint.

Creating Constant interpolation

You can set keyframes with Constant interpolation or change keyframes to use Constant interpolation.

To set keyframes with Constant interpolation:

1 In the Key Controls window, select Constant from the Type menu.



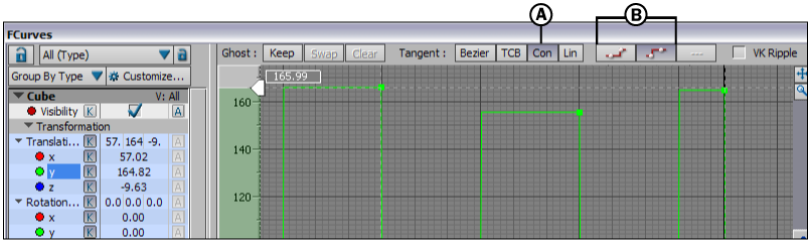
Key Controls *A.* **Constant interpolation selected in the Type menu**

2 Set keyframes (see Setting keyframes on page 819). The keyframes you set have Constant Standard interpolation until you select a different type of interpolation.

To change the interpolation of a keyframe to Constant:

1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.

2 In the Tangent options, select the Constant interpolation type.



FCurves window *A.* **Constant interpolation type selected for the keyframe selection** *B.* **Standard and Next mode**

3 Select Standard mode or Next mode, which determine whether the interpolation maintains the value of the current or next keyframe. See Constant interpolation on page 922 for more information.

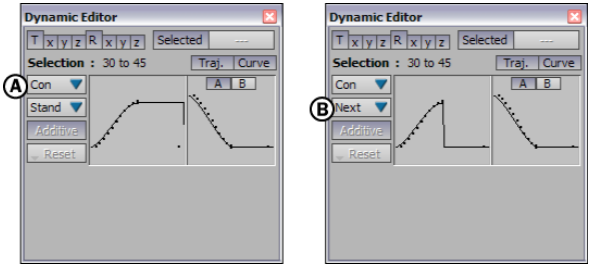
■ Constant interpolation on page 922

Editing Constant interpolation

To edit Constant interpolation:

1 Move the Timeline indicator to the animation you want to edit or select a range of keyframes.

2 In the Dynamic Editor, select Constant in the Interpolation Mode menu.



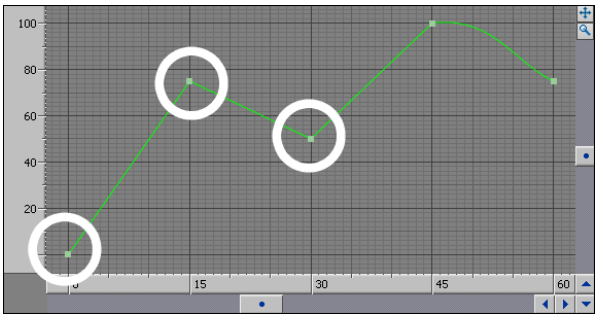
Dynamic Editor *A.* **Constant interpolation type selected in the Interpolation Mode menu** *B.* **Standard and Next modes in the Interpolation Options menu**

3 In the Interpolation Options menu, select either Standard or Next. Constant Standard is the default.

See Constant interpolation on page 922 for more information.

Linear interpolation

Linear interpolation joins a selected keyframe and the next keyframe with a straight line. The slope between keyframes is constant. For example, the curve in has three keyframes with Linear interpolation.



Three keyframes with linear interpolation

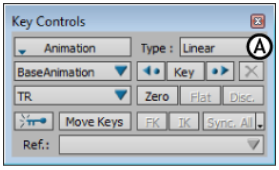
- Creating Linear interpolation on page 926

Creating Linear interpolation

You can set keyframes with Linear interpolation or change a keyframe's interpolation after the keyframe is already set.

To set keyframes with Constant interpolation:

1 In the Key Controls window, select Linear from the Type menu.



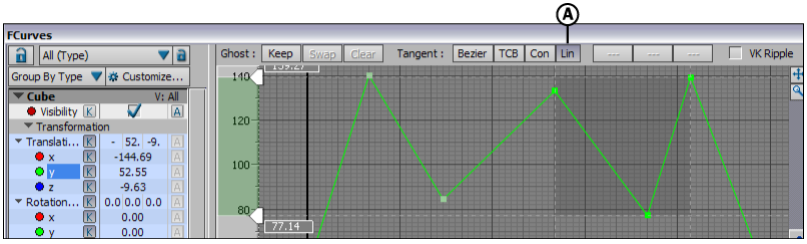
Key Controls *A.* **Linear type selected in the interpolation Type menu**

2 Set keyframes (see Setting keyframes on page 819). The keyframes you set have Linear interpolation until you select a different type of interpolation.

To change the interpolation of a keyframe to Linear:

1 In the FCurves window, select the keyframe or keyframes whose interpolation you want to change.

2 In the Tangent options, select Linear to set the interpolation type.



FCurves window *A.* **Linear interpolation type selected for the keyframe selection**

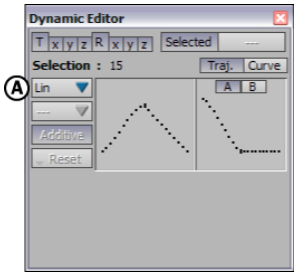
See Editing Linear interpolation on page 927 for how to edit your interpolations.

Editing Linear interpolation

To edit Linear interpolation:

1. Move the Timeline indicator to the animation you want to edit or select a range of keyframes.
2. In the Dynamic Editor, select Linear in the Interpolation Mode menu.

The selected animation has Linear interpolation. See Linear interpolation on page 925 for more information.



Dynamic Editor *A.* **Linear selected in the Interpolation Mode menu**

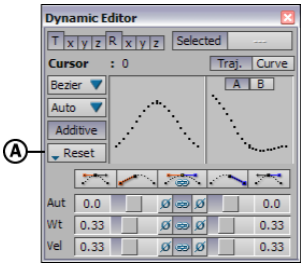
Resetting interpolation

When editing Bezier and TCB interpolation with the Dynamic Editor, you can return settings to their default values using the Reset menu.

To reset Bezier interpolation:

1. Move the Timeline indicator to the animation you want to reset.
2. In the Dynamic Editor, click Reset to open the menu and select from the following:
   - To reset values in the Auto settings to zero, select Reset Angular Parameters.
   - To reset values in the Weight settings to 0.33, select Reset Weight Parameters.
   - To reset the Velocity settings to 0.33, select Reset Velocity Parameters.

- To reset all values in the Auto settings to zero, and reset the Weight and Velocity settings to 0.33, select Reset All Parameters.



Dynamic Editor *A.* **Reset menu**

To reset TCB interpolation:

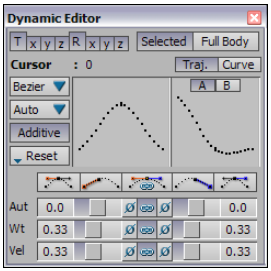
1. Move the Timeline indicator to the animation you want to reset.
2. In the Dynamic Editor, open the Reset menu and select Reset All.
   The Tension, Continuity, and Bias settings are all reset to 0.

- Bezier interpolation on page 914
- TCB interpolation on page 919
- Dynamic Editor on page 929

Dynamic Editor

54

The Dynamic Editor lets you modify the interpolation of multiple keyframes at the same time. You can modify the keyframes at the current time that are not selected, or modify selected keyframes.



Dynamic Editor

Open the Dynamic Editor by selecting Window > Dynamic Editor from the menu bar, or by selecting Animation > Dynamic Editor in the Key Controls.

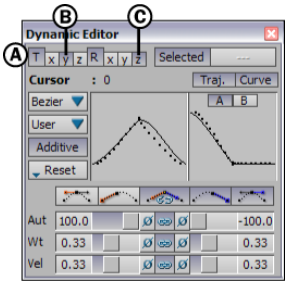
Translation (T) and Rotation (R) options

The Translation (T) and Rotation (R) options let you modify translation or rotation keyframe animation specifically.

When both options are active, you can modify all keyframes for translation and rotation at the current time. When only one of the options is active, you can modify the keyframes of either translation or rotation at the current time, without modifying the other keyframes.

You can also modify the keyframe animation of a specific axis for translation and rotation. For example, the following figure shows a situation in which only the keyframe animation for Translation along the Y axis and Rotation along

the Z axis is modified (refer to B and C). The other translation and rotation animation is not modified.



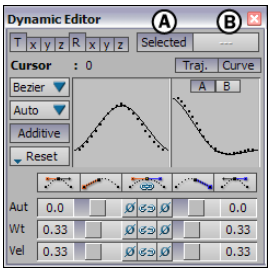
Dynamic Editor *A.* **Translation and Rotation options** *B.* **Keyframe animation for translation along the Y axis** *C.* **Keyframe animation for rotation along the Z axis**

The Translation and Rotation options are disabled when keyframes are selected in the FCurves or Dopesheet windows. See Status indicator on page 932 for more information.

Character Keying Mode options

The Character Keying Mode options let you modify the keyframe animation of selected effectors, all effectors, or effectors in a body part.

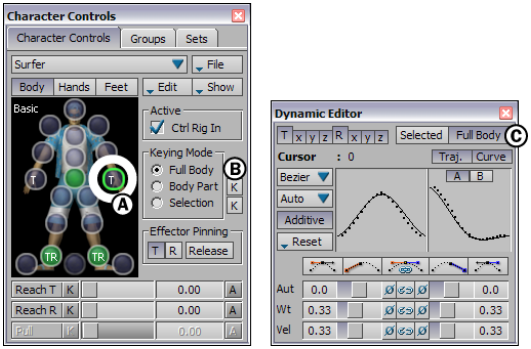
When there is no selected effector, only the Selected option is active, indicating that you can modify the keyframe animation of other types of selected objects.



Character Keying Mode options *A.* **Selected option is active** *B.* **Character Key Mode option is disabled when no effector is selected**

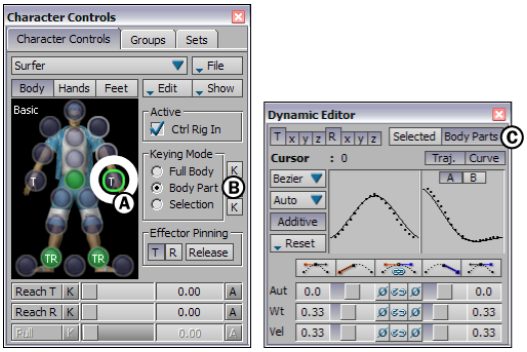
When an effector is selected, you can click the Selected option to modify only the keyframe animation of the selected effector. You can also select either Full Body or Body Parts from the other option when an effector is selected. When there is no selected effector, the second option is not available.

When Full Body is selected in the Character Controls window, the Full Body option is active in the Dynamic Editor. When this option is active, the keyframes on all effectors are modified, even when only one effector is selected. You can also toggle back and forth between the Selected option and the Full Body option when modifying animation.



Character Controls window *A.* **Selected left wrist effector** *B.* **Full Body mode** *C.* **Full Body option**

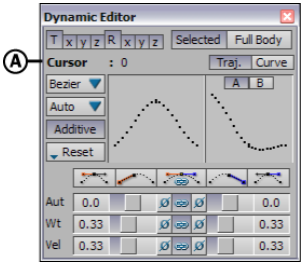
When Body Parts is selected in the Character Controls window, the Body Parts option is active in the Dynamic Editor. When this option is active, the keyframes on all effectors that belong to the body part of the selected effector are modified. You can also toggle back and forth between the Selected option and the Body Parts option when modifying animation.



Character Controls window *A.* **Selected left wrist effector** *B.* **Body Parts mode selected** *C.* **Body Parts option**

Status indicator

The text in the top left corner of the Dynamic Editor indicates which part of the animation is affected by the changes you make.

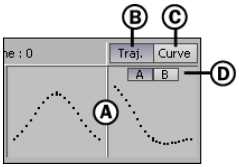


Dynamic Editor *A.* **Text indicating the keyframe or keyframes that can be modified**

Animation representation area

The animation representation area displays the changes you make to animation. The area on the left represents the peak of the trajectory or curve of the animation. The area on the right represents the slopes of the trajectory or curve of the animation. See A and B options on page 935 for more information.

You can also choose to have representations of the animation display as trajectories, curves, or both.



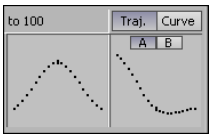
Animation representation area *A.* **Animation representations** *B.* **Trajectory option** *C.* **Curve option** *D.* **A and B options**

Since you can manipulate many different trajectories and curves at once with the Dynamic Editor, the trajectories and curves that display in the window represent the changes you make, not the actual trajectories and curves you are modifying.

To see the changes you make to the trajectory of your animation, look in the Viewer window. To see the exact changes you make to the curves of your animation, look in the FCurves window.

Trajectory (Traj.) option

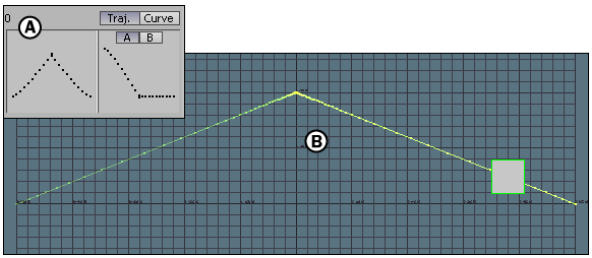
The Trajectory option lets you show or hide the trajectories, which display as dotted lines in the animation representation.



Animation displayed as a trajectory

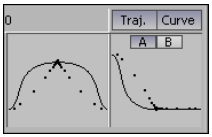
A trajectory is a path of animation through space. For example, in the previous figure, the cube's trajectory in the Viewer window is similar to the trajectory representation in the Dynamic Editor.

The dots represent motion through time, and display close together or far apart depending on the velocity of the animation.



Animation *A.* **Trajectory representation** *B.* **Actual trajectory**

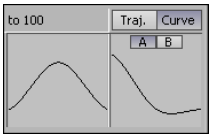
The Trajectory option can be active at the same time as the Curve option, so you superimpose curve and trajectory representations.



Trajectories (dotted lines) and curves (solid lines) displaying animation

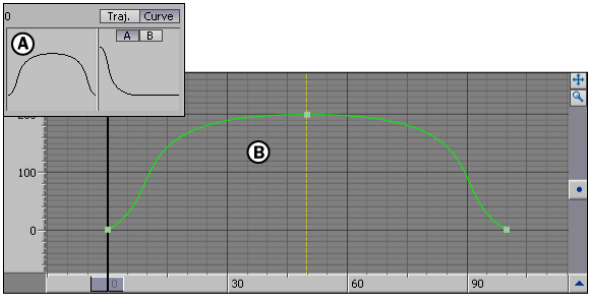
Curve option

The Curve option lets you show or hide the animation curves, which display as solid lines in the animation representation.



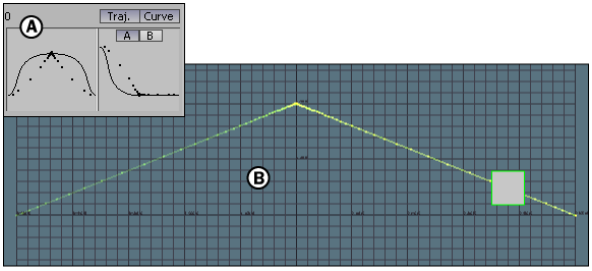
Animation displayed as curves

A curve represents animation through time, similar to what you would see in the FCurves window.



Animation *A.* Curve representation *B.* Actual function curve of the animation

The trajectory of the animation as seen in the Viewer window can be different than its curve.



Animation *A.* Curve and trajectory representation *B.* Actual trajectory in the Viewer window

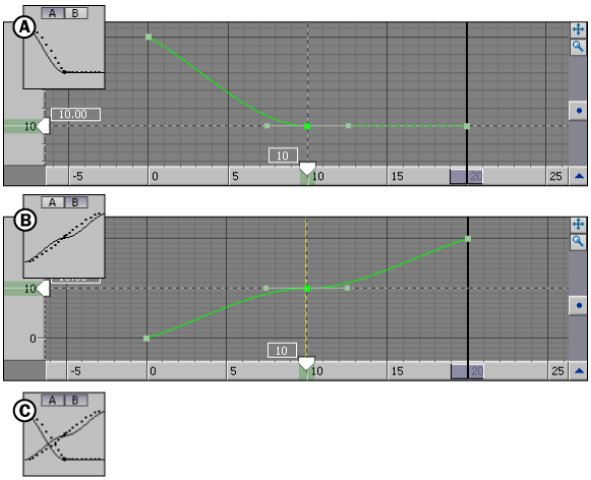
The Curve option can be active at the same time as the Trajectory option, so you can superimpose trajectory and curve representations. See Trajectory (Traj.) option on page 933 for more information.

A and B options

The A and B options let you show or hide different representations of trajectories and curves.

The A option lets you show or hide the representation of a function curve that descends and then plateaus.

The B option lets you show or hide the representation of a function curve with an incremental slope that can have a pause in the middle. Both options can be active at the same time to display both representations.



Animation representation *A.* **The A representation.***B.* **The B representation** *C.* **A and B representations superimposed**

- Function curves on page 953
- The Dynamic Editor asterisk on page 950
- Status indicator on page 932

Interpolation Mode menu

The Interpolation Mode menu lets you select between Bezier, TCB, Constant, and Linear interpolation modes. The interpolation mode you select in this menu determines which settings display in the Interpolation settings ares. See Interpolation settings area on page 937.

Additive option

The Additive option lets you change the values of keyframes starting from the values they already have. Additive works for Bezier and TCB interpolation modes, and is active by default.

Reset menu

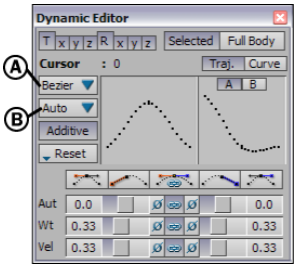
The Reset menu lets you reset Bezier and TCB interpolation settings. The options in the menu depend on which interpolation mode is selected. There are no reset options for Linear and Constant interpolation.

When you select Bezier interpolation, the Reset menu lets you reset the Angular, Weight, and Velocity values. When you select TCB interpolation, you can reset all TCB settings at once.

See Resetting interpolation on page 927 and for more information.

Interpolation settings area

The options in the Interpolation settings area change depending on which type of interpolation you select in the Interpolation Mode menu.

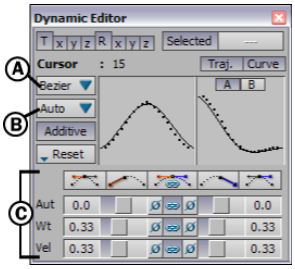


Dynamic Editor *A.*
Interpolation Mode menu *B.*
Interpolation Options menu

See Types of interpolation on page 914 for information on each type of interpolation.

Bezier interpolation settings

When you select Bezier from the Interpolation Mode menu, options and settings that let you manipulate Bezier curves display in the Dynamic Editor.



Dynamic Editor *A.* **Bezier interpolation mode** *B.* **Auto and User options displayed in the Interpolation Options menu** *C.* **Bezier settings displayed in the settings area**

The Bezier settings in the Dynamic Editor consist of the following:

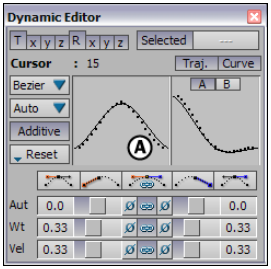
- Auto and User options on page 938
- Break on page 938
- Flat Left and Flat Right on page 939
- Discontinuity Left and Right on page 939
- Auto settings on page 940
- Weight settings on page 942
- Velocity settings on page 943
- Reset Left and Right on page 945
- Link on page 946

Auto and User options

When Bezier is selected in the Interpolation Mode menu, the Interpolation Options menu lets you select Auto or User mode. These options are the same as the options available when Bezier is selected as the interpolation mode in the FCurves window. See Bezier option on page 975 for information.

Break

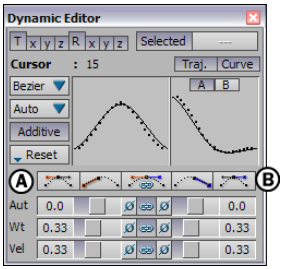
The Break option splits the tangent and lets you manipulate the left and right tangents separately. The Additive option should be active when you use the Break option.



Dynamic Editor *A.* **Break button disabled**

Flat Left and Flat Right

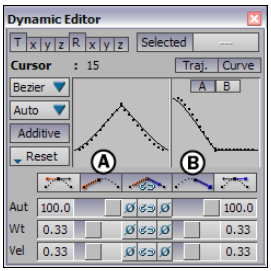
The two Flat buttons (A and B) let you flatten the left and right tangents of current keyframes. The Flat button on the left affects the left tangent, and the Flat button on the right affects the right tangent.



Dynamic Editor *A.* **Flat Left button** *B.* **Flat Right button**

Discontinuity Left and Right

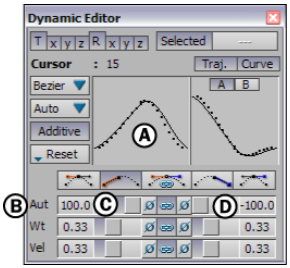
Clicking the left or right Discontinuity button causes the left or right tangent to point to the previous or next keyframe. Clicking the Discontinuity button on the left causes the left tangent to point to the previous keyframe. Similarly, clicking the Discontinuity button on the right causes the right tangent to point to the next keyframe.



Dynamic Editor *A.* **Discontinuity Right button** *B.* **Discontinuity Left button**

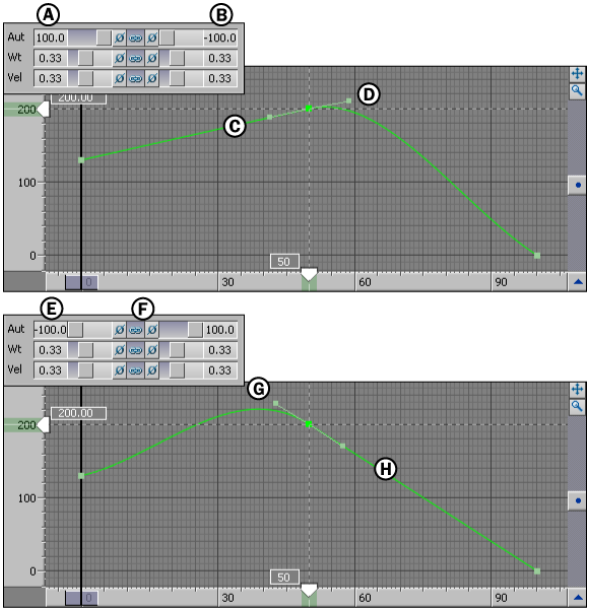
Auto settings

The Auto settings let you change the value of tangents to the left and right of editable keyframes.



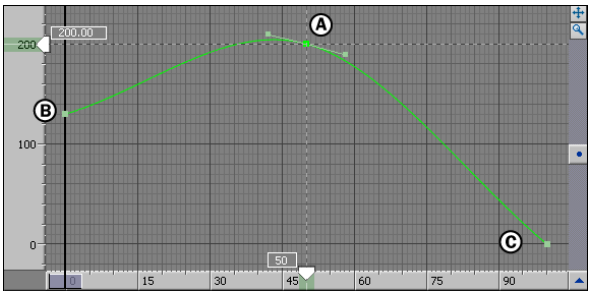
Changing tangent angles *A.* **Animation representation showing an angle change** *B.* **Auto settings** *C.* **Field and slider affecting the left tangent** *D.* **Field and slider affecting the right tangent**

The Auto settings include two fields and sliders (A and B) which let you change the value of the left and right tangents of editable keyframes. The field on the left side affects the left tangent, and the field on the right side affects the right tangent.



Editing tangent angles using Auto settings *A*. Left Auto field set to 100 *B*. Right Auto field is set to -100 *C*. Left tangent pointing to the previous keyframe *D*. Right tangent pointing away from the previous keyframe *E*. Left Auto field set to -100 *F*. Right Auto field set to 100 *G*. Left tangent pointing away from the next keyframe *H*. Right tangent pointing to the next keyframe

When you use the Auto settings, the tangents of editable keyframes are automatically calculated based on the values of neighboring keyframes.



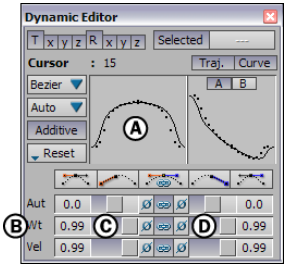
Keyframe with Bezier-Auto interpolation *A*. Tangents are the average between the previous and next keyframes *B*. Previous keyframe *C*. Next keyframe

The values in the left and right Auto fields change the angle of tangents as described in the following table.

0	At 0, the curve represents the average between the previous and next keyframes.
100	When the left Auto field is at 100, the left tangent points to the previous keyframe (A and C). When the right Auto field is at 100, the right tangent points to the next keyframe (F and H).
-100	When the left Auto field is at -100, the left tangent points away from the next key-frame (E and G).When the right Auto field is at -100, the right tangent points away from the previous keyframe (B and D).

Weight settings

The Weight settings let you create curves that you cannot create with unweighted tangents.



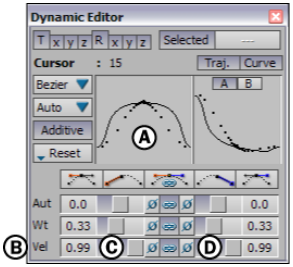
Changing weight *A.* Animation representation showing the weighting change *B.* Weight settings *C.* Field and slider affecting the left tangent *D.* Field and slider affecting the right tangent

The Weight settings include two fields and sliders (C and D) which let you change the weight of the tangents for the current keyframe. The field and slider on the left side affect the left tangent, and the field and slider on the right side affect the right tangent.

Velocity settings

The Velocity settings let you speed up or slow down animation on either side of a keyframe without changing the trajectory of the animation. Unlike Auto and Weight settings, Velocity changes the animation in time, but not in space.

In the Dynamic Editor, the trajectories in the animation representation area display velocity changes. The dots of the trajectory, which represent time, move closer together to show an acceleration and move further apart to show deceleration.



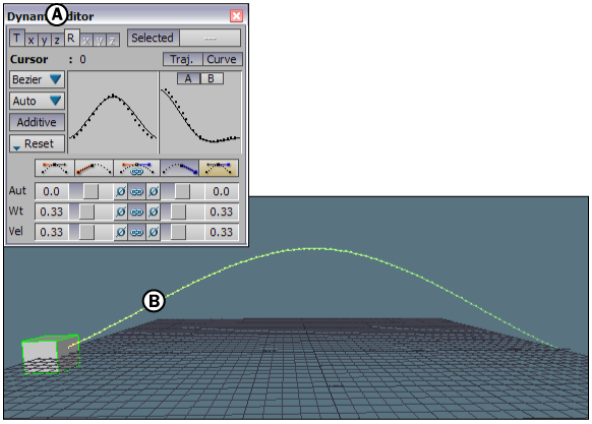
Changing velocity *A.* **Trajectory representation showing a velocity change** *B.* **Velocity settings** *C.* **Field and slider affecting the left tangent** *D.* **Slider and field affecting the right tangent**

The Velocity settings include two fields and sliders (C and D) which let you change the animation speed to the left and right of editable keyframes. The field and slider on the left side affect the left tangent, and the field and slider on the right side affect the right tangent.

Velocity settings work when the speed of the animation changes without changing the trajectory of the animation. That is, the trajectory of the animation remains the same but its function curve is weighted.

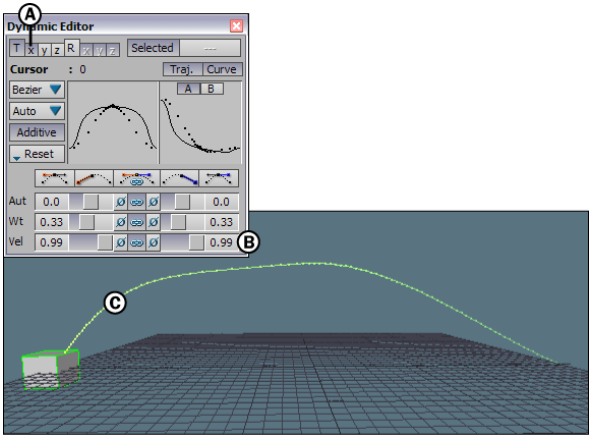
For the Velocity settings to work, you must edit the XYZ values of a property at the same time, or edit the X, Y, or Z values that change during the animation.

For example, in the following figure, keyframes are set for the X, Y, and Z values of a cube's Translation property. However, the cube moves only along the X-axis and Y-axis during the animation, and the Z value remains the same throughout. The cube's trajectory before any changes are made is an arc.



Animation before velocity changes *A.* XYZ Translation property values are shown selected *B.* Cube trajectory along the X-axis and Y-axis, in an arced path

In the following figure, using Velocity does not work, because only the X value is selected and modified. The cube's trajectory is changed as a result.

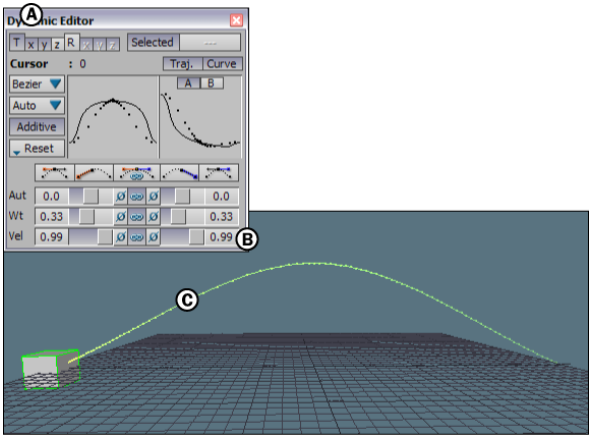


Bad example using Velocity settings to change the animation speed *A.* X Translation property value selected *B.* Velocity settings changed *C.* Result: The cube's trajectory changes instead of the cube's animation speed.

This is an undesired result, which also occurs if, for example, only the Y value is selected, or if the X value or Y value is selected as well as the Z value. Selecting only the Z value has no effect at all, because the value does not change during the animation.

For the Velocity settings to work in this situation, both the X value and the Y value must be selected. When the Velocity settings are changed, the cube's trajectory remains the same and the cube speeds up and slows down during the animation.

The Velocity settings would also work in this situation if all three XYZ values were selected. In some situations, selecting all XYZ values for selected keyframed properties can be simpler when using the Velocity settings.

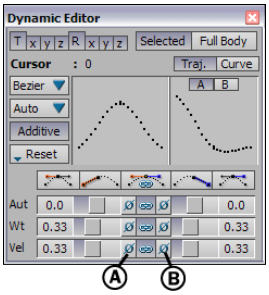


Good example using Velocity settings to change the animation speed *A.* X and Y Translation property values selected *B.* Velocity settings changed *C.* Result: The cube speeds up and slows down during the animation.

In addition, while you can easily use the Dynamic Editor and the FCurves window together, you may notice that the FCurves window does not have Velocity settings. In fact, when you use the Velocity settings, you change the angle and weight of tangents in such a way that the speed of the animation is modified without modifying its trajectory. The values of the Angle and Weight settings in the FCurves window reflect this when you use the Velocity settings in the Dynamic Editor.

Reset Left and Right

The Auto, Weight, and Velocity settings each include two reset buttons (A and B), which let you reset left and right parameters.



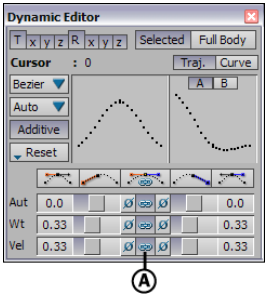
Dynamic Editor *A.* **Reset button for left tangent** *B.* **Reset button for right tangent**

The Reset buttons in the Auto settings let you reset the angle of the left and right tangents to zero. The Reset buttons in the Weight settings let you reset the weight of the left and right tangents to 0.33. The Reset buttons in the Velocity setting let you reset the speed of the left and right tangents to 0.33. You can also reset all three parameters at the same time. See Resetting interpolation on page 927 for more information.

Link

The Auto, Weight, and Velocity settings each include a Link option. When the Link option is active for a particular, you can modify the angle, weight, or velocity of both left and right tangents at the same time, whether or not the tangents are broken or unbroken.

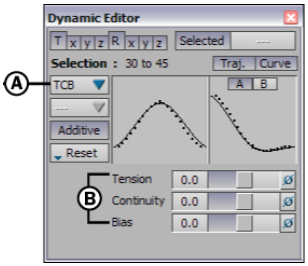
You can modify the angle of each tangent separately when the Link option is disabled and the Break option is active (see Break on page 938). When the Link option is active, you can modify the angle of each tangent separately if you drag a tangent handle in the FCurves window.



Dynamic Editor *A.* **Link option**

TCB interpolation settings

When you select TCB in the Interpolation Mode menu, Tension, Continuity, and Bias settings appear in the settings area. Each of the settings changes a different part of the tangent.

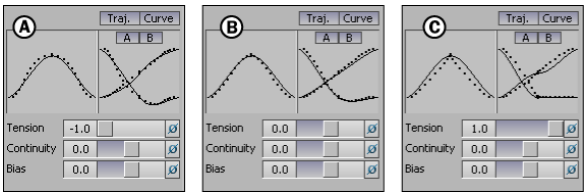


Dynamic Editor *A.* **TCB interpolation mode selected** *B.* **TCB settings displayed in the settings area**

Each TCB setting consists of a value field, a slider, and a Reset button. The value field and slider let you edit the function curves of the animation. The Reset button sets the value of each setting to 0.

Tension

The Tension settings let you change the tautness of the function curve. For example, when Tension is set to a value of 1, the result is similar to a selected keyframe with Bezier interpolation with flat tangents.

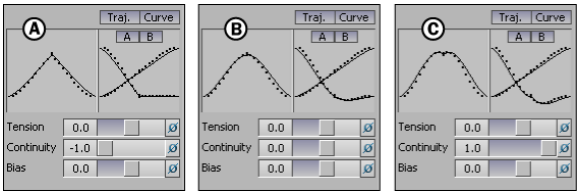


Changing tension *A.* **Tension at -1** *B.* **Tension at 0***C.* **Tension at 1**

Continuity

The Continuity settings let you create a break in the curve to change that trajectory and speed of the animation.

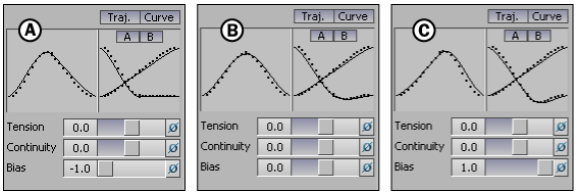
When Continuity is set to a value of -1, the result is similar to using both the Discontinuity Right and Discontinuity Left buttons for a selected keyframe with Bezier interpolation.



Changing continuity *A.* **Continuity at -1** *B.* **Continuity at 0** *C.* **Continuity at 1**

Bias

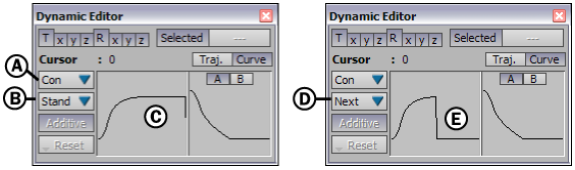
The Bias settings let you change the angle of the trajectories and curves in the animation, making them lean left or right. For example, when Bias is set to a value of -1, the result is similar to using the Discontinuity Right button on a selected keyframe with Bezier interpolation.



Changing bias *A.* **Bias at -1** *B.* **Bias at 0** *C.* **Bias at 1**

Constant interpolation settings

Constant interpolation maintains the same keyframe value between keyframes. There is no slope between keyframes with Constant interpolation.

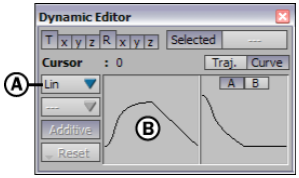


Constant interpolation *A.* **Constant interpolation mode selected** *B.* **Standard interpolation option** *C.* **Constant Standard interpolation** *D.* **Next is the selected interpolation option** *E.* **Constant Next interpolation**

When Constant (Con) is selected in the Interpolation Mode menu, the Interpolation Options menu lets you select Standard (Stand) or Next. These options are the same as those available when Constant (Con) is selected as the interpolation mode in the FCurves window. See Standard option on page 977 and Next option on page 977 for information.

Linear interpolation settings

When Linear (Lin) is selected in the Interpolation Mode menu, there are no additional settings in the Dynamic Editor. For more information on this type of interpolation, see Linear interpolation on page 925.



Dynamic Editor *A.* **Linear interpolation mode selected** *B.* **Linear interpolation displayed**

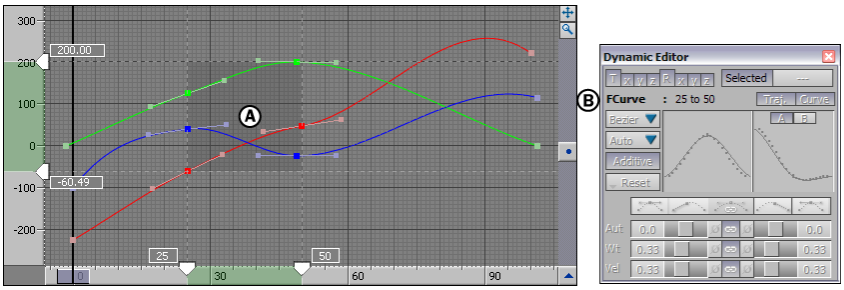
What the Dynamic Editor modifies

The Dynamic Editor lets you modify keyframes at the current time without selecting them, but you can also use it to modify selected keyframes or selected keyframe regions. When no other keyframes are selected, keyframes at the current time are editable.

When you select keyframes in the Transport Controls window, or when no keyframes are selected, the Keying Mode menu of the Key Controls window determines which properties are affected. For example, if the TRS keying mode is selected, animation on translation, rotation, and scaling properties is modified.

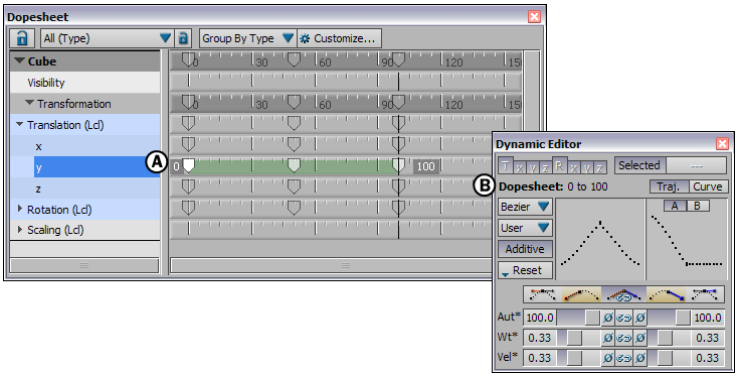
The Dynamic Editor also has options that let you make exceptions to which keyframes are modified. See Character Keying Mode options on page 930, and Translation (T) and Rotation (R) options on page 929 for more information.

If you select one or more keyframes in the FCurves window, the Dynamic Editor indicates this and only the selected keyframes are modified.



Editing keyframes *A*. Six keyframes selected in the FCurves window *B*. Dynamic Editor indicating only the keyframes selected in the FCurves window are modified

The Dynamic Editor also indicates that keyframes are selected in the Dopesheet window and only the selected keyframes are modified.

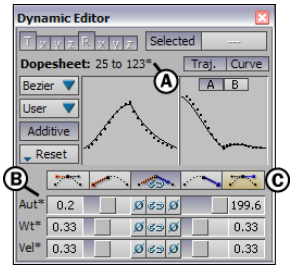


Editing keyframes *A*. Three keyframes selected in the Dopesheet window *B*. The Dynamic Editor indicating only the keyframes selected in the Dopesheet window are modified

The Dynamic Editor asterisk

In the Dynamic Editor, an asterisk (*) beside a frame number indicates that the editable keyframe does not snap to a frame.

An asterisk beside one of the Bezier or TCB interpolation settings indicates that at least one of the editable keyframes does not have the same values as the other editable keyframes.



Status *A.* **Asterisk following a frame number** *B.* **Asterisk following a setting name** *C.* **Button that displays yellow**

Flat, Discontinuity, or Break buttons that are yellow also indicate that at least one of the editable keyframes has different values than the others.

For example, in the previous figure, C, the yellow Flat Right button indicates that at least one of the keyframes selected in the FCurves window does not have a flat tangent on the right. Clicking the Flat Right button in this situation flattens the tangent or tangents with a different angle, and the Flat Right button displays dark blue.

Function curves

55

Function curves (FCurves) are a graphical representation of the interpolation between keyframes, showing the value of an animated property over time.

The FCurves window lets you work with function curves to create and modify animation. You can use this window to alter the shape of function curves using tangent handles, change the timing of the animation, and filter captured data, until you are satisfied with your final result.

- Interpolation on page 913
- FCurves window on page 971
- Tangents on page 961
- Animating on Layers on page 873

Creating function curves

To create function curves in the FCurves window:

1. Select an object, such as a model.
2. Make sure the properties you want to animate are selected. For example, you can select Translation.
3. Select the time at which you want to set a keyframe.
4. Set a keyframe.
5. Move the timeline indicator, change the selected properties, and set a second keyframe.

Interpolation is automatically created between the two keyframes. This interpolation is represented graphically as function curves in the FCurves window.

6 In the FCurves window, select the properties you animated, then click in the FCurves pane and press A to center the function curves.

■ FCurves window on page 971

Viewing function curves

To view function curves in the FCurves window:

1 Select an animated object.

2 In the FCurves window's Property list, select a property or multiple properties.

Function curves display in the FCurves pane. If they display as flat, uninterrupted lines, the properties you selected are not animated.

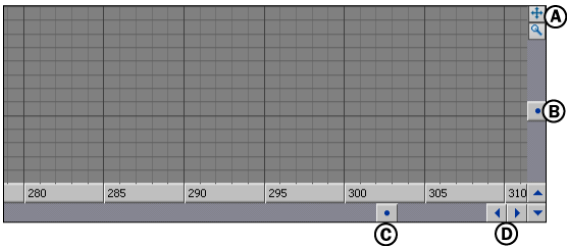
If they do not display at all, the function curves may not be centered in the FCurves pane.

3 Click in the FCurves pane and press A to center all function curves of selected properties.

■ FCurves window on page 971

Navigating in the FCurves pane

The scroll bars, arrows, and buttons in the FCurves pane let you change the view in the FCurves pane. You can also change your view using keyboard shortcuts.



FCurves pane *A.* **Pan and Zoom buttons** *B.* **Side scroll bar** *C.* **Bottom scroll bar** *D.* **Scroll arrows**

Where you *Ctrl*-click is the reference point for scaling your view of the curve. The view scales around this reference point. Dragging from left to right scales the view horizontally, while dragging up and down scales the view vertically.

FCurve timeline *A.* **Original timeline** *B.* **Scaled timeline** *C.* **Scrolled timeline**

Use the following methods to scroll and zoom in the FCurves pane:

Changing Direction	Click any of the scroll arrows to move in the direction specified by the arrow.
Scrolling Horizontally	Shift-click within the FCurves pane, drag left or right, or drag the Bottom scroll bar left or right.
Scrolling Vertically	Shift-click within the FCurves pane, drag up or down, or drag the Side scroll bar up or down.
Zooming In and Out	In the FCurves pane, Ctrl-drag left or down to zoom out and Ctrl-drag right or up to zoom in.
Zooming on Specific Regions	Z-click and drag around the area. Zooming in shows larger increments in the FCurve

	timeline; zooming out shows smaller increments. Only the size of the time increments on the timeline change, the length or scale of the function curve remains the same.
Pan and Zoom buttons	Click and drag either the Pan or Zoom buttons to pan or zoom respectively.

Editing function curves

Manipulating function curves lets you change not only the time and value of keyframes but also the interpolation between keyframes.

1. In the FCurves Property pane, select the animated property whose function curves you want to edit. A function curve displays for each property.

   For example, if you select Translation, there is a function curve for Translation *x*, Translation *y*, and Translation *z* properties.

2. To see the keyframes function curves clearly, click in the FCurves pane and press A to frame the function curves, if necessary. See also Changing the color of function curves on page 960.

3. Select one of the keyframes, which display as small square dots along the function curves.

   To select a keyframe on a function curve, click or drag around it. To select a keyframe region, *Ctrl*-click each keyframe or drag around them.

4. Drag the selected keyframe left or right to change its time. You can also enter a frame number in the Time field. Changing the time of a keyframe means that its value occurs sooner or later than when the keyframe was originally set.

   TIP When you drag the keyframe in the FCurves pane, dotted lines indicate the previous location of the keyframe.

5. Drag the selected keyframe up or down to change its value. You can also enter a value in the Value field. Changing the value of a keyframe is like changing a property setting. For example, changing the value of a keyframe set for the Translation *y* property of a cube moves the cube up

and down in the scene. See Scaling keys in the FCurves window on page 957.

6 When the keyframe uses Bezier interpolation, you can drag its tangents to change the function curve without moving the keyframe. See Editing Bezier interpolation on page 918 for more information.

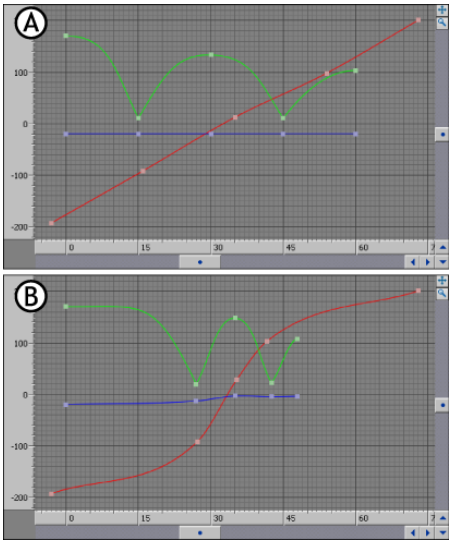
- Interpolation on page 913
- Changing the color of function curves on page 960

Scaling keys in the FCurves window

You can scale a group of keys using the selected keyframes as the pivot point of scaling within the FCurves window.

To do this, drag-select a group of keys in the FCurves window and *Ctrl*-middle-drag them. Dragging the keys inward or outward stretches and scales the keyframes, and affects their relationship with each other. This is useful if you need to tweak or re-purpose the animation.

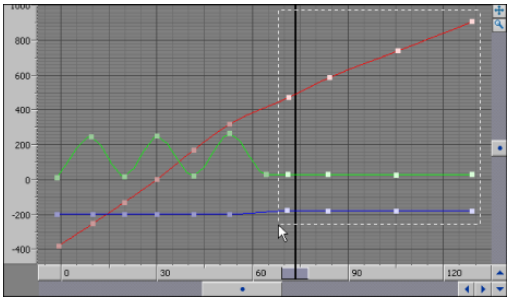
For example, the following illustration shows the FCurve of an animation curve and how you can use FCurve scaling to tighten the selected keyframes.



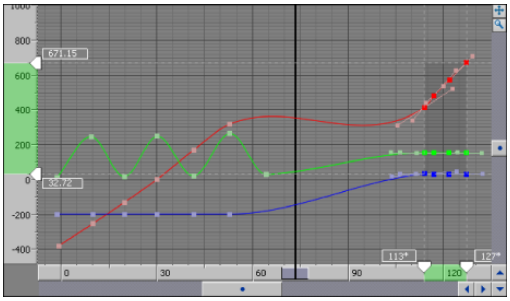
A. Original bouncing ball curve B. Curve scaled to create tighter bounce.

To scale selected keys in the FCurves window:

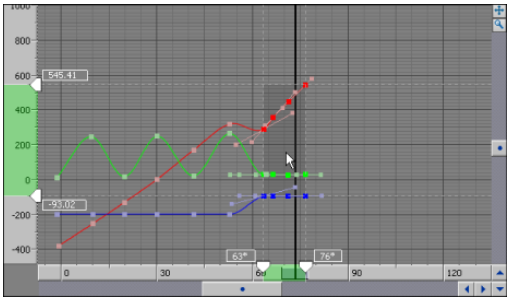
1 Drag across a group of keyframes on a curve to select them. In this example, the keys that are on the flat end of all curves are selected.



2 *Ctrl*-Middle-drag them inward to shrink or outward to expand the selected keys on the curve. In the illustration below, the keys are shrunk together on the curve.



3 Release *Ctrl* and drag the selected area closer to the active part of the animation, where the green T-axis curve is wavy.



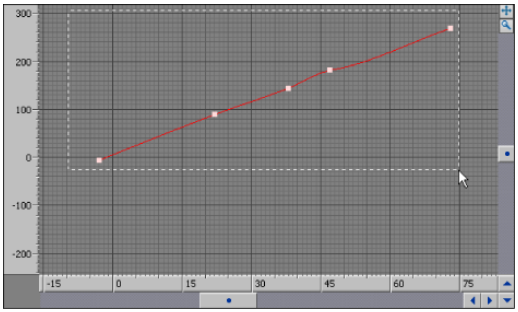
This scales the selected area.

Negative FCurve scaling

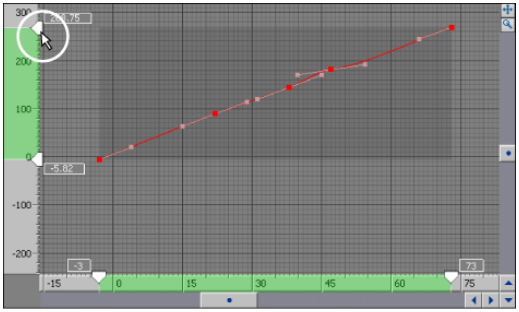
You can drag an FCurve manually to scale a group of keyframes negatively and view the result in the Viewer window. This is useful if you want to mirror or invert certain types of animation.

To negatively scale an FCurve:

1 Drag-select a group of keyframes on a FCurve. This illustration show keys on the x-translation curve.

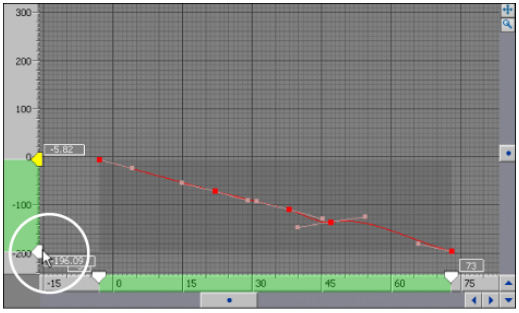


2 Select the top white arrow.



3 Drag the top white arrow so that it is below the bottom white arrow. This inverts the direction travelled along the x-axis.

NOTE You can also *Ctrl*-middle-drag to scale about a point, similar to the Autodesk Maya F-Curve editor.

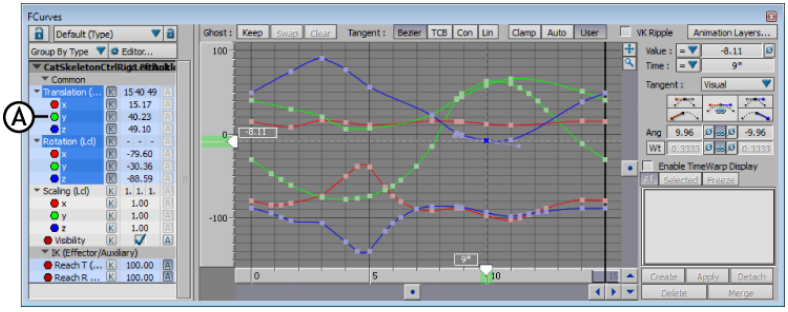


Changing the color of function curves

Using different colors can make it easier to distinguish between different properties. For example, the Y values of translation, rotation, and scaling curves display in the same color by default. Changing the color of the Y translation curve differentiates it from the Y rotation and scaling curves.

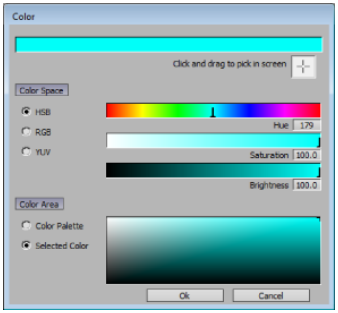
To change a function curve's color:

1 In the FCurves Properties pane, double-click the Color indicator next to the property whose function curve color you want to change.



FCurves window *A.* **Color indicator**

2 In the Color window that opens, define a color for the function curve of the selected property and click Ok.



Color window

For more information see Color window on page 2.

The color of the function curve for the selected property is changed in the FCurves pane.

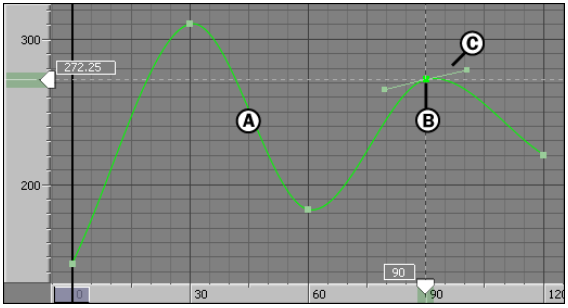
You can also right-click a property in the property tree and select one of the following contextual menu options:

Option	Function
Edit Curve Color	Opens the Color window to let you change a function curve's color.
Edit All Curve Colors of This Type	Opens the Color window to let you change all curves of the same type to the color.
Reset Curve Color	Restores the selected curve's color to its default colors.
Reset All Curve Colors	Restores all curve colors to their default colors.

- FCurves Properties pane on page 972

Tangents

Function curves with Bezier interpolation have tangents that enable you to change the slope of the curve on either side of a keyframe. The angle and weight of tangents affect interpolation.



FCurves window *A.* **Function curve with Bezier interpolation** *B.* **Keyframe** *C.* **Tangent**

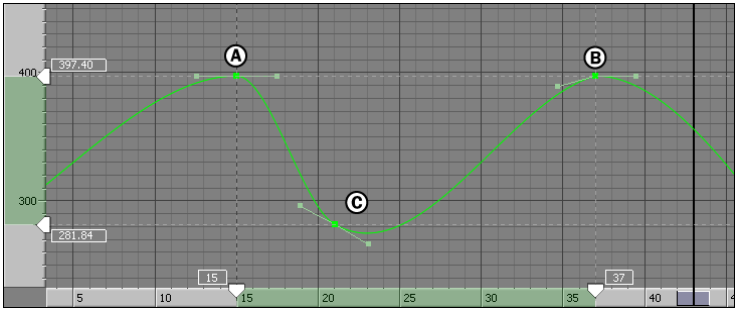
Once you set keyframes with Bezier interpolation, you can edit their tangents by dragging them in the FCurves window, or by using settings in the Dynamic Editor and FCurves window.

Tangent behavior is the only difference between the three types of Bezier interpolation (Clamp, Auto, and User). See Bezier interpolation on page 914 for more information.

You can set keyframes with flat of discontinuous tangents. When you manipulate tangents, you can also weight, break, and link them. The rest of this topic discusses these concepts.

Flat tangents

Tangents with an angle of 0 are *flat*. In the FCurves window, flat tangents display as completely horizontal. Flat tangents keep the interpolation from overshooting or undershooting the keyframe.



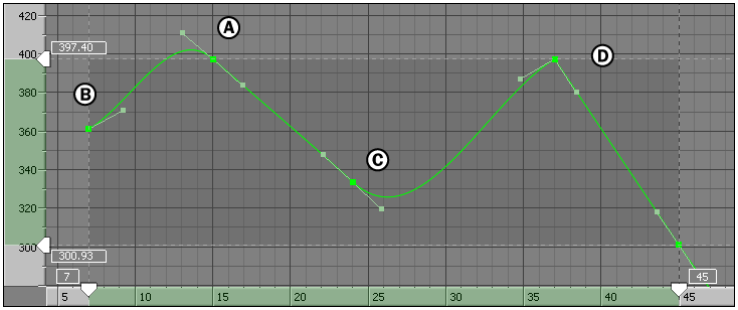
FCurves pane *A.* **A keyframe with flat tangents.** *B.* **A keyframe with one flat tangent.** *C.* **A keyframe without flat tangents.**

While you can always drag tangents so that they are horizontal, you can create flat tangents more quickly. You can set keyframes with flat tangents using the Flat button in the Key Controls window. You can choose to set keyframes using Bezier-Clamp interpolation, which flattens the tangents of keyframes when neighboring keyframes have nearly the same value. You can also select a keyframe, then click one of the Flat buttons in the FCurves window (Flat buttons on page 985) or the Dynamic Editor (Flat Left and Flat Right on page 939).

Discontinuous tangents

Discontinuous tangents point directly to the next or previous keyframe.

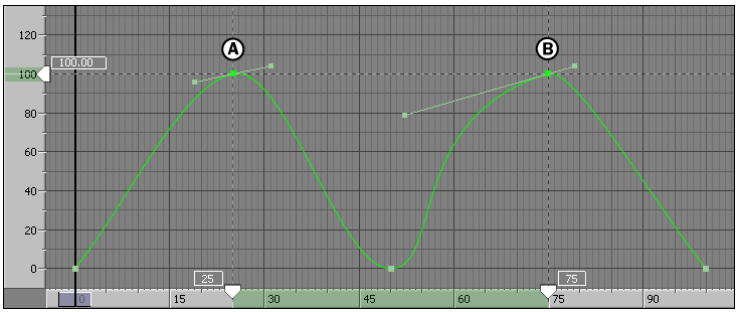
You can set a keyframe with discontinuous tangents by clicking the Discontinuity (Disc.) button in the Key Controls. You can also select a keyframe, then click one of the Discontinuity buttons in the FCurves window (Discontinuity buttons on page 985) or the Dynamic Editor (Discontinuity Left and Right on page 939).



FCurves pane *A.* **A keyframe with discontinuous tangents.** *B.* **Previous keyframe** *C.* **Next keyframe** *D.* **A keyframe with broken discontinuous tangents.**

Weighted tangents

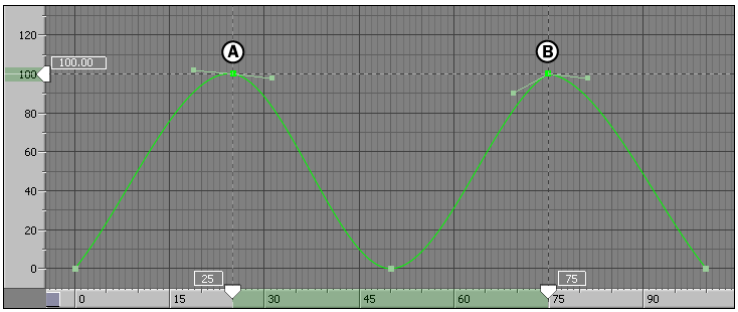
You can alter the arc of a curve by stretching or shortening tangents. This is called *weighting*. Weighting tangents lets you create curves that you cannot create by simply changing the angle of tangents. See Weight settings on page 942 for more information.



FCurves pane *A.* **Normal tangents** *B.* **Weighted tangents**

Broken tangents

Each keyframe has a left tangent and a right tangent. When tangents are not broken, the left and right tangents always form a straight line. When tangents are broken, you can manipulate them at different angles.



FCurves pane *A.* **Unbroken tangents** *B.* **Broken tangents**

Linked tangents

When tangents are linked, you can modify the angle of both left and right tangents at the same time, whether or not the tangents are broken or unbroken (see Broken tangents on page 964).

When tangents are broken, you can modify each linked tangent separately by dragging a tangent handle. To modify linked tangents together, use the tangent settings in the FCurves Options pane.

- Tangent area on page 983
- Tangent options on page 975

TimeWarp curves

By default, a function curve progresses at a constant speed from start to end. A TimeWarp curve acts as a speed measurement. Applying a TimeWarp curve over a function curve and changing its shape changes the timing of an animation.

You can add additional keyframes and change the shape of the TimeWarp curve to slow down, speed up, or reverse the animation.

TimeWarp curves are applied as a separate curve over a function curve, so altering a TimeWarp curve does not change the function curve. The modifications you make with a TimeWarp curve only become permanent if you merge them with a function curve.

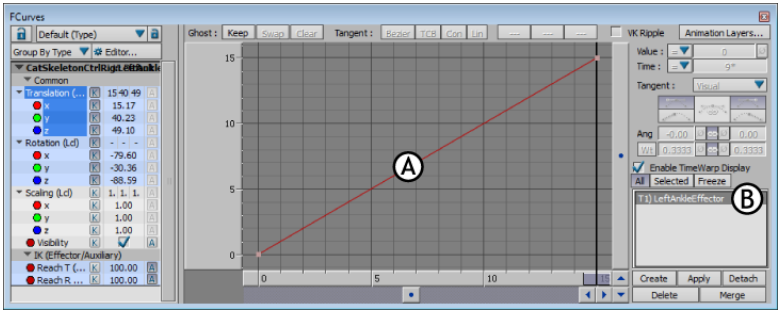
- Creating a TimeWarp curve on page 965
- Merging a TimeWarp curve on page 969
- TimeWarp pane on page 993

Creating a TimeWarp curve

To create a TimeWarp curve:

1. Select the model with the animation you want to timewarp.
2. In the FCurves window, activate the Enable TimeWarp Display option to access the TimeWarp pane.
3. In the TimeWarp pane, click Create.

   A curve called “T1) No Name” displays in the TimeWarp list. In the FCurves pane, a linear red TimeWarp curve displays with two keyframes, one at the beginning of the animation, and one at the end. The X and Y keyframe values are the same and respect the length of the original animation.



FCurves window *A.* **TimeWarp curve** *B.* **TimeWarp list**

After you have created a TimeWarp curve, you can apply it to the function curve and start editing it.

To rename a TimeWarp entry:

➤ Double-click the item in the TimeWarp list, type a name, and press Enter.

NOTE You can rename the TimeWarp curve, but you cannot change its reference number.

- TimeWarp curves on page 965
- Applying a TimeWarp curve on page 966
- Editing a TimeWarp curve on page 967
- TimeWarp pane on page 993

Applying a TimeWarp curve

Before you can start modifying a TimeWarp curve, you must apply it to a function curve.

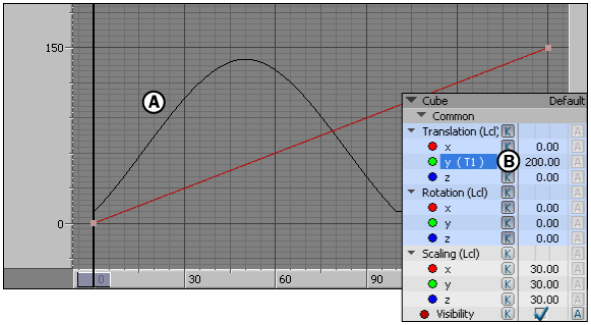
NOTE Applying a TimeWarp curve does not permanently change the function curve.

To apply a TimeWarp curve:

1 Select the property to TimeWarp from the FCurves Properties pane on page 972.

2 Select the TimeWarp curve from the TimeWarp list, and click Apply.

Once the TimeWarp curve is applied, its reference number appears next to the name of the property in the FCurves Properties pane. A black curve shows how the TimeWarp curve affects the function curve for the selected property.



A. **The black curve shows the result.** *B.* **The reference number of the applied TimeWarp (T1) displays.**

- TimeWarp curves on page 965
- Detaching a TimeWarp curve on page 969
- Merging a TimeWarp curve on page 969
- TimeWarp pane on page 993

Editing a TimeWarp curve

After you have applied a TimeWarp curve to an animated property, you can edit the TimeWarp curve to change the timing of the animation.

To edit a TimeWarp curve:

➤ Set, modify, or delete keyframes at different frames on the TimeWarp curve.

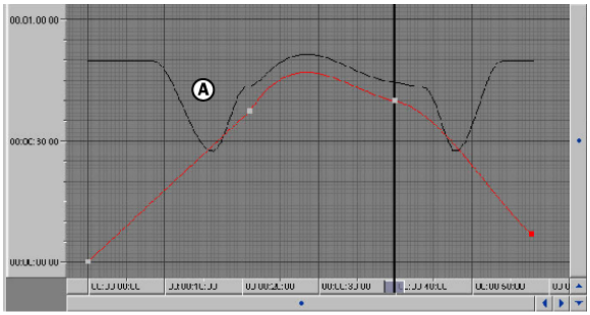
For example, try the following modifications:

- Delete the first keyframe and set a keyframe on a later frame, removing the beginning of the animation and making the action start later.
- Set a keyframe in the middle of the TimeWarp curve and drag it to a higher value. The animation plays faster because you have increased the slope of the TimeWarp curve.
- Set or select a keyframe and change the interpolation type to Bezier-User. This type of interpolation calculates the slope based on neighboring keyframes.
- Select the last keyframe and click the left Flat option in the Tangent options. The flat tangent causes the action to slow before stopping at the last keyframe.

NOTE Keyframes on the TimeWarp curve display as small pink squares which turn red when selected.

As you edit the TimeWarp curve, you can see the effect your TimeWarp modifications have on the black curve in the FCurves pane.

The black curve represents the effect on the BaseAnimation layer only. See BaseAnimation layer on page 874 and Animating on Layers on page 873.



A. **The black curve shows the result of the TimeWarp applied to a curve.**

To make the modifications permanent and keep the black curve, you can merge the TimeWarp curve and the function curve. To discard the changes you have made, you can detach the TimeWarp curve.

- TimeWarp curves on page 965

- Merging a TimeWarp curve on page 969
- Detaching a TimeWarp curve on page 969
- TimeWarp pane on page 993

Detaching a TimeWarp curve

NOTE You can only detach a TimeWarp curve if it has not been merged with its function curve.

To detach a TimeWarp curve:

1. In the FCurves property pane, select a property with a TimeWarp curve.
2. In the TimeWarp pane, click Detach.

   The TimeWarp curve is still listed in the TimeWarp list, but it is no longer applied to a property. The black preview curve no longer displays in the FCurves pane.

- TimeWarp curves on page 965
- Deleting a TimeWarp curve on page 970
- TimeWarp pane on page 993

Merging a TimeWarp curve

When you are finished working with at TimeWarp curve, you can merge it with its function curve to make your changes permanent.

To merge a TimeWarp curve:

1. In the FCurves Properties pane, select the property whose function curve you want to merge with the TimeWarp curve.
2. In the TimeWarp pane, select the TimeWarp curve and click Merge.
3. Optional: In the Animation Layer editor, select the Base Layer (if it is not already selected) and view the final function curves for your animation.

After you have merged a TimeWarp curve with the Base Layer, you can delete the TimeWarp curve from the scene.

- TimeWarp curves on page 965
- Deleting a TimeWarp curve on page 970
- TimeWarp pane on page 993

Deleting a TimeWarp curve

In the TimeWarp pane, select a TimeWarp curve from the TimeWarp list and click Delete.

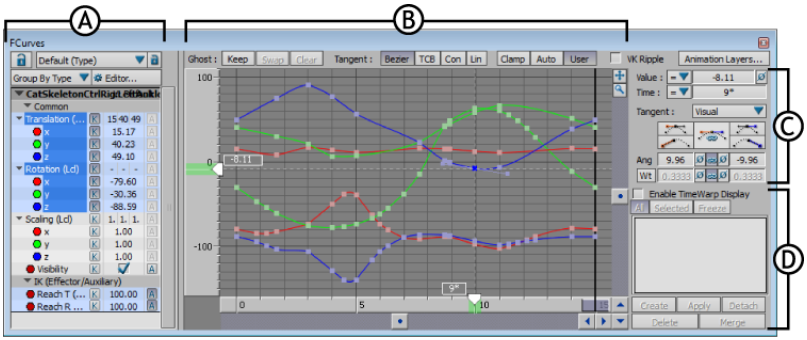
- TimeWarp curves on page 965
- Detaching a TimeWarp curve on page 969
- TimeWarp pane on page 993

FCurves window

56

The FCurves window lets you create, view and modify function curves in various ways. For example, you can control the interpolation between keyframes, the extrapolation of a curve, and the value and time of the function curve.

To display the FCurves window, select Window > FCurves in the menu bar. In the Editing layout, the FCurves window also appears in the Navigator window, where you can click on the FCurves tab to display the settings.



FCurves window *A.* **FCurves Properties pane** *B.* **FCurves pane** *C.* **FCurves Options pane** *D.***TimeWarp pane**

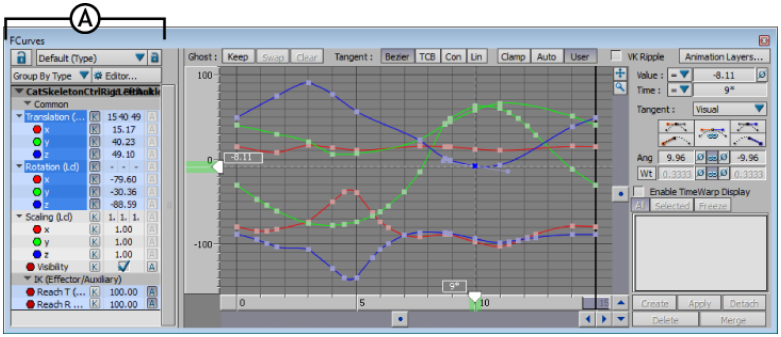
For more about editing FCurves, see also Function curves on page 953 and Scaling keys in the FCurves window on page 957.

The FCurves window consists of the following main areas:

- FCurves Properties pane on page 972
- FCurves pane on page 973
- FCurves Options pane on page 980
- TimeWarp pane on page 993

FCurves Properties pane

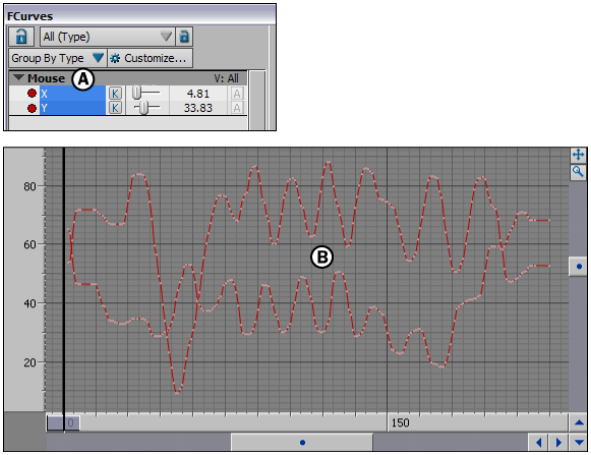
The FCurves Properties pane is simply a representation of the Properties window on page 765 in the FCurves window. When an object is selected, the FCurves Properties pane displays only the object's properties that you can animate, which you can select to view curves in the FCurves pane.



FCurves window *A.* **Properties pane**

When you select a property in the Properties pane, its function curve appears in the FCurves pane, and the value of each property displays in the Value field at the current time code. If the property is a vector, such as Translation or Rotation, its X, Y, and Z values also display.

For example, the following figure shows the captured data of a Mouse device. Two function curves display because both the devices's X and Y properties are selected in the Properties pane. To view only the X or Y data captured to the Mouse device, select only the X or Y property in the Properties pane.



A. **The selected Mouse device's properties display in the Properties pane.** *B.* **All the data recorded to the device's X- and Y-axes display in the FCurves pane.**

You can hide or show more of the Properties pane by dragging the vertical gray bar between the Properties pane and the FCurves pane.

- Properties window on page 765
- FCurves window on page 971

FCurves pane

The FCurves pane displays the function curves of selected properties and gives you controls for manipulating the curves. You can edit curves directly by moving a keyframe's tangent handles to change the shape of the curve, and you can also choose different types of interpolation to either smooth the curve or sharpen angles.

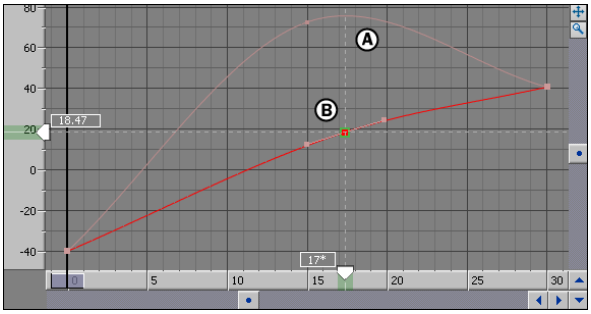
Ghost options

The Ghost options let you edit function curves progressively while using the position of the previous curve as a visual reference. The previous curve is referred to as a Ghost curve.

Ghost options in the FCurves window *A.* **Keep** *B.* **Swap** *C.* **Clear**

As you modify a function curve, its Ghost curve remains static in the background of the FCurves window and displays in the a lighter shade of the same color of the original curve.

For example, the following figure shows a Ghost curve behind the modified function curve.



FCurves pane *A.* **Ghost of the original curve displays behind the curve being modified.** *B.* **New curve.**

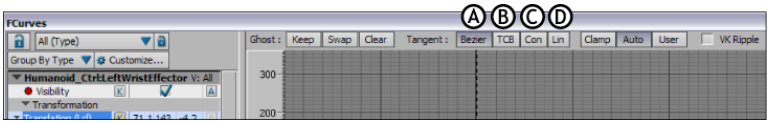
You can move between the current and previous function curves to view the differences as you edit, exchange the current function curve with the previous curve at any time, or keep the modified curve.

Ghost option	Function
Keep	Click the Keep button to record the current function curve as the Ghost curve. The Keep button takes a snapshot of state of the current function curve and places it in memory, creating a Ghost curve. To keep the new position of the modified function curve and clear the Keep buffer, click Keep again. The Ghost curve updates based on the current position of the function curve.
Swap	The Swap button exchanges the active curve with the Ghost curve. Click Swap again to swap the two curves once more.
Clear	The Clear button deletes any Ghost curves from memory, and from the FCurves pane. Ghost curves do not display on subsequent edits

Ghost option	Function
	until you click Keep again. You can hide Ghost curves but keep them in memory when you right-click in the FCurves pane, and disable Display > Ghosts in the contextual menu (see Display menu options on page 999).

Tangent options

By default, MotionBuilder automatically manages the slope, or interpolation, of function curves. The four Tangent options (Bezier, TCB, Con, and Lin) let you select how MotionBuilder interpolates the values between keyframes in order to manually change the interpolation.



Tangent options in the FCurves window *A.* **Bezier** *B.* **TCB** *C.* **Constant** *D.* **Linear**

To change interpolation, select one or more keyframes, then select an interpolation option. Depending on the option you choose, the interpolation between the selected keyframes changes.

When you change the interpolation of a keyframe region, you affect the shape of the curve between the keys in the region and the next set of keys that follow the region.

Depending on the interpolation option you click, additional options may appear. For example, if you click Bezier, the Clamp, Auto, and User options appear.

For information on changing the mathematical algorithm that calculates the extrapolation of a curve, see Extrapolation on page 997.

Bezier option

Activates Bezier interpolation mode, which lets you create cubic curves that you can modify using tangent handles or angle and weight settings.

Tangent options *A.* **Bezier option is active.** *B.* **Clamp option** *C.* **Auto option** *D.* **User option**

The following table describes the Clamp, Auto, and User modes (B, C, and D in the figure) available when you select Bezier interpolation mode in the FCurves window.

Mode	Function
Clamp	Creates a cubic curve whose slopes are automatically recalculated based on the values of the neighboring keyframes as you edit. When you set or edit a Bezier-Clamp key, the key's tangents flatten when neighboring keyframes have nearly the same value. See Bezier-Clamp on page 915.
Auto	Creates a cubic curve whose slopes are automatically recalculated based on the values of the neighboring keyframes as you edit. Auto is the default mode when keyframing, unless you change the type of interpolation in the Type menu of the Key Controls window. When Auto is selected, Auto and Weight settings display in the Tangent area. See Tangent area on page 983 for more information.
User	User mode creates a cubic curve whose slopes are not influenced by neighboring keyframes. When you edit neighboring keyframes, the slopes of a Bezier-User keyframe do not change. When User is selected, Angle (Ang) and Weight settings display in the Tangent area. See Tangent area on page 983.

There are two options in the FCurves contextual menu on page 995 that affect your use of Auto and User modes. See Switch to User on Edit on page 1001 and Reset Tangents on Switch to Auto on page 1001 for more information.

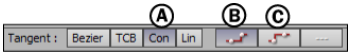
TCB option

Activates TCB interpolation mode, joining each keyframe using a Hermite-type curve. The slope on either side of a keyframe is changed using the TCB (Tension/Continuity/Bias) values.

Constant (Con) option

Activates Constant interpolation mode, maintaining the same keyframe value between keyframes. With Constant interpolation mode active, there is no slope between keyframes.

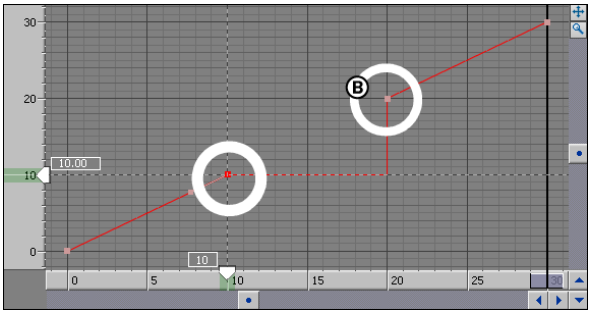
When you click the Constant option in the FCurves window, the Standard and Next options appear (B and C in the figure).



Tangent options *A.* **Constant option is active.** *B.* **Standard option** *C.* **Next option**

Standard option

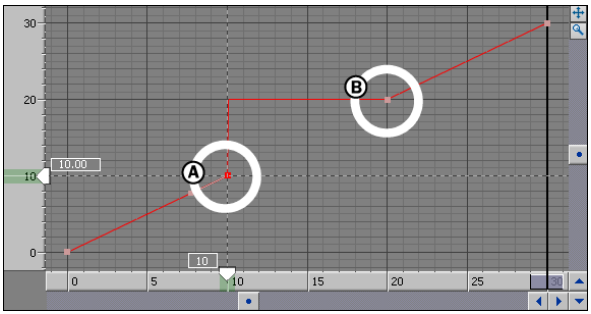
When the Standard option is active, constant interpolation maintains the value of the selected keyframe until the next keyframe.



Standard constant interpolation *A.* **Selected keyframe** *B.* **Next keyframe**

Next option

When the Next option is active, constant interpolation maintains the value of the next keyframe between the selected and next keyframes.



Next constant interpolation *A.* **Selected keyframe.** *B.* **Next keyframe**

TIP The Constant Next interpolation is useful for marking the end of a referential when using the Multi-Referential constraint.

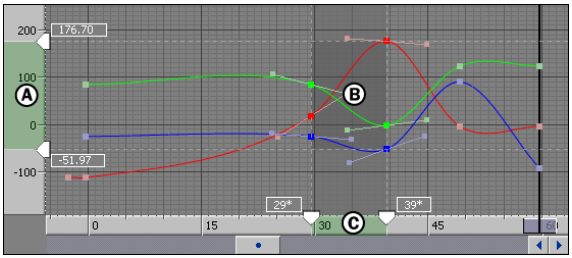
Linear option

Activates Linear interpolation mode, joining the selected keyframe and the next keyframe with a straight line. The slope between keyframes while this mode is active is constant.

VK Ripple option

As you manipulate keyframe selections using the visual keyframes in the FCurves pane, the VK (Visual Keyframes) Ripple option lets you determine how keyframes move to accommodate your changes.

When VK Ripple is active, and the VK Ripple Options in the contextual menu are also active, dragging keyframe selections using the green bars, pushes other keyframes later in time outside the selected region (A and C in the following figure).



Using VK Ripple *A.* **Green bar along the vertical axis** *B.* **Gray box** *C.* **Green bar along the horizontal axis**

If you use the gray box to drag the keyframe selection, the keyframes move as if VK Ripple is not active.

For example, to push keys forward at the end of a keyframe region, activate VK Ripple and drag the selected region to the right using the visual keyframes on the horizontal or vertical axes.

When VK Ripple is disabled, moving keyframe selections does not change the position of other keyframes, as each keyframe maintains its space.

VK Ripple must be activated if you want to use the VK Ripple options in the FCurves contextual menu and ripple your edits in various ways. See VK Ripple Options on page 1000.

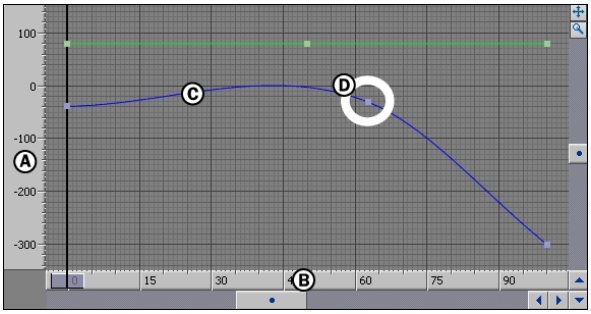
Animation Layers button

The Animation Layers button opens the Animation Layer editor, which lets you manage and select multiple animation layers. See Animating on Layers on page 873.

Horizontal and vertical axes

The value of a property appears along the vertical axis, and its time appears along the horizontal axis.

The slope of the curve determines the speed of the change between each value. For example, a steep slope means the value changes quickly, and a gradual slope means the value changes more slowly over a longer period of time.

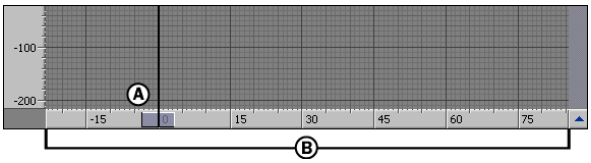


A. **Value on vertical axis** *B.* **Time on horizontal axis** *C.* **Function curve** *D.* **Keyframe**

NOTE The horizontal and vertical axes change when you edit TimeWarp curves (see TimeWarp pane on page 993).

The FCurve timeline on the horizontal axis shows the progression of time in the FCurves window, and indicates the area of the current function curves relative to the current take. Both axes show selected keyframes and keyframe regions.

The Timeline indicator in the FCurves pane shadows the Timeline indicator on the Action timeline in the Transport Controls window, which also displays the length of the current take. See Selecting time on page 787.



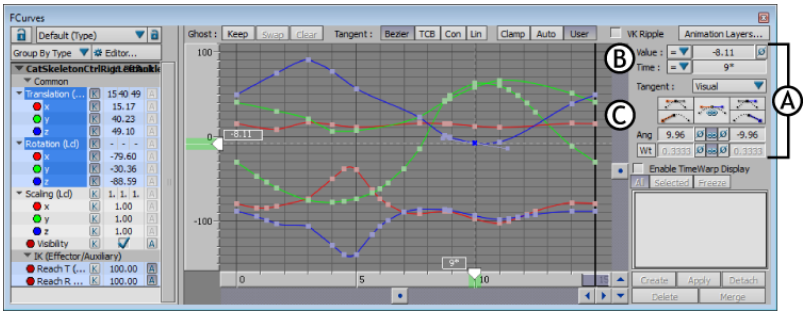
FCurves window *A.* **FCurve Timeline indicator** *B.* **FCurve time axis**

- Changing the color of function curves on page 960

FCurves Options pane

The FCurves Options pane contains options that let you change selected curves and editing modes in the FCurves pane.

The Value, Time, and Tangent options let you adjust tangent handles and change keyframes based on their time or frame. These options apply to the selected function curves or keyframes.



FCurves window *A.* **FCurves Options pane** *B.* **Value and Time settings** *C.* **Tangent area**

Value and Time settings

The Value and Time settings (A and B in the following figure) let you edit keyframes by adding, subtracting, or multiplying by a specific value or time for offsetting keyframe selections without changing the animation.

FCurves window *A.* **Value settings** *B.* **Time settings**

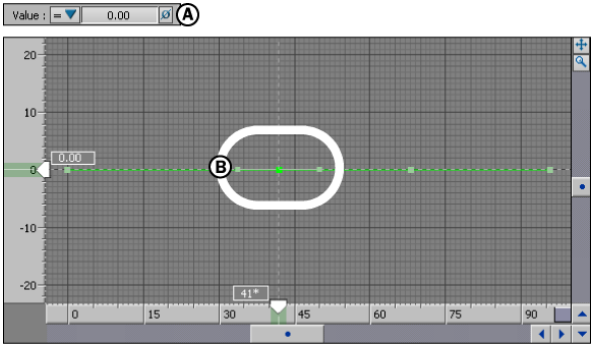
The Value field reflects the value of a selected keyframe in the FCurves pane, and the Value menu lets you edit keyframes by a selected value.

The Time field reflects the time of a selected keyframe in the FCurves pane, and the Time menu lets you edit keyframes by a selected time.

The following table describes the options in the Value and Time menus:

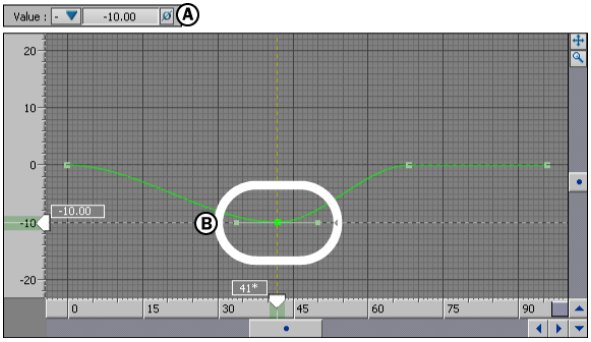
Option	Description
=	Reflects the actual value.
+	Adds the value specified in the Value or Time field.
-	Subtracts the value specified in the Value or Time field.
*	Multiplies the value specified in the Value field.

The selected keyframe in the following figure has a value of 0.



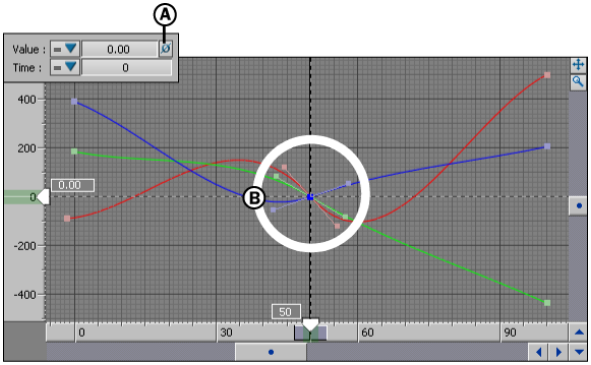
A. **Value field reflects selected curve's value of 0.***B.* **Selected keyframe in the FCurves pane.**

In the previous figure, the minus (-) option (A) is selected and 10 is in the Value field. This causes the selected keyframe that originally had a value of 0 to change to a value of -10.



A. **Minus is selected in the Value menu. Entering 10 in the Value field becomes -10.** *B.* **The Selected keyframe changes to the selected value in the FCurves pane.**

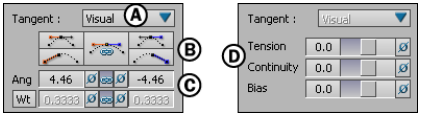
To reset the value of the keyframe to 0, you can click the Reset button for the Value setting.



Resetting values *A.* **Reset button** *B.* **Keys are set to 0.**

Tangent area

The options in the Tangent area let you set values for the tangents of selected keyframes. The settings in the Tangent area change depending on which tangent option is selected.



Tangent area *A.* **Tangent menu** *B.* **Flat, Discontinuity, and Break options** *C.* **Angle and Weight settings** *D.* **TCB settings**

When the TCB tangent option is active, the Tangent area displays the Tension, Continuity, and Bias settings that are the same as those in the Dynamic Editor. See TCB interpolation settings on page 947.

When the Bezier, Constant, or Linear tangent options are selected, the Tangent area can include the Tangent menu, Tangent buttons, Angle settings, Auto settings, and Weight settings.

Tangent menu

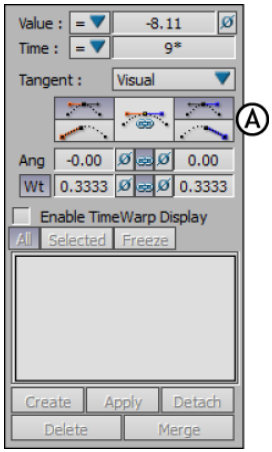
The Tangent menu lets you choose between Visual and Exact options.

Option	Description
Visual	Lets you intuitively adjust tangents based on the current visual display of the tangents. To adjust tangents, drag or change values in the Left and Right tangent fields. Visual is the default option.
Exact	Lets you adjust a tangent using precise degrees. Use this option to paste or reuse exact values independent of the current visual display.

Tangent buttons

In the FCurves window, the following buttons affect the tangents of selected keyframes:

- Flat buttons on page 985
- Discontinuity buttons on page 985
- Break option on page 986



FCurves Options pane *A.* **Flat buttons, Discontinuity buttons, and Break option**

These buttons display in the FCurves Options pane when certain Tangent options are selected.

Flat buttons

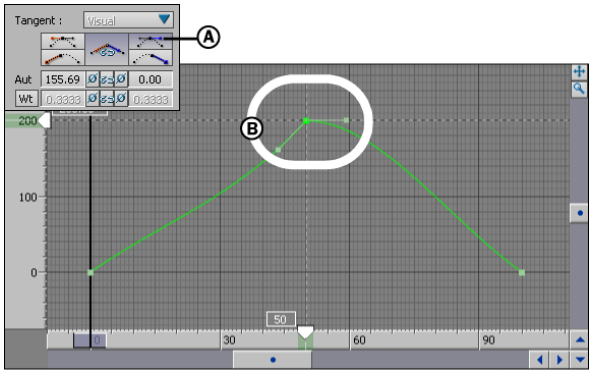
When the Bezier interpolation mode is active, the two Flat buttons let you flatten the left and right tangent handles of selected keyframes. Also, when the Bezier interpolation mode and the Auto interpolation option are active, clicking a Flat button switches the interpolation option from Auto to User.

Tangent area *A.* **Flat Left button** *B.* **Flat Right button**

The Flat button on the left affects the interpolation to the left of a keyframe, and the Flat button on the right affects the interpolation to the right of the keyframe.

Also, when the Break option is disabled, clicking one Flat button flattens both left and right tangents. When the Break option is disabled, clicking one Flat button flattens only one tangent.

For example, clicking the right Flat button flattens the right tangent handle horizontally.



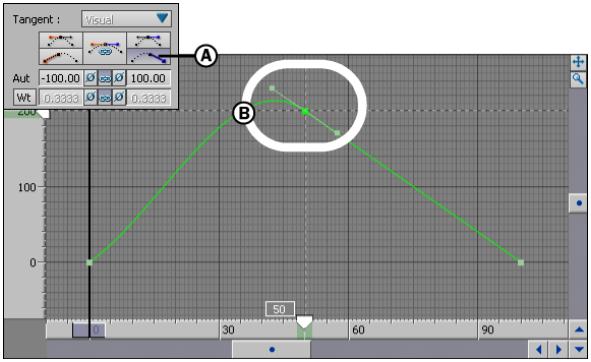
using the Flat buttons *A.* **The right Flat button is active.***B.* **The right tangent handle is flatten.**

Discontinuity buttons

When the Bezier interpolation mode is active, the two Discontinuity buttons cause the left or right tangents to point at the previous or next keyframes.

Tangent area *A.* **Discontinuity Left button** *B.* **Discontinuity Right button**

Clicking the Discontinuity button on the right causes the right tangent handle to point to the next keyframe. Similarly, clicking the Discontinuity button on the left causes the left tangent to point to the previous keyframe.

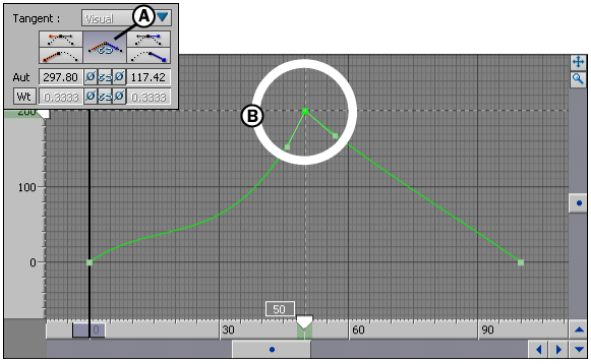


Using Flat buttons *A.* **The right Discontinuity button is active.** *B.* **The right tangent handle is points to the next keyframe.**

Also, when the Break option is disabled, clicking one Discontinuity button affects both left and right tangents. When the Break option is active, clicking one Discontinuity button affects only one tangent.

Break option

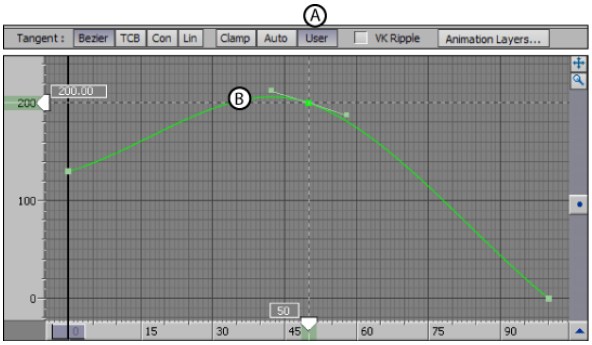
The Break option splits a keyframe's tangent handle into two tangent handles that you can move independently. This lets you change the slope of the function curve on either side of the keyframe or weight left and right tangents differently.



Breaking tangents *A.* **Break option is active.** *B.* **Tangent handles of a selected keyframe are broken. Each handle moves independently.**

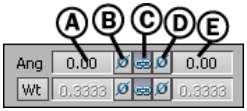
Angle settings

When Bezier and User options are active, the Angle settings let you edit the angles of function curves using degrees, and the angle of left and right tangents are unaffected by previous and next keyframes.



A. **The User option for Bezier interpolation is selected.** *B.* **The tangent of the selected keyframe is offset by 20 degrees.**

The Angle settings consist of fields, Reset buttons, and a Link button.



Angle settings *A.* **Angle for left tangent** *B.* **Reset left tangent** *C.* **Link option** *D.* **Reset right tangent** *E.* **Angle for right tangent**

Angle (Ang) fields

Let you change the angle of the tangents for a selected keyframe to specific degrees. The Angle field on the left affects the left tangent, and the Angle field on the right affects the right tangent. The values of these fields depend on whether Visual or Exact is selected in the Tangent menu.

The angle of a selected keyframe's left and right tangents are not affected by neighboring keyframes. Instead, the values in the Angle fields are negative or positive in relation to the selected keyframe, as if the keyframe is at coordinates (0, 0) on a Cartesian plane.

When a tangent is set to 0, it is flat and displays horizontally. When a tangent is set to a positive number, the tangent angle points upwards from the selected keyframe. When a tangent is set to a negative degree, the tangent angle points downwards from the selected keyframe.

Reset

Let you reset the Angle values for the right and left tangents of a selected keyframe to zero (B and D in the figure above). Tangents set to zero are flat, and display horizontally.

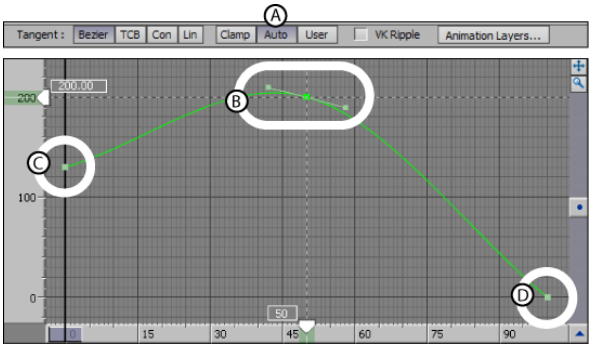
Link

When the Link option next to the Angle fields is active, you can modify the angle of both left and right tangents at the same time, whether or not the tangents are broken or unbroken.

When the Break option is active (Break option on page 986), you can modify the angle of each tangent separately when the Link option is disabled, or by dragging a tangent handle.

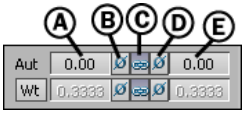
Auto settings

When Bezier and Auto buttons are active, the Auto settings let you edit the angles of function curves parametrically, where the angle of left and right tangents are changed in relation to the previous or next keyframes.



A. **The Auto button for Bezier interpolation is selected.** *B.* **Selected keyframe's tangents are the average between the previous and next keyframes.** *C.* **Previous keyframe** *D.* **Next keyframe**

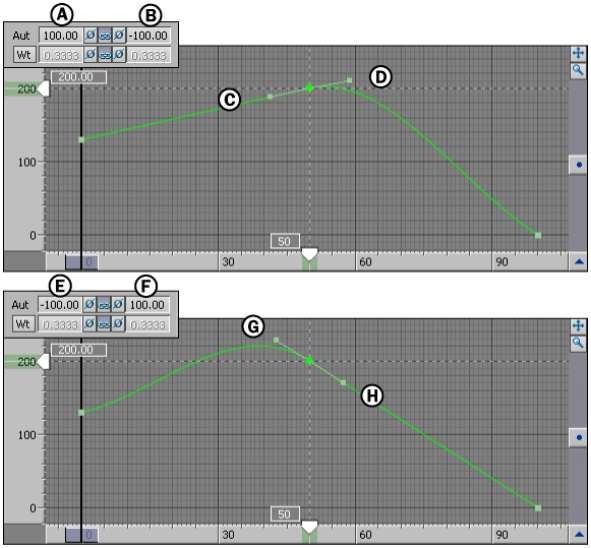
The Auto settings consist of fields, Reset buttons, and a Link button.



Auto settings *A.* **Value for left tangent** *B.* **Reset left tangent** *C.* **Link option** *D.* **Reset right tangent** *E.* **Value for right tangent**

Auto (Aut) fields

The Auto settings include two fields (A and E in the following figure) which let you change the angle of a selected keyframes's tangents. The field on the left side affects the left tangent, and the field on the right side affects the right tangent.



Editing tangent angles using Auto settings *A.* **The left Auto field is set to 100.** *B.* **The right Auto field is set to -100.** *C.* **The left tangent points to the previous keyframe.** *D.* **The right tangent points away from the previous keyframe.** *E.* **The left Auto field is set to -100.** *F.* **The right Auto field is set to 100.** *G.* **The left tangent points away from the next keyframe.** *H.* **The right tangent points to the next keyframe.**

When you modify the Auto settings, the tangents behave as described in the following table:

0	At 0, the curve represents the average between the previous and next keyframes.
100	When the left Auto field is at 100, the left tangent points to the previous keyframe (A and C in the figure above). When the right Auto field is at 100, the right tangent points to the next keyframe (F and H in the figure above).
-100	When the left Auto field is at -100, the left tangent points away from the next keyframe (E and G in the figure above).When the right Auto field is at -100, the right tangent points away from the previous keyframe (B and D in the figure above).

Reset

The Reset buttons for the Auto fields (shown as B and D in the figure above) let you reset the right and left tangents to zero. When a left or right tangent is reset to zero, the tangent represents the average between the previous and next keyframes.

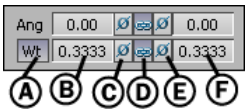
Link

When the Link option for the Auto fields is active, you can modify the angle of both left and right tangents at the same time, whether or not the tangents are broken or unbroken.

When the Break option is active (Break option on page 986), you can modify the angle of each tangent separately when the Link option is disabled, or by dragging a tangent handle.

Weight settings

The Weight settings let you change the weight of tangents. When you stretch or shorten the handle of a weighted tangent, the interpolation curve is affected by a third point, represented by the end of the tangent handle. You can stretch a weighted tangent without affecting its angle.



Weight settings *A.* **Weight Selection option** *B.* **Value for left tangent** *C.* **Reset left tangent** *D.* **Link option** *E.* **Reset right tangent** *F.* **Value for right tangent**

Weight Selection

The Weight Selection option lets you weight the left and right tangents selected keyframes at the same time. The Weight settings are available only when this option is active.

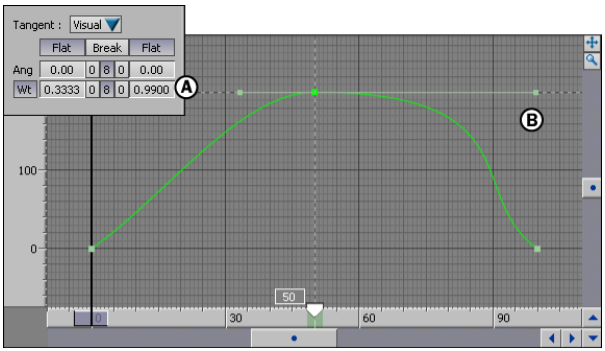
This option is similar to the Weight Selection option in the contextual menu. See Weight Selection on page 998 for more information.

Disabling the Weight Selection option removes weighting from both tangents of selected keyframes. See Reset on page 992 to reset tangents separately.

Weight (Wt) fields

The Weight settings include two fields (B and F in the previous figure,) that let you change the weight of the tangents for a selected keyframe.

To change the value in a field, drag in the field, or double-click in the field and type a value. You can also drag the tangent handles themselves. The Weight field on the left affects the left tangent, and the field on the right affects the right tangent.



Changing the weight of a curve *A*. The Weight settings are at 0.333 and 0.990. *B*. The weight of the tangent on the right is changed.

Reset

The Reset buttons for the Weight fields (C and E in the figure,) let you reset the right or left tangents of selected keyframes to 0.3333, removing the weight from either tangent.

Link

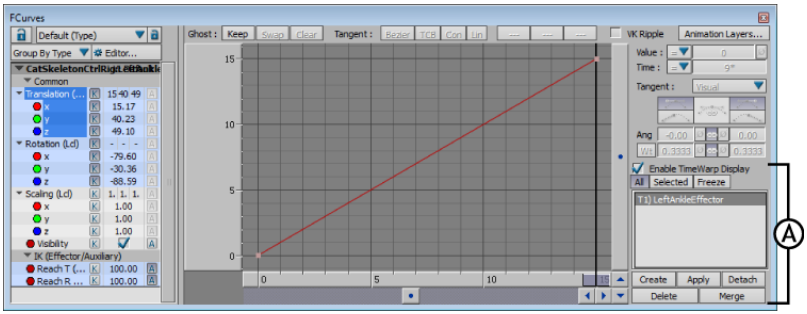
When the Link option for the Weight fields is active, you can modify the weight of both left and right tangents at the same time, whether or not the tangents are broken.

When the Break option is active (see Break option on page 986), you can modify the weight of each tangent separately when the Link option is disabled, or by dragging a weighted tangent handle.

- Tangents on page 961
- FCurves window on page 971

TimeWarp pane

When the TimeWarp pane in the FCurves window is active, all changes such as editing, selecting, keyframing, and other actions apply to the selected function curve's TimeWarp curve.



FCurves window *A.* **TimeWarp pane**

The TimeWarp pane includes the following options and buttons:

Enable TimeWarp Display

Activates the TimeWarp pane and displays the selected function curve's TimeWarp curve.

All option

Displays all TimeWarp curves in the scene.

Selected option

Displays TimeWarp curves for selected properties in the FCurves Properties pane.

Freeze option

Freezes the current TimeWarp list until you choose All or Selected.

TimeWarp list

The TimeWarp list is empty by default until you create a TimeWarp curve (see Creating a TimeWarp curve on page 965).

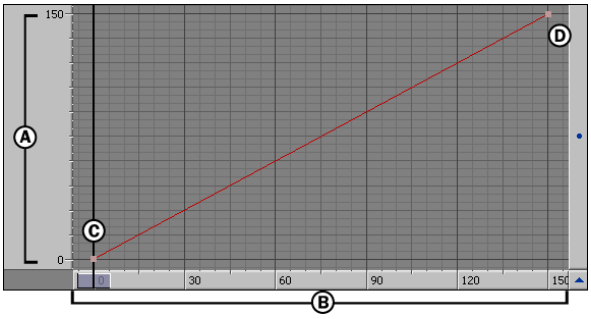
Curves are listed in the TimeWarp pane and numbered "Tn", where n is a reference number for the TimeWarp curve. The name is based on the object

last selected in the FCurves pane. If nothing is selected, the curve is numbered and called “No Name”.

Create button

Click to create a TimeWarp curve. See Creating a TimeWarp curve on page 965.

In TimeWarp mode, the original time code is graphed by TimeWarp time code. The vertical axis shows the time values for the original animation, and the horizontal axis shows the time values for the TimeWarp animation.



A. **Original animation values on Y-axis.** *B.* **TimeWarp animation values on X-axis.** *C.* **Beginning of time** *D.* **End of time**

Apply button

Click to apply a TimeWarp curve to its selected property. See Applying a TimeWarp curve on page 966.

Detach button

Click to detach a selected TimeWarp curve from its function curve, and returns to the original motion data. See Detaching a TimeWarp curve on page 969.

Delete button

Click to delete a selected TimeWarp curve. See Deleting a TimeWarp curve on page 970.

Merge button

Click to merge a TimeWarp curve with its function curve and make the curve permanent. See Merging a TimeWarp curve on page 969.

- TimeWarp curves on page 965

FCurves contextual menu

The FCurves contextual menu lets you set display and additional options for keyframes and function curves.

To display this menu, right-click anywhere in the FCurves pane. The menu options may change depending on what is selected, or on the previous editing operation.

Cut

Removes selected keyframes and stores them in memory. To cut a selection, right-click in the FCurves pane and choose Cut from the contextual menu. You can also use the keyboard shortcut *Ctrl-X* to cut selections.

Copy

Copies selected keyframes and stores them in memory for inserting into another location. To copy a selection, right-click in the FCurves pane and choose Copy from the contextual menu. You can also use the keyboard shortcut *Ctrl-C* to copy selections.

Paste

Pastes a copied or cut selection into a selected area. If nothing is selected, the selection is pasted at the current time.

To paste a selection, right-click in the FCurves pane and select Paste from the contextual menu. You can also use the keyboard shortcut *Ctrl-V* to paste selections.

The first keyframe of the copied or cut curve is pasted at the current timecode. All selected keyframes are pasted, preserving the shape of the copied or cut curve.

Replacing a keyframe or keyframe region with a pasted selection deletes all keys within the region, and replaces the first key of the region with the pasted keyframe. When pasting a keyframe region on a keyframe, the region's first key replaces the original keyframe.

You can also cut, copy, and paste multiple function curves at the same time. This means that you can select an object's X, Y, and Z function curves, then copy and paste these curves to another object.

NOTE Activating the Paste Ripple option offsets keyframes that follow the paste according to the size of the pasted region (See Snap menu options on page 1001).

Insert Key

The Insert Key option lets you add a keyframe at the position of the Timeline indicator to selected properties associated with the selected element or model.

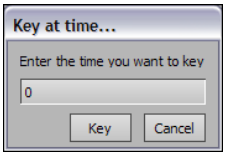
This option is the same as pressing K on the keyboard, or the Key button in the Key Controls window.

Key At Time

The Key at Time option opens a Key at Time dialog box which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing *Ctrl-Shift-K*.

See Setting many keyframes at once on page 826 for more information.



Key at Time dialog box

Delete

The Delete option deletes selected keyframes and regions. Deleted keyframes and keyframe regions are not stored in memory.

To delete a keyframe selection, right-click in the FCurves pane and select Delete. You can also press Delete on the keyboard to delete selections.

Select All

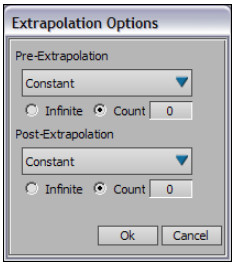
The Select All option selects every keyframe on the function curve of the current property. Some operations require that you select all of a curve's keyframes, such as when you translate an entire function curve or set a curve's interpolation.

Select Keys in Box

The Select Keys in Box option selects every keyframe within a selected region. To select a region, click-drag in the FCurves pane.

Extrapolation

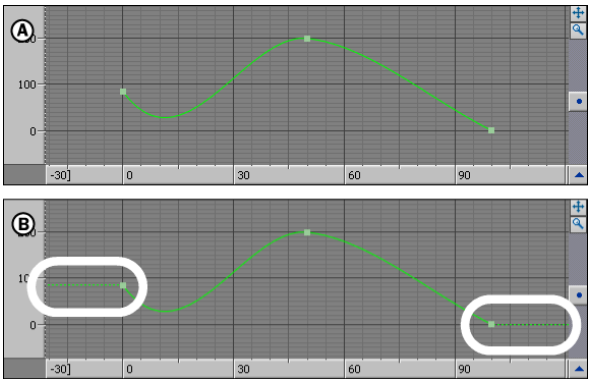
Opens the Extrapolation Options dialog box, letting you set pre- and post-extrapolation modes.



Extrapolation Options dialog box

Extrapolation determines the state of a curve before the first keyframe (pre-extrapolation) and after the last keyframe (post-extrapolation).

Once you set the pre- or post-extrapolation modes, the selected function curves display with the extrapolation settings.



Extrapolation *A.* Function curve without extrapolation. *B.* The function curve after extrapolation, with both extrapolation modes set to Constant. The extrapolated regions appear as dotted lines (circled).

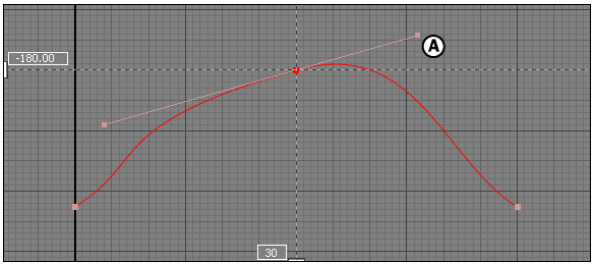
To change a curve's extrapolation, select one of the following extrapolation modes in the Pre-Extrapolation or Post-Extrapolation fields.

Extrapolation mode	Description
Constant	Flattens the slope of a curve before the first and after the last key-frame.
Repetition	Duplicates a curve, then places it before the first or after the last keyframe. The Count option repeats the curve a set number of times, and the Infinity option repeats the curve continuously.
Mirror Repetition	Duplicates and mirrors a curve, then places it before the first, or after the last keyframe. Count mirrors the curve and repeats it a set number of times, and Infinity repeats the curve continuously.
Keep Slope	Extends the slope of the curve past the last or before the first key-frame.

Weight Selection

The Weight Selection option lets you weight both tangents of selected keyframes.

By stretching the weighted tangent handle, you can create curves that you cannot create with unweighted tangents.



A. **Weighted tangents.**

Unweight Selection

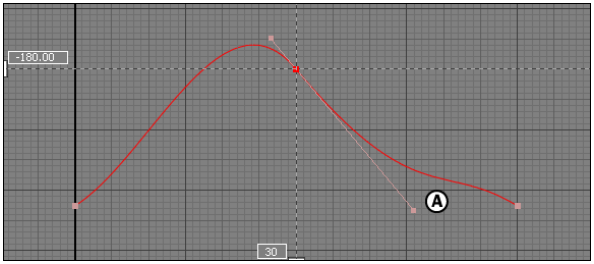
The Unweight Selection option lets you remove the weighting from weighted tangents of selected keyframes.

Weighted Tangent

Selecting the Weighted Tangent option lets you weight selected keyframes. When you right-click the tip of a tangent handle, Weighted Tangent lets you weight that single tangent.

By stretching the weighted tangent handle, you can create curves that you cannot create with unweighted tangents.

Clicking a weighted tangent handle and selecting Weighted Tangent from the menu lets you remove the weight settings from a single tangent.



A. **A single weighted tangent.**

Display menu options

The following table describes the options in the FCurve window's Display menu.

Option	Description
Visual Keys	Activate to display visual keyframes on the FCurve timeline. Disable to hide visual keyframes.
Ghost	Activate to display the Ghost curves in the FCurves pane. Disable to hide Ghost curves. The Ghost option is active by default.
Tangents	Activate to show all keyframe tangents. Disable to hide tangents. The Tangents option is active by default.
Audio	Activate to display audio on the FCurve timeline. Disable to hide audio. The Audio option is active by default.

Keys menu options

The options in the Keys menu let you select how your visual keyframes behave relative to your manipulations in the FCurves pane.

Paste Ripple

When pasting a keyframe region, activate Paste Ripple to make keys that follow the pasted selection move according to the size of the pasted region. Disable to keep other keys anchored when pasting a keyframe region.

VK Ripple

When manipulating keyframe selections, VK Ripple lets you set how keyframes behave relative to your edits. The VK Ripple option is the same as the VK Ripple option in the FCurves pane. To change the behavior of the keyframes when VK Ripple is active, see VK Ripple Options on page 1000.

VK Ripple Options

This section describes the options in the VK Ripple menu.

Option	Description
Move Ripple X	When offsetting a selection, activate to push deselected keys horizontally according to the offset. Disable to keep deselected keys anchored when offsetting. Disabled by default.
Stretch Ripple X	When stretching a selection, activate Stretch Ripple X to move deselected keys horizontally according to the stretch. Disable to keep keys that are not selected anchored when stretching. Disabled by default.
Move Ripple Y	When offsetting a selection, activate Move Ripple Y to push deselected keys vertically according to the offset. Disable to keep keys that are not selected anchored when offsetting. Disabled by default.
Stretch Ripple Y	When stretching a selection, activate Stretch Ripple Y to move deselected keys vertically according to the stretch. Disable to keep keys that are not selected anchored when stretching. Disabled by default.
Ripple All Y	When moving a region, activate Ripple All Y to ripple all keys vertically outside the selected region.

Switch to User on Edit

When Switch to User on Edit is active, editing a Bezier keyframe by dragging its tangents in the FCurves pane switches its interpolation from Bezier-Auto to Bezier-User. Switch to User on Edit is active by default.

When Switch to User on Edit is disabled, editing a keyframe does not switch its interpolation from Bezier-Auto to Bezier-User. The interpolation option also does not change if you edit a keyframe using the Tangent settings in the FCurves Options pane. See Tangent area on page 983.

Reset Tangents on Switch to Auto

When Reset Tangents on Switch to Auto is active, switching from Bezier-User or Bezier-Clamp to Bezier-Auto resets the selected keyframe's tangents, so that they are the average of the previous and next keyframes. This option is active by default.

When Reset Tangents on Switch to Auto is disabled and you switch a keyframe from Bezier-User or Bezier-Clamp to Bezier-Auto, the tangents of the selected keyframe are not reset and retain their offset. See Tangent area on page 983.

Snap menu options

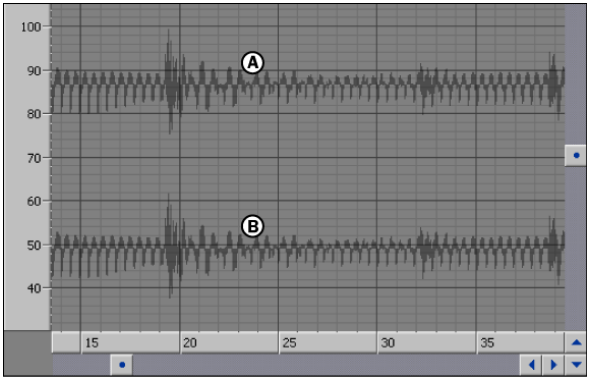
The following table describes the options in the FCurve window's Snap menu.

Option	Description
Grid Snap X	When dragging a keyframe selection, activate Grid Snap X to snap the selected region to the closest X grid lines, and to lock the value of the selected region.
Grid Snap Y	When dragging a keyframe selection, activate Grid Snap Y to snap the selected region to the closest Y grid lines, and to lock the time of the selected region.
Box Snap	When dragging a selection, activate Box Snap to snap the selected region to the original lines of the region. These lines represent the original values before snapping was performed.
Filtering Region Snap	When filtering data, activate this option to snap the selection to the closest keyframes within the selected region.

Audio menu options

The Audio options let you add audio clips in the *.wav* format in the FCurves window, and select mono or stereo display.

To add an audio clip, choose Audio > Open Audio Clip, from the contextual menu, and select a *.wav* file. The audio clip displays in the FCurves pane as waveforms, and shows both left and right channels by default.



Audio clip displays in the FCurves window. *A.* **Right channel** *B.* **Left channel**

The rest of this section describes the Audio options.

Option	Description
Open Audio Clip	Opens a file browser, which lets you select a .wav audio file to add to the FCurves pane.
Select Audio Clip	Lets you select previously loaded audio clips.
Select Audio Track	Lets you select from available audio tracks that were created in the Story settings.
Show Left Channel	Shows the left channel when activated, and hides the left channel when disabled. Both left and right audio channels are active by default.
Show Right Channel	Shows the right channel when activated, and hides the right channel when disabled.

Filters window

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The Filters window lets you modify your animation data using filters. You can filter function curves and optical data.

Select Windows > Filters to open the Filters window.

Properties menu

The Properties menu lets you choose which animated properties are filtered. You can filter all properties, specific properties, or properties you select.

The Properties menu is contextual to the object that is selected. Any object that is animated has properties that can be filtered, but when you select certain objects, such as lights, object-specific options appear in the Properties menu. For example, if the Cone angle property for a light is animated, a Cone angle option appears in the Properties menu letting you filter only that property.

The Properties menu consists of the following common options:

- Selected Properties on page 1003
- All on page 1004
- Lcl Translation on page 1004
- Lcl Rotation on page 1004
- Lcl Scaling on page 1004
- Optical on page 1004

Selected Properties

When the Selected Properties option is active, the Filters menu displays filters based on the type of properties that are selected. This option is automatically

selected when you select one or more animated properties in the FCurves, Properties, or Dopesheet window.

When this option is selected and you filter animation, the filter is applied only to the selected properties.

All

When you select the All option, every filter displays in the Filters menu. This option is automatically selected when you deselect every animated property, or when the FCurves, Properties, and Dopesheet windows are closed.

When you filter animation, the filter is applied to all properties.

Lcl Translation

When you select the Lcl Translation option, the Filters menu displays only the filters that can be applied on translation data. When you filter animation, only Translation properties are filtered.

Lcl Rotation

When you select the Lcl Rotation option, the Filters menu displays only the filters that can be applied on rotation data. When you filter animation, only Rotation properties are filtered.

Lcl Scaling

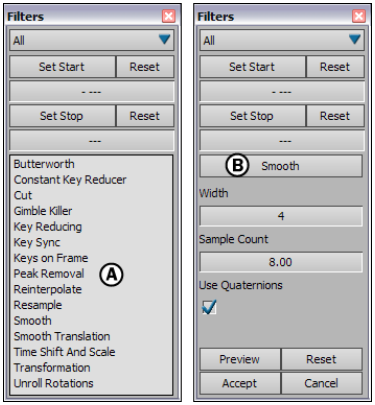
When you select the Lcl Scaling option, the Filters menu displays only the filters that can be applied on scaling data. When you filter animation, only scaling properties are filtered.

Optical

When you work in the Optical settings, the Optical option is automatically selected in the Properties menu and a list of filters that can be applied only to optical data (translation) display.

Filters menu

The Filters menu lists the available filters based on what you select to filter. Selecting a filter changes the layout to reflect the selected filter .



Filters window *A.* Filters menu displaying all filters *B.* Smooth is the selected filter in the Filters menu.

The following describes all the available filters in MotionBuilder:

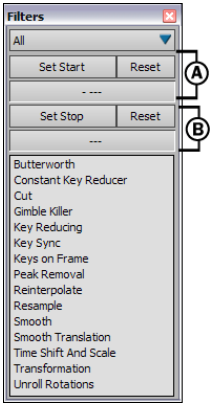
- Butterworth filter on page 1010
- Constant Key Reducer filter on page 1010
- Cut filter on page 1011
- Gimbal Killer filter on page 1012
- Key Reducing filter on page 1012
- Key Sync filter on page 1013
- Keys on Frame filter on page 1014
- Peak Removal filter on page 1015
- Reinterpolate filter on page 1015
- Resample filter on page 1016
- Smooth filter on page 1017
- Smooth Translation filter on page 1018
- Time Shift and Scale filter on page 1019
- Transformation filter on page 1020
- Unroll Rotations filter on page 1020

Filter options

Depending on what you select to filter, different filters and options appear in the Filters window. The Start and Stop areas and the group of buttons (Preview, Reset, Accept, and Cancel) at the bottom of the Filters window are common to all filters.

Start and Stop

The Start and Stop areas (, A, B) in the Filters window let you define the region for filtering.



Filters window *A.* **Start area** *B.***Stop area**

Set Start and Set Stop

The Set Start button sets the start of the filtering region to the current time, and the Set Stop button sets the end of the filtering region to the current time.

For example, if the Start value is 15 and the Stop value is 30, clicking the Set Start button when the current time is 0 changes the filtering region to begin at 0 and end at 30. The Start value displays in the Start field, and the Stop value displays in the Stop field.

A. **The Start field defines the start of the filtering region.** *B.***The Stop field**

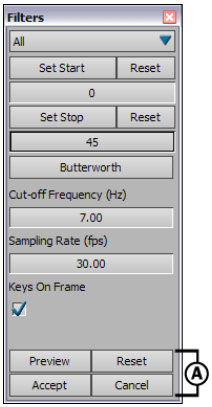
defines the end of the filtering region.

Reset

The Reset button clears the Start or Stop field. When no values display in the Start or Stop fields, applying a filter affects the entire function curve.

Preview, Reset, Accept, and Cancel buttons

When you select any filter, the Preview, Reset, Accept, and Cancel buttons appear at the bottom of the Filters window. Use these buttons after defining the filtering area, selecting the filter, and, if necessary, selecting the properties to filter.



Filters window *A*. The Preview, Reset, Accept, and Cancel buttons

Button	Function
Preview	Lets you see the effects of a filter before you accept the filter.
Reset	Returns the animation to its original state without changing the Filter settings.
Accept	Lets you apply the filter to the animation.

Button	Function
Cancel	Aborts the filtering operation without changing anything.

Filtering

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Filtering is often used to clean, manipulate, or modify motion capture data. For example, magnetic capture systems might generate noisy samples or localized distortions that require you to tweak the captured data. You can use filters and filtering options to manipulate captured data according to your own specifications.

To filter animation data, select the properties of the object you want to filter and the region or function curve you want to change in the FCurves window or Optical settings, then select and apply a filter.

- Filters window on page 1003
- Defining filter parameters on page 1009

Defining filter parameters

Most filters let you select which properties and regions you want to filter. You can also apply filters to entire function curves.

If you want to define a filtering region, enter a value in the Start and Stop fields of the Filters window on page 1003, or drag in the Start and Stop fields to modify a value. You can also Spacebar-drag in the FCurves pane on page 973 to select a region. The start and end frames automatically display in the Start and Stop fields when a selection is made.

To apply a filter to an entire function curve, click Reset in the Start and Stop areas, or double-click an empty space in the FCurve or Optical panes to remove the current selection.

When both the Start and Stop fields are empty, applying a filter affects the entire function curve in the FCurve or Optical panes.

Butterworth filter

Averages all keyframes using intelligent low-pass smoothing. The Butterworth is a frequency filter that works best on curves affected by noise.

Unlike the Smooth filter (see Smooth filter on page 1017), the Butterworth filter removes noise from data without affecting the FCurve's minimum or maximum values. In this way, the Butterworth filter avoids the "over-averaging" problems that can happen when filtering motion capture data.

When you select the Butterworth filter in the Filters window, you can set the following parameters:

Cut-Off Frequency

Lets you establish a limit frequency value, in Hertz (Hz). All frequencies higher than this value are cut. The lower the value, the more frequencies are removed, resulting in a much smoother curve.

Removing too many frequencies changes the shape of the curve.

Sampling rate

Lets you specify the sampling rate at which keyframes are added to the filtered curve. The default value is 30.

Keys on Frame

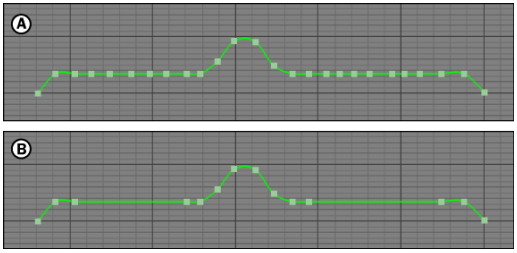
Snaps all keyframes to the nearest frame (see Keys on Frame filter on page 1014).

- Filters window on page 1003

Constant Key Reducer filter

Reduces the number of keyframes by eliminating redundant keyframes.

For example, a function curve before applying the Constant Key Reducer filter has many keyframes. After applying the Constant Key Reducer filter, the number of redundant keyframes used by the function curve is reduced.



Key Synchronizing *A.* **Original curve** *B.* **Constant Key Reducer filter applied**

When you select the Constant Key Reducer filter in the Filters window, you can set the following parameters:

Keep At Least One Keyframe option

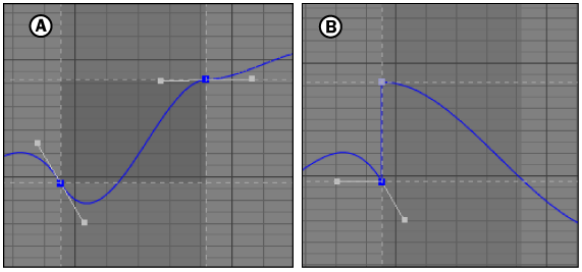
When your animation contains keyframes that all have the same value, using the Constant Key Reducer can remove all of these keyframes. Activating the Keep At Least One Keyframe option prevents this from happening.

■ Filters window on page 1003

Cut filter

Cuts the selected region, keeps the first and last keyframes in the selected region, and offsets the last keyframe of the region to the same frame of the region. This is similar to deleting a region, but also adds an offset to data that follows the cut.

For example, after cutting the selected region in the following figure, the B keyframe moves to the same frame as the A keyframe, and the two keys are interpolated.



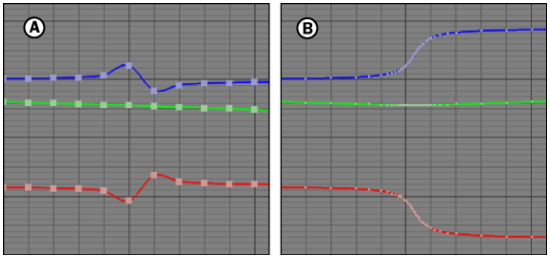
Cutting keys *A.* **Original curve** *B.* **Cut applied**

■ Filters window on page 1003

Gimbal Killer filter

Visually compensates gimbal locking effects by adding additional keyframes to rotation function curves.

These additional keyframes compensate for sudden flipping or shaking caused by the interpolation between keyframes during large rotational changes. Gimbal lock is most often encountered when you plot animation onto the skeleton (bones) of your model.



Gimbal Killer *A.* **Original curves** *B.* **Gimbal Killer applied**

■ Filters window on page 1003

Key Reducing filter

Reduces the number of keyframes by eliminating unnecessary keyframes on entire curves. Key Reducing is designed to filter Cubic curves, but it can be used on other curve types.

When you select the Key Reducing filter in the Filters window, you can set the following parameters:

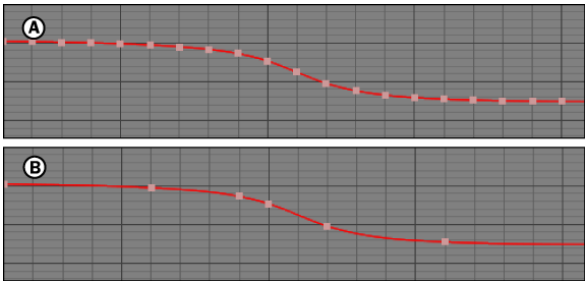
Precision

Lets you set a precision value. The default is 1. Greater values eliminate more keys, giving a less precise result, while lower values eliminate fewer keys giving a more precise result.

Key Sync

After keys are reduced, Key Sync adds a keyframe to all curves (X, Y, Z) for each key that is encountered (see Reinterpolate filter on page 1015).

Avoid using the Key Reducing filter for rotations on a characters's feet since it may introduce offsets that change the motion, such as foot sliding.



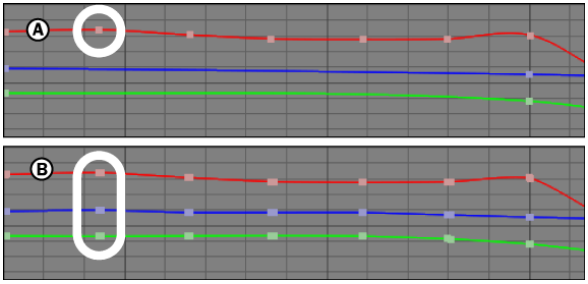
Key reducing *A.* **Original curve** *B.* **Key Reducing applied**

- Filters window on page 1003

Key Sync filter

Adds a keyframe to all curves (X, Y, Z) for each key that is encountered . For example, if a light has a keyframe set on its X translation function curve, a keyframe is set on its Y and Z translation curves at exactly the same time. This synchronizes all keyframes on each of the object's function curves.

If you do not have all three (X, Y, and Z) of the attribute's curves selected, Key Sync has no effect.



Key synchronizing *A.* **Original curve** *B.* **Key Sync applied**

■ Filters window on page 1003

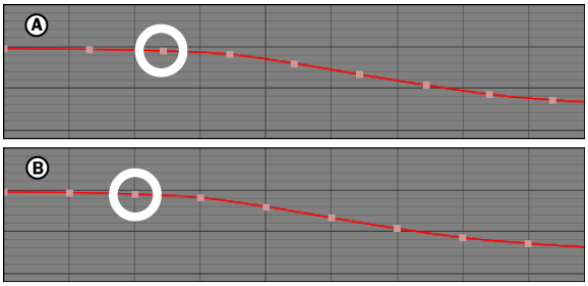
Keys on Frame filter

Snaps all keyframes to the nearest frame . If two keyframes exist for the same frame, Keys on Frame does not change them.

When you select the Keys on Frame filter in the Filters window, you can set the following parameters:

Frame Rate

Lets you set the filtering frame rate. Set this value to the same rate set in the Action timeline Frame Rate menu.

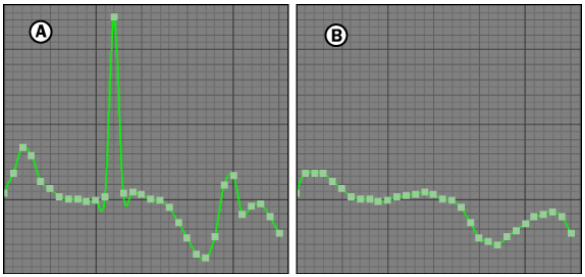


Keys on frame *A.* **Original curve** *B.* **Keys on Frame applied**

■ Filters window on page 1003

Peak Removal filter

Replaces unwanted peaks and spikes with cubic keys that have an average value based on the neighboring keys.



Peak removal *A.* **Original curve** *B.* **Peak Removal applied**

- Filters window on page 1003

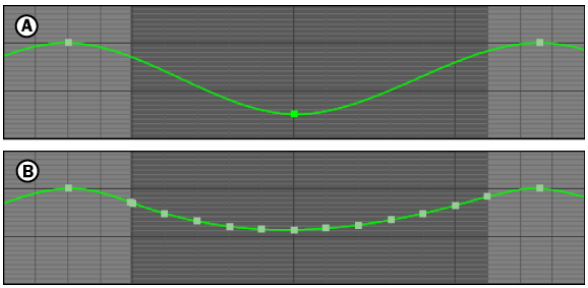
Reinterpolate filter

Replaces the selected region with a simple cubic curve . A keyframe is set at the beginning and end of the region, if one does not already exist. A smooth cubic curve joins these two keyframes and replaces all other keyframes in the region.

When you select the Reinterpolate filter in the Filters window, you can set the following parameters:

Resample and Resample Frame Rate

Resamples the selected region by creating keys on the curve (see Resample filter on page 1016).



Reinterpolate *A.* **Original curve** *B.* **Reinterpolate applied (with Resample)**

- Filters window on page 1003

Resample filter

Resamples the selected region by creating keys on the curve.

When you select the Resample filter in the Filters window, you can set the following parameters:

Frame Rate

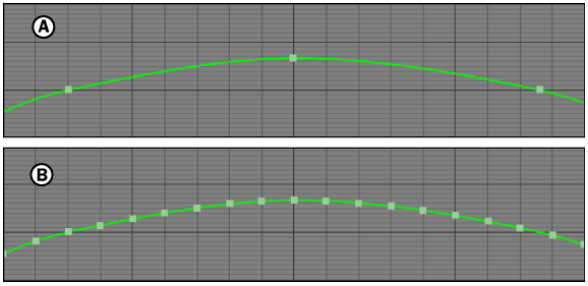
Lets you determine the amount of keys that are created. The equation works as follows:

Action timeline Frame Rate / Resample Frame Rate equals the frame rate at which keys are added.

For example, if your *Action timeline Frame Rate* is set to 30 FPS and you set the *Resample Frame Rate* to 15, the equation calculates a value of 2 (30/15=2). Therefore, a keyframe is added every 2 frames.

Keys on Frame

Snaps all keyframes to the nearest frame (see Keys on Frame filter on page 1014).



Resample *A.* **Original curve** *B.* **Resample applied**

With Interpolation

Affects the key type and the tangent.

When activated, the With Interpolation option makes the interpolation of each FCurve keyframe equal to the interpolation of the nearest keyframe. Also, the Tangent mode for each created FCurve keyframe is set to match the tangent mode of the nearest keyframe.

When disabled, the With Interpolation option sets each created FCurve keyframe to Bezier Interpolation mode. It also sets each created keyframe's Tangent mode to auto.

NOTE Sometimes, when you activate the With Interpolation option, filtered keyframes produce inconsistent results.

- Filters window on page 1003

Smooth filter

Averages all keyframes to create smooth movement . Smooth works best when filtering cubic (auto) or resampled curves.

When you select the Smooth filter in the Filters window, you can set the following parameters:

Sample Count

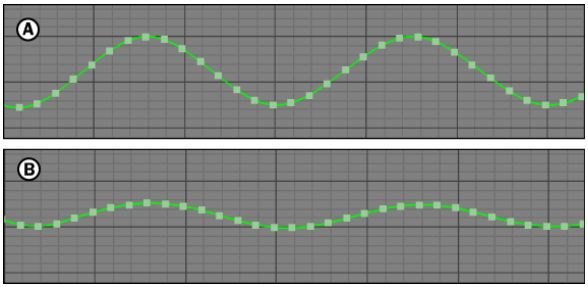
Lets you set the number of samples that are taken on the curve. The default value is 8.

Width

Lets you set the smoothing window width. The default value is 4. Greater values strengthen smoothing, while lesser values decrease smoothing.

Use Quaternions

Converts rotation curves to quaternions before smoothing. Quaternions are converted back to Euler curves after smoothing.



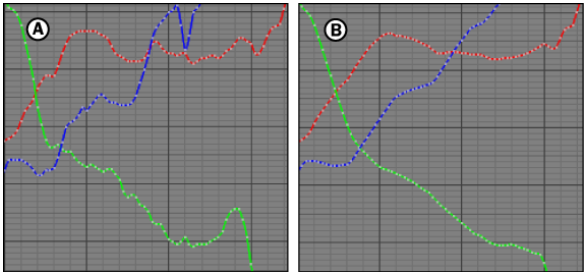
Smooth *A.* **Original curve** *B.* **Smooth applied with Use Quaternions**

■ Filters window on page 1003

Smooth Translation filter

Like the Smooth filter, Smooth Translation averages all keyframes to smooth movement. Smooth Translation also smoothes the curve motion by reducing the shaking of data.

Shaking (or “noise”) mostly occurs on translation data obtained with motion capture devices. Smooth Translation was specifically developed for smoothing translation curves.



Smooth Translation *A.* **Original curves** *B.* **Smooth Translation applied**

When you select the Smooth Translation filter in the Filters window, you can set the following parameters:

Width

Lets you set the smoothing window width. The default value is 8. Greater values strengthen smoothing, while lesser values decrease smoothing.

Factor

Lets you set the smooth multiplying factor. The default value is 1.5. Greater values decrease smoothing, while lesser values increase smoothing. Factor values normally range from 0-2.

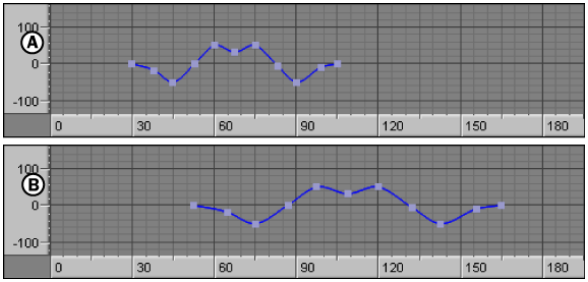
Sample Count

Lets you set the number of samples that are taken on the curve. The default value is 8.

- Filters window on page 1003

Time Shift and Scale filter

Changes the time and scale of selected function curves.



Time shift and scale *A.* **Original curve** *B.* **Time Shift and Scale applied**

When you select the Time Shift and Scale filter in the Filters window, you can set the following parameters:

Shift

Lets you select the number of frames by which you want to shift (offset in time) the curve.

Scale

Lets you select the scaling factor. This option only scales time, not value.

■ Filters window on page 1003

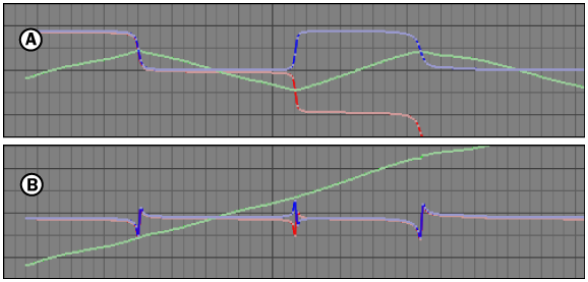
Transformation filter

Applies a translation, rotation, or scaling change to a selected function curve or region. You can choose which curves (X, Y, or Z) you want to manipulate using the Translation, Rotation, and Scaling options. The curve or region is resampled after a transformation.

■ Filters window on page 1003

Unroll Rotations filter

Compensates for gimbal locking effects by unrolling rotations. Unroll Rotations is designed to clean motion capture data that contains large rotations which cause flipping or shaking in animations.



Unroll rotations filter *A.* **Original curves** *B.* **Unroll Rotations applied**

When you select the Unroll Rotations filter in the Filters window, you can set the following parameters:

Quality

Lets you manipulate the algorithm that affects the path of rotation curves. The default value (.25) concentrates on the Y curve path . Tweak the Quality value to manipulate the path of the X, Y, and Z rotation curves.

Path

Select Path to enable the Quality field. When Path is disabled, the Unroll Rotations filter searches for and cleans sudden jumps in the Y rotation curves.

- Filters window on page 1003

Part 8: Animating with Constraints

This section is about MotionBuilder constraints. In the real world, we are surrounded by constraints; for example gravity constrains us to the ground, or a dog is constrained by the length of his leash.

To simulate these limits in the 3D animation world, these relationships between objects must be established by the animator.

Constraints are tools used to create relationships between objects. You can use constraints to make a character pick up an object, have a camera follow a character, manipulate other objects in relation to each other or use the keyboard or mouse to trigger events.

This section covers MotionBuilder constraints, their settings, properties, and how you can use them to create relationships with models and animation.

This section covers the following topics:

- Constraints basics on page 1025
- 3 Points constraint on page 1041
- Aim constraint on page 1047
- Chain IK constraint on page 1053
- Expressions constraints on page 1065
- Mapping constraint on page 1095
- Multi-Referential constraint on page 1099
- Parent-child constraint on page 1107
- Path constraint on page 1113
- Position constraint on page 1125
- Range constraint on page 1131

- Relations constraints on page 1135
- Rigid Body constraint on page 1193
- Rotation constraint on page 1199
- Scale constraint on page 1205

Constraints basics

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In the real world, we are surrounded by constraints; for example gravity constrains us to the ground, or a dog is constrained by the length of his leash.

To simulate these limits in the 3D animation world, these relationships between objects must be established by the animator.

Constraints are tools used to create relationships between objects. You can use constraints to make a character pick up an object, have a camera follow a character, or use the keyboard or mouse to trigger events. For example, in the image below, a lantern is constrained to the character's hand, so that however he moves his arm. the lantern follows.

The lantern is constrained to the character's hand.

Another way to think of constraints is that they are a restriction of the translation, rotation, and other data of an object based on the position, translation, rotation, and other data of another object. So, in the image above, the transformation information of the character's hand informs the behavior of the lantern.

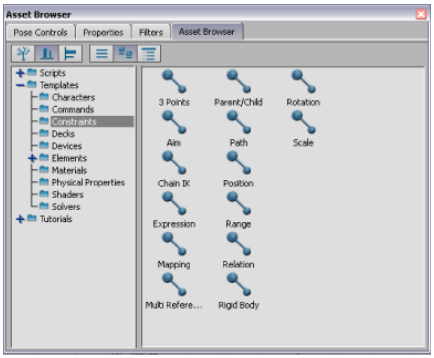
The equation $x<3$ is a mathematical constraint of the variable x, limiting it to any value smaller than 3.

You can use these limits to simulate real-world relationships between objects. For example, the constraint on a dog attached to a five-foot leash is X<5, meaning that x, representing the dog's area of motion, must be less than 5, which is the full length of the leash. This simple constraint ensures that your dog behaves like it is on a leash.

Similar constraints can be used to restrain a model's arm motion to an area defined by the shoulder joint, and so on. In fact, the whole Control rig is actually a series of many constraints. The rig's hand is constrained by the motion of the arm, which is constrained by the elbow joint, which in turn is constrained by the upper arm, and so on.

Each of these connections form complex relationships that work to create a recognizable simulation of the human body in motion.

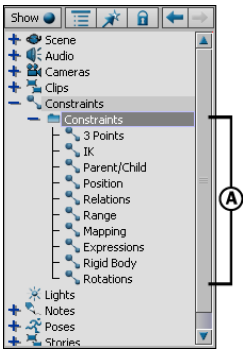
In the Asset browser, the Constraints folder lets view and access constraint assets you can add to your scene.



Asset browser: Constraints folder

Constraints in the Scene browser

The Scene browser in the Navigator window lists all the constraints used in the scene. This is where you add and remove constraints.



Constraints in the Scene browser.

You can add a constraint to your scene by right-clicking the Constraints folder in the Scene browser and selecting Insert Constraint from the contextual menu.

Import and export of constraints

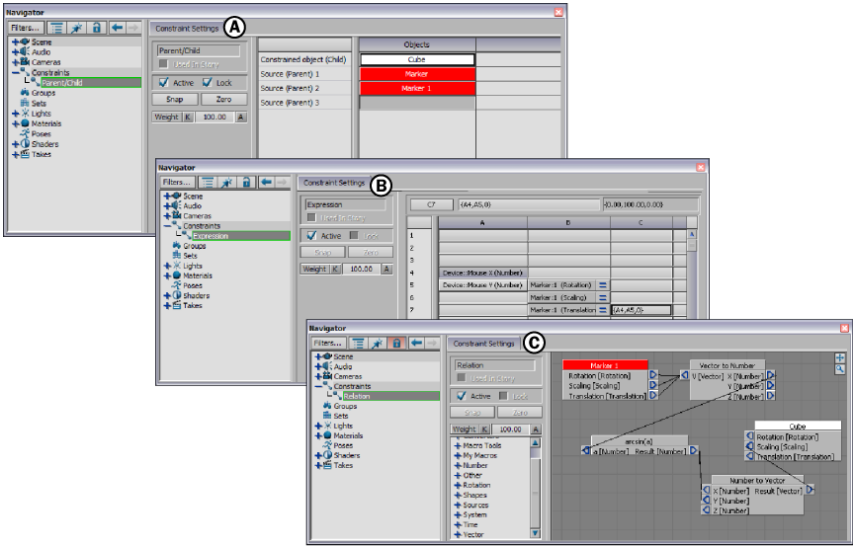
Constraints can be exchanged between MotionBuilder and Maya using the FBX file format.

For example, you can import a Parent constraint created in Maya or into MotionBuilder and vice-versa.

Constraint types

Since you can use constraints to make anything from simple relationships to complex mathematically-based constructs that generate random variables to subtly affect objects, there are three different types of constraints you can use, depending on your approach:

- a simple fill-in-the-blanks formula found in the Navigator window (A). Most constraints are of this basic type.
- a mathematical spreadsheet-style system called Expression constraints.
- a graphical approach called Relations constraints where you “connect the dots” by drawing connections between the data, represented by boxes



Constraint types: A. Simple constraint B. Expressions constraint C. Relations constraint

Adding a constraint asset

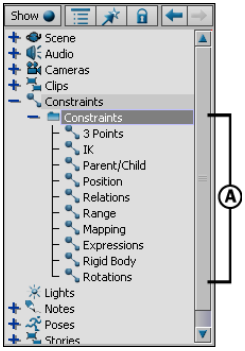
To create constraints between objects you must first add a constraint to your scene.

To add a constraint asset:

1 Select a constraint asset in the Asset browser, and drag it into the Viewer window.

If you drag the constraint on top of an object in the Viewer window, a contextual menu appears asking you if you would like to constrain the object or set it as a source object in the constraint. If you drag the constraint into an empty

The Navigator window displays the Constraint settings, and the constraint is added to the Scene browser.



Scene browser A. Constraints folder

A new folder named “Constraints” appears in the Scene browser, with the new constraint added, and the Navigator window displays the Constraint settings.

2 Alt-drag objects from the Viewer window or Scene browser and assign them to the appropriate object cells in the constraint settings.

3 Click Active to activate the constraint. The objects move to accommodate the constraint.

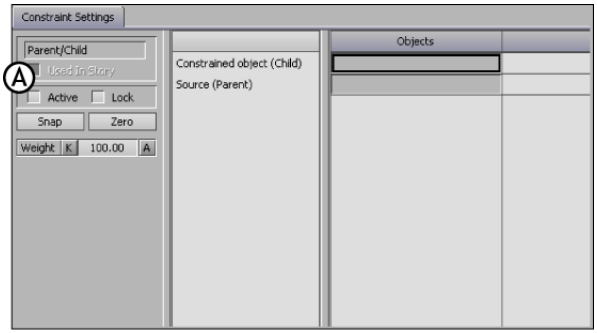
4 You can make the following adjustments to the positioning and offset of objects:

- You can create a blend between the constrained object’s original position and its constrained position by activating the constraint and adjusting the Weight values. See Creating and removing constraint offsets on page 1033.
- You can retain the constrained object’s base position so that it maintains the same position in relation to the source object by clicking Snap before activating the Active option. Clicking Snap also activates the constraint, but with the offset retained. See Snap button on page 1038.
- You can zero the constraint offset by clicking Zero. This locks the constrained object and disables the Source object’s offset values in the Properties window.

For more information, see Common constraint settings on page 1036.

Activating a constraint

To activate a constraint, click the Active option in the Navigator or Properties window's Constraints settings.



Relations constraint A. Active option.

Activating the constraint changes the position of the object being constrained, for example, when you activate a Range constraint, the constrained object moves on top of the source object when Active is enabled.

To "turn off" the constraint, you can disable the Active option. For more information, see Common constraint settings on page 1036.

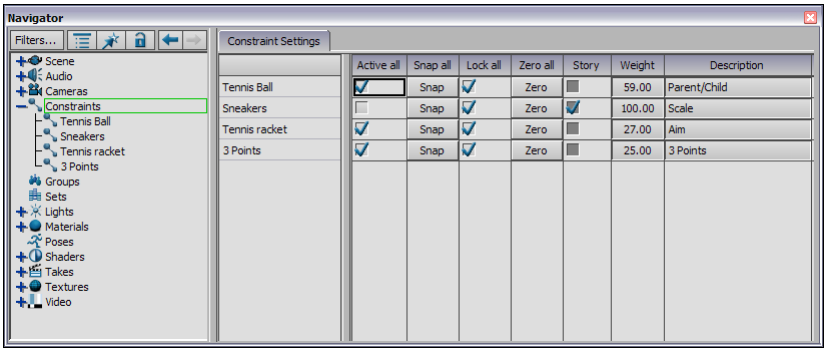
Setting basic constraint commands in the Root folder

You can use the constraint root folder to Activate, Snap, Lock, Zero, View in Story, and set Weighting for multiple constrains at the same time.

The Constraints root folder is like a table of contents that lets you view constraints settings all at once, rather than opening each individual constraint.

To set commands in the constraints Root folder:

1 Select the Constraints folder in the Scene browser to display the contents of the folder in the Constraint settings.



Constraints Root folder

2 Set basic commands in the Constraints Root folder, such as Activate, Snap, Lock, Zero, View in Story, and set Weights for each constraint in the Folder, without needing to open the constraint.

For more on these basic commands see Common constraint settings on page 1036.

Grouping constraints

Create Constraints folders in the Scene browser to group your constraints. For example, you can use one folder to coordinate constraints for a model's facial animation, and another folder with all of the constraints affecting a light.

To group constraints into folders:

1 Add a new constraint folder by right-clicking the Constraints folder in the Scene browser.

2 Selecting Insert Folder from the contextual menu.

3 Drag constraints from the Scene browser or the Asset browser into the new folder.

Remove a constraint folder by right-clicking it and selecting Delete from the contextual menu.

NOTE Deleting a folder does not remove the constraints within it. Instead, they are added to the Constraint root directory in the Scene browser.

Changing constraint priority

Constraints are applied from top to bottom in the Constraints Root folder in the Scene browser. That is, constraints at the bottom of the list are applied last.

To change a constraint's priority:

➤ In the Scene browser, drag the constraint above or below the other constraints.

If two constraints affect the same model, the constraint closest to the bottom overrides any earlier constraints. However, two separate constraints can influence different properties of a model. For example, if you create a Relations constraint to change the rotation of a cube, and follow it with a Position constraint to change the marker's position, the marker is rotated using the first constraint and translated using the second constraint. If the second constraint was a Rotations constraint, it would override the Relations constraint. For more information, see Common constraint settings on page 1036

Duplicating constraints

To duplicate constraints:

1. Right-click a constraint in the Scene browser and select Duplicate from the contextual menu.

   The new, cloned constraint is added at the end of the Scene browser's Constraints folder. Constraints can be copied into different Constraints folders.

   The new constraint is given the same name as the original, plus a sequential number. For example, if your constraint is called "Arm", the duplicate constraints are called "Arm1", "Arm2", and so on.

2. Rename a Constraints folder by right-clicking it and selecting Rename from the contextual menu.

Creating Macro relations on page 1142

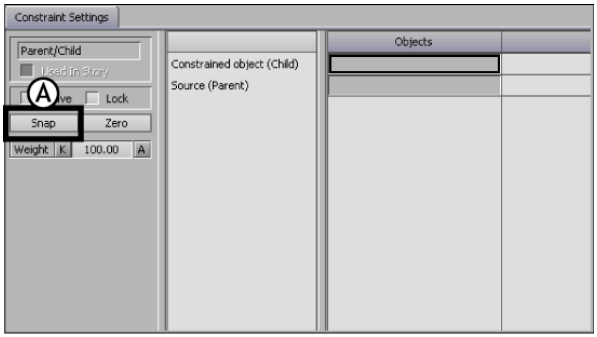
Setting basic constraint commands in the Root folder on page 1030

Creating and removing constraint offsets

Activating a constraint zeros the constrained (child) object's translation, rotation, or scaling to match that of its source (parent) objects. You can reposition your objects to create a more appropriate offset.

To create a constraint offset:

1. Arrange the objects in your constraint.
2. Click Snap to create an offset between the position, rotation, or scale of the constraint and the current position of the object being constrained.



Parent/Child constraint A. Snap button

3. Activate the Lock option so the constrained object is frozen in position and cannot be transformed.

To remove a constraint's offset:

1. Disable the Active, and Lock (if applicable) options in the Constraints Settings.
2. Re-position your objects.
3. Click Snap to reestablish the constraint's new offset.
4. Activate the Lock option so the constrained object cannot be moved.

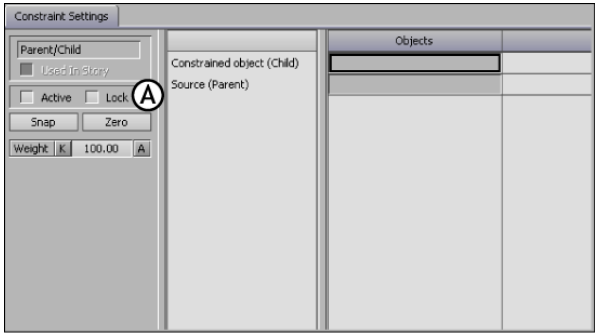
Locking the position of a constrained object

Lock a constraint to make sure that the position and rotation of its constrained object does not change after the constraint is active. This can be useful in complex scenes where you do not want to move constrained objects accidentally.

NOTE You cannot lock Expression or Rotations constraints.

To lock the position of a constrained object:

1. In the constraints setting for the appropriate constraint, make sure the constraint is activated.
2. Activate the Lock option. This locks the position or rotation of the constrained object.



Parent/Child constraint A. Lock option

To reposition locked objects:

1. Disable the constraint's Active and Lock options.
2. Transform the object and click Snap
3. Activate the lock Option.

Weighting constraints

Use the weight values in a constraint to moderate a source object's influence on the constrained object.

NOTE While all constraints can be weighted, individual weight settings apply only to the Aim, Parent/Child, Rotation, Scale, and Chain IK constraints. See Aim constraint settings on page 1049, Parent-child constraint settings on page 1111, Rotation constraint settings on page 1202, Scale constraint settings on page 1207, and Chain IK constraint settings on page 1056 for information on these constraints' other settings.

To weight source objects:

1. Double-click to select the constraint in the Scene browser. The constraint settings display in the Properties or Navigator window.
2. Adjust the Weight values until you achieve the desired effect.

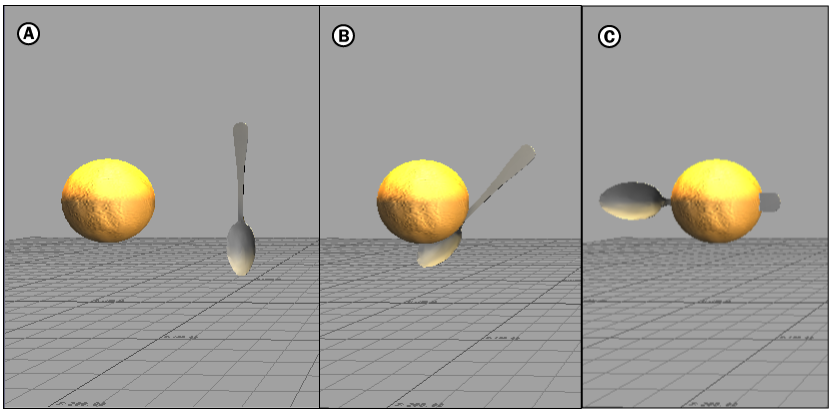
See Blending constraints on page 1035 for more on changing weight values.

Weight setting on page 1040

Blending constraints

Use the Weight setting to control the level of activity of the constraint and create constraint "blends". The default Weight value is 100%, meaning that the constraint is fully active.

A weight value of 50% indicates that the affected constraint is half as active, and a value of 0% would makes the constraint completely inactive.



A. 0% weighting (the constraint is inactive) B. 50% weighting C. 100% weighting

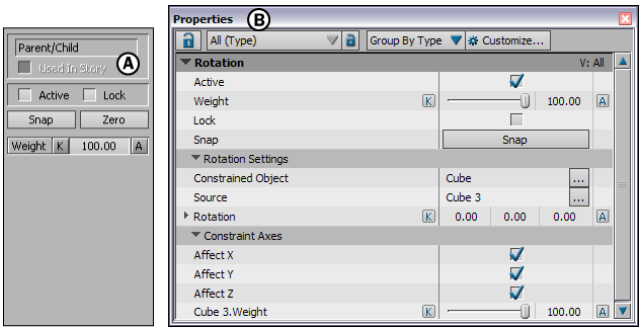
For example, if you set the weight for a Position constraint at 50%, the position of the constrained object on page 1994 is halfway between its original position and the position of its source object.

The Weight value can also be animated or used in a Relations constraint.

NOTE The Story window can be do many of the same functions on multiple constraints. See Story clips on page 1777.

Common constraint settings

The Constraint settings contain controls that let you activate, offset, lock, and set other factors that govern the behavior of your constraints. These features are found in both the Navigator and Properties window constraint settings (see the following figure, A and B).



Constraint settings A. Navigator window B. Properties window

Constraint Type field

The Constraint Type field shows the kind of constraint that is selected, for example “Relations” or “Position”. This is useful if you have renamed the constraint, as it always shows you what kind of constraint it was originally.

Used In Story indicator

The Used In Story indicator displays if the current constraint is used by the Story window. The Story window lets you schedule when constraints are active.

By changing a constraint’s status when it is active, you can simulate changes in a character’s environment, switch and blend between different constraints, and fade constraints in and out.

Active option

Enable Active if activating the constraint changes the position of the object being constrained. For example, when you activate a Range constraint, the constrained object moves on top of the source object when Active is enabled.

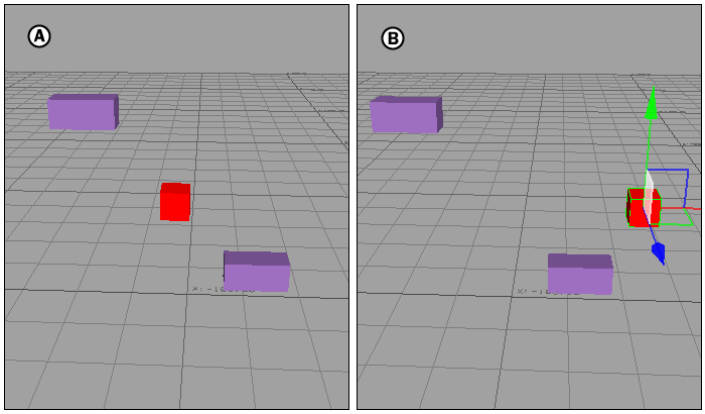
Lock option

Activate Lock to lock the position or rotation of the constrained object. This locks the constrained object so you cannot move it while the constraint is activated.

NOTE Relations and Expressions constraints do not use the Lock button.

For example, in a Position constraint where two markers influence the position of a third marker, you can translate the third marker after the constraint is activated. You can do this in order to add a local offset to the constrained object.

Once you have applied an offset to the constrained object, activate the Lock option to save the offset. If you disable the constraint, translate the constrained object, then activate the constraint again. The constrained object returns to the position it was in when you originally enabled the Lock option. This is illustrated below.



You can move the constrained object after activating the constraint.
A. Before activating the constraint B. After activating the constraint.

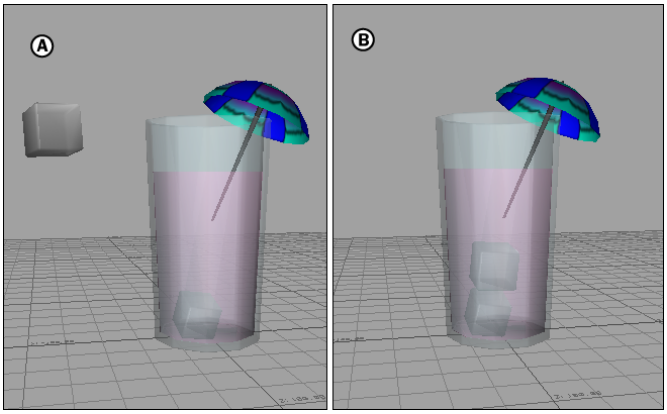
NOTE When you lock a constraint, you cannot use any of the other constraint options such as Snap or Zero. No translation or rotation of the constrained object is allowed as long as the constraint is active.

Locking a constraint stops you from accidentally moving an object, which would prove unfortunate if you had spent time fine-tuning its position or rotation.

If you have plotted data to a model used in a constraint, it is recommended that you disable the constraint. Otherwise, the source object controls the model and not the model's data.

Snap button

Click Snap to create an offset between the position, rotation, or scale of the constraint and the current position of the object being constrained. Snap is used when repositioning the constrained object and adding offsets.



Snap example A. The ice cube in a parent/child constraint before Snap is activated B. The ice cube after Snap is activated, inside the glass.

When you click Snap, the constraint is activated, but the offset between the constrained object's current translation and rotation and its constrained translation and rotation is kept. This is useful when you want to activate a constraint, but you do not want to change its current position or rotation.

When a constraint is active, you can translate and rotate the constrained object to change its local offset. Click Snap to save the new offset. Disable the constraint, translate the constrained object, and then activate the constraint

again. The constrained object returns to its position from the last time you clicked the Snap option.

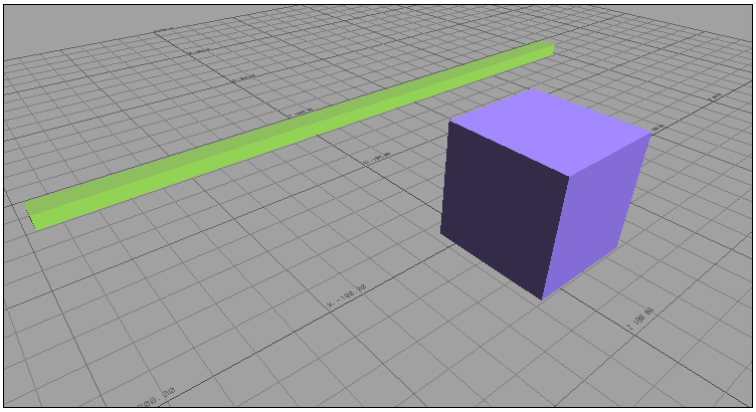
Snap and the Chain IK constraint

Clicking Snap with a Chain IK constraint does not move Pole objects. If you set the Chain IK Pole Type to Object in the Chain IK settings' Pole Type menu manually overrides the Pole Vector, causing the chain to flip or move after Snap is activated.

Zero button

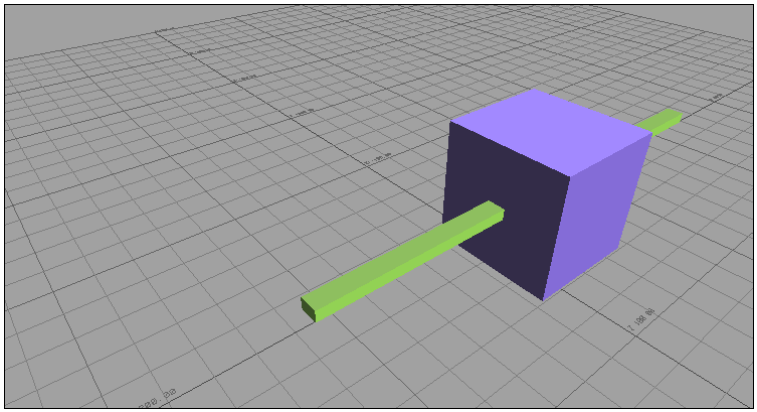
Click Zero to remove the translation and rotation offset between the source and the constrained object.

For example, if two markers are constrained using the Position constraint, an offset is established between the markers.



A cube is constrained and offset from its source object, the rod.

If you click the Zero option for this constraint, the offset is removed and the constrained object is placed at the position of the source object.



Click Zero to remove the offset and align the axes to the cube and rod.

Zero works only with constraints that use source and constrained objects.

NOTE Relations and Expressions do not use the Zero button.

Weight setting

Use the Weight setting to control the level of activity of the constraint and create constraint "blends". The default Weight value is 100%, meaning that the constraint is fully active.

A weight value of 50% indicates that the affected constraint is half as active, and a value of 0% would makes the constraint completely inactive.

For example, if you set the weight for a Position constraint at 50%, the position of the constrained object is halfway between its original position and the position of its source object.

The Weight value can also be animated or used in a Relations constraint.

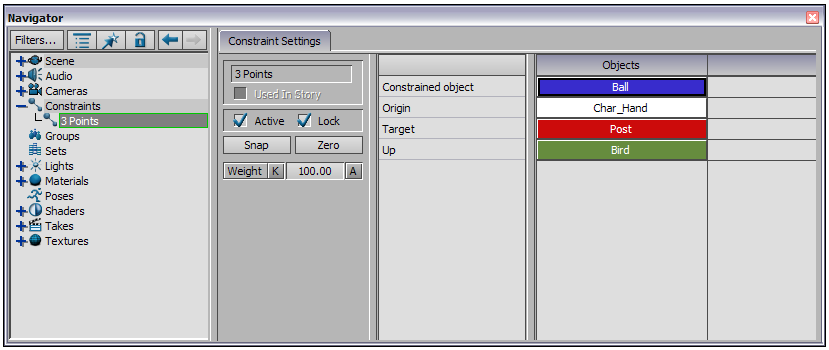
The Story window can be used to perform the same function on multiple constraints.

For more information, see Locking the position of a constrained object on page 1034 and Creating and removing constraint offsets on page 1033.

3 Points constraint

60

The 3 Points constraint is a rotations constraint where the position of three objects is used to constrain the rotation of another object.

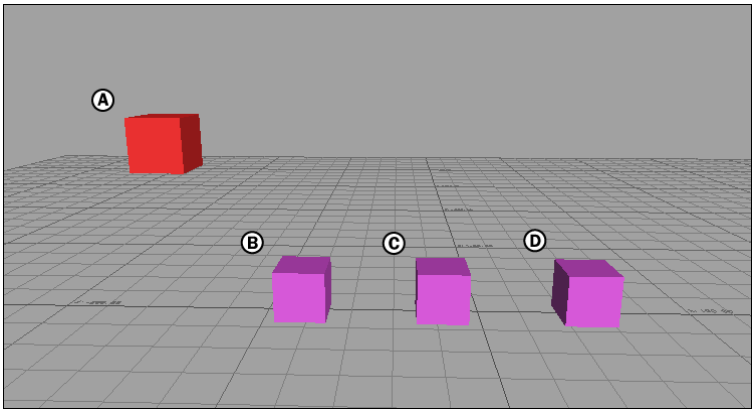


3 Points constraint

When you perform optical motion capture, only the translation of each sensor is captured. Optical sensors do not send rotation information.

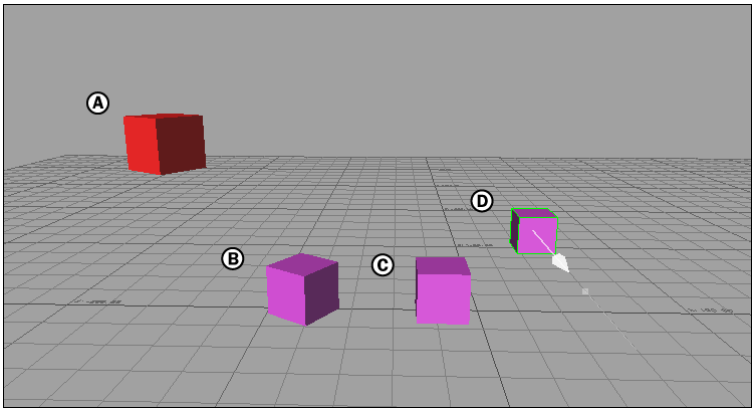
However, the rotation of a limb, for example, can be derived based on the translation of three sensor positions. For more on Optical motion capture, see Optical motion data on page 1387.

When you first activate or snap the Rotation From 3 Points constraint, it aligns the constrained object's X-axis with the vector defined by the Origin and Target sources. The constraint then attempts to align the Y-axis of the constrained object to point towards the Up source.



3 Points constraint *A*. **Constrained object** *B*. **Up source object** *C*. **Origin source object** *D*. **Target source object.**

In the following graphic, the cube A is the constrained object. When you move any of the three cubes (the sources) after the constraint is active, the X, Y, and Z rotation of the constrained object changes.



3 Points constraint activated: Translating *B*, *C*, **and** *D* **rotates the constrained object (***A***) in various directions.**

NOTE If you rotate or scale the source objects, it does not alter the constrained object.

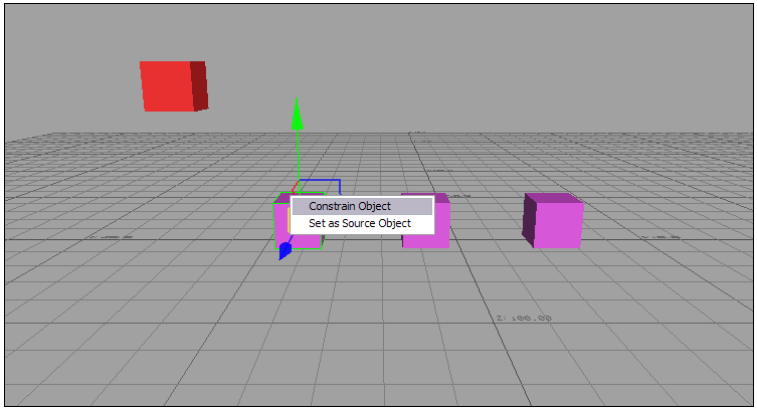
Constraining an object's rotation with another object

You can use the 3 Points constraint to constrain the rotation of an object with the position of three objects.

To constrain an object's rotation with the 3-Points constraint:

1 Select a 3-Points constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the 3-Points constraint template appears in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source (parent) or Constrained (child) object.



Constraint contextual menu

2 Assign the object whose rotation on which you want to base the position and movement of three source objects to the Constrained Object cell.

3 Assign the object whose position affects the pivot point of the constrained object to the Origin cell.

NOTE You can specify the same asset, model, or marker as the Origin and the constrained object.

4 Assign the object whose position affects the rotation of the constrained object to the Target cell.

5 Assign the object whose position affects the roll of the constrained object to the Up cell.

6 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

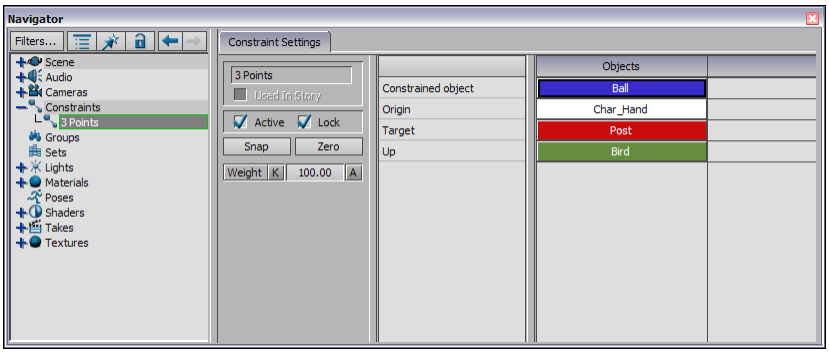
7 Click Active to activate the constraint.

NOTE Rotating or scaling the source objects does not alter the constrained object.

■ 3 Points constraint settings on page 1044

3 Points constraint settings

Use the 3 Points constraint to use the position of three objects to constrain the rotation of another object.



3 Points constraint

The 3 Points constraint requires the following objects:

Constrained object

An asset, model, or other object whose rotation is based on the position and movement of three source objects (Origin, Target, and Up).

Origin

An asset, model, or marker whose position affects the pivot point of the constrained object. You can specify the same asset, model, or marker as the Origin and the constrained object.

Target

An asset, model, or marker whose position affects the rotation of the constrained object.

Up

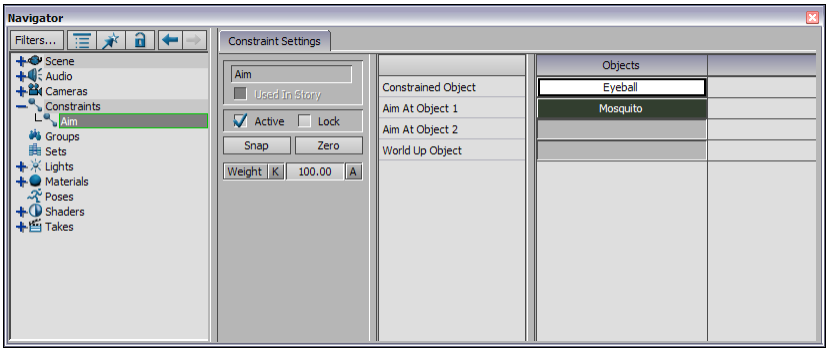
An asset, model, or marker whose position affects the roll of the constrained object.

■ 3 Points constraint on page 1041

Aim constraint

61

The Aim constraint governs an object's orientation so that the object points to other objects, much the same as camera interest. For example, you can use the aim constraint to point a light at an object or group of objects, or with character setups, to set a locator that you can use to control eyeball movement.



Aim constraint

- Aim constraint settings on page 1049
- Making objects point at other objects on page 1047

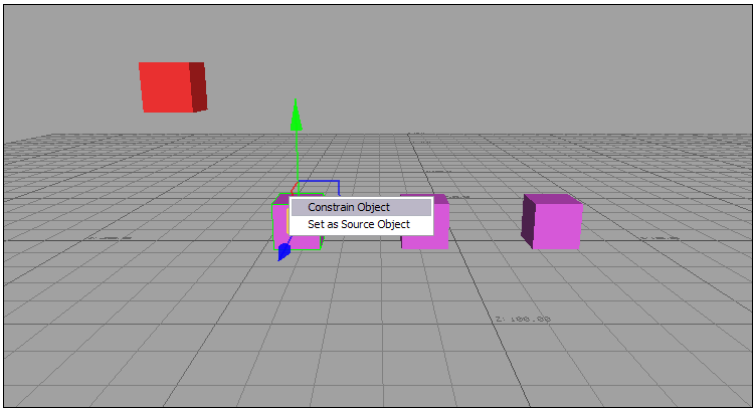
Making objects point at other objects

You can use the Aim constraint to modify an object's orientation so that the object points to other objects.

To use the Aim constraint to orient objects:

1 Select an Aim constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Aim constraint template appears in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as one of the constraint's operators.



Constraint contextual menu

2 Assign the object that you want to aim to the Constrained object (child object) cell.

3 Assign the objects that you want set as a target for the aimed object to the Source (parent object) cell.

TIP You can have more the object divide its aim between multiple objects by *Alt*-dragging them to the resulting Source cells.

4 Click Lock in the Constraint settings if you want to maintain the current offset between the source and target.

5 Click Snap.

6 Click Active to activate the constraint.

- Aim constraint on page 1047

Constraining individual axes (Aim constraint)

You can constrain an individual axis with the Aim constraint. For example you can have the child object only affected on its Y-axis.

To constrain an axis with the Aim constraint:

1. Double-click the Aim constraint in the Scene browser to select it.
2. Open the Properties window. The Aim constraint settings display.
3. Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.
4. To reactivate the unconstrained axes, activate the option.

Setting the rotation offset for an Aim constraint

To set a rotation offset with the Aim constraint:

1. Expand the constraints folder in the Scene browser and double-click the Aim constraint.
2. In the Properties window, expand Aim settings.
3. Set the Rotation Offset X, Y, or Z for the parent object you want to affect.

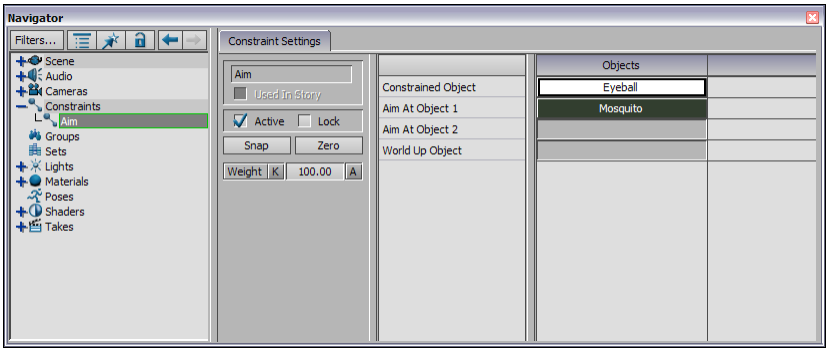
   NOTE If the numbers are disabled, click Lock in the Aim constraint settings.

   You can key and animate this offset by activating the Key and Animate buttons next to each setting you modify.

- Aim constraint on page 1047
- Making objects point at other objects on page 1047

Aim constraint settings

Use the Aim constraint to make an object point in the direction of another object, creating an effect similar to a camera interest.



The Aim constraint

The Aim constraint requires the following objects:

Constrained object

An asset, model, or other object whose orientation derives from the Aim At Object(s) position. Also known as the "child" object.

Aim at object(s)

Object from which the position of the constrained object is derived. You can have multiple Aim At objects for this constraint.

World Up object

Lets you select an asset, model, or other object whose orientation defines the Up rotation for the object.

NOTE It is not necessary to specify a World Up Object for the Aim constraint to function.

Properties settings

The following Aim constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Properties window setting	Function
Aim Vector	Lets you set a specific XYZ axis for the constrained object to orient towards. Expand Aim Vector to view the individual X, Y, and Z axes.

Properties window setting	Function
Up Vector	Lets you set a specific XYZ axis for the object whose orientation defines the Up rotation for the object. Expand Up Vector to view the individual X, Y, and Z axes.
Rotation Offset	Lets you set a specific XYZ offset for the object whose orientation defines the Up rotation for the object. Expand Rotation Offset to view the individual X, Y, and Z axes.
World Up Type	An asset, model, or other object whose orientation defines the Up for the object. See World Up type settings on page 1052 for information about what objects you can specify as a World Up Type.
Up Vector	Lets you specify an X, Y, or Z coordinate for the Up Vector.
World Up Object	Lets you assign an asset. model, or other object whose orientation defines the Up for the constrained object. This is the same setting as the World Up Object cell in the Navigator window Aim constraint settings. This setting is active when either Object Up or Object Rotation Up is selected at the World Up Type.
Constraint Axes	Activate the Affect X, Y, or Z axis option to assign which axis the Aim constraint takes effect on.
[Object] Weight	Adjust the Weight setting(s) to set the amount of influence the Source object has over the constrained objects, letting you create constraint "blends". Each Aim At object has a Weight slider so you can modify its offset.

- Aim constraint on page 1047
- Making objects point at other objects on page 1047

World Up type settings

You can specify an asset, model, or other object whose orientation defines the Up for the object as your World Up type object.

World Up type	Description
Scene Up	Specifies the direction of the world up vector relative to the scene's axis.
Object Up	Lets you use a specific object in the scene influence the rotation of the constrained object. To set an object, select the Aim constraint, expand the World UP Object asset list, and select an object in the scene.
Object Rotation Up	When World Up Type is Object Up, this is the object from which the World Up Vector is derived.
Vector	Activates the WorldUpVector values where you can specify a precise X, Y, or Z coordinate of the world up vector.
None	Specifies no World Up Vector for the constrained object.

Chain IK constraint

62

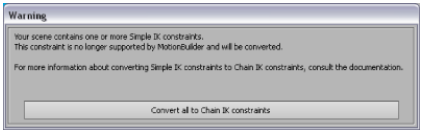
This constraint lets you use Inverse Kinematics to constrain the movement of a chain. This is done by calculating the position of the IK effector in relation to the root node of the joint chain, and rotating all the joints so that the end node reaches the IK effector's position.

- Chain IK constraint settings on page 1056
- Using Chain IK to constrain a chain of bones on page 1055

Simple IK constraint conversion

When you load a scene that contains Simple IK constraints, a warning dialog appears stating the Simple IK constraint(s) will be converted to Chain IK constraints.

Warning: Simple IK constraints to Chain IK constraints conversion



To continue, click Convert all to Chain IK.

NOTE The Chain IK constraint is similar to the Simple IK constraint, but with additional control.

Simple IK conversion process

When a Simple IK constraint is converted into a Chain IK constraint the following occurs:

- Objects are re-assigned in the corresponding object list properties.
- The solver type is switched to ikRPsolver.
- The constraint snaps so it can calculate the pole vector and twist angle.

A new floor property has been created for the Chain IK constraint so that it can interpret converted Simple IK constraint behaviors correctly.

Limitations

- Because the iKRP solver is used, chains may be solved differently in some situations.
- Certain conversions of the Simple IK constraint into a Chain IK constraint cause inconsistencies in the Twist values of the Chain IK constraint.
- Effector offsets are not supported. Unlike the Simple IK constraint, the Chain IK constraint does not create offsets between the end joint and the effector. With the Chain IK constraint, the end joint always reaches the effector.

  NOTE You can recreate the original offset behavior by adding a Null child-object to the end point and then using it as the end point.

- The Pole Vector may cause the chain to flip.

  TIP If the chain flips when it should not, adjust the Pole Vector to fix the problem. You can also try changing the solver type to ikSCsolver or tweaking the Twist value.

- When the End Point is not a direct child of the Last Limb object, the conversion process of the Simple IK constraint to a Chain IK constraint makes the first child of the Last Limb object become the End Joint object for the Chain IK constraint. This causes the End Joint to reach the effector, creating a different result.

  TIP To recreate the original Simple IK behavior, create a Null and make it a child of the original Last Limb object. Set it at the position of the original End Point object, and use it instead as the End Joint object of the Chain IK constraint.

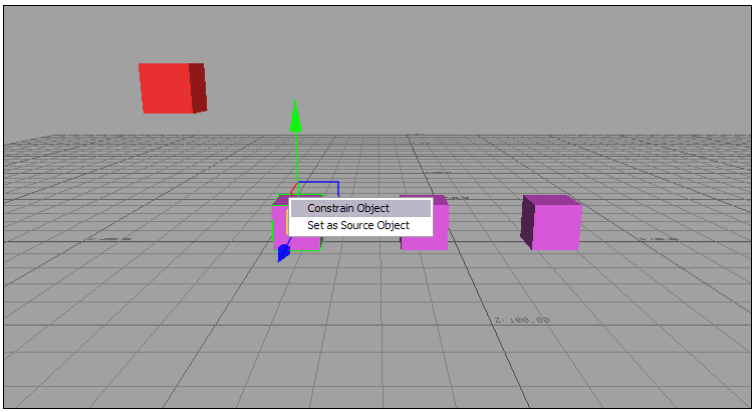
Using Chain IK to constrain a chain of bones

The Chain IK constraint lets you use Inverse Kinematics to constrain the movement of a chain.

To constrain a chain of bones with the Chain IK constraint:

1 Select a Chain IK constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Chain IK settings appear in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as one of the constraint's operators.



Constraint contextual menu

2 Assign the objects that you want to be the first and last nodes in the IK chain to the First Joint and End Joint cells.

3 If you have a node that branches to more than one node, drag a node into the Effector cell to specify which one is the End Joint.

4 If you want, assign an object to be the aim of the chain to the Pole object cell.

5 Click Snap to activate the constraint without moving the constrained objects, or click Active to activate the constraint.

NOTE If you are using IkRPSolver, rotating the effector object does not alter the constrained object. See Solver Type on page 1058 for more information.

- Chain IK constraint settings on page 1056

Creating Pole offsets for the Chain IK constraint

You can use the Pole offset settings found in the Chain IK constraint to change the Pole's position. These values are added to the Pole object's position.

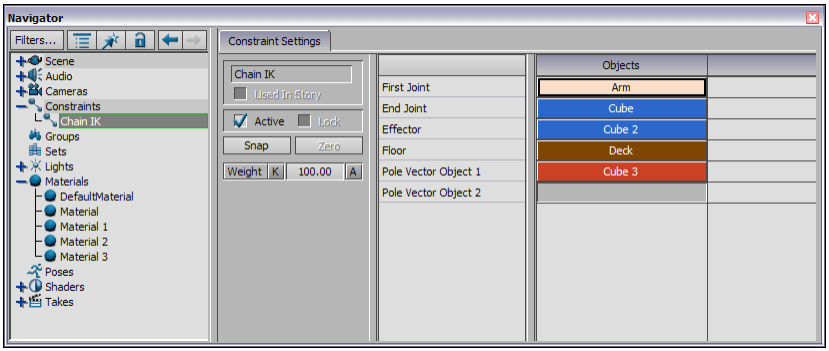
To create a Pole offset:

1. Double-click the Chain IK constraint in the Scene browser to select it.
2. Open the Properties window. The constraint settings display.
3. Expand IK Settings > Pole Offset and set a value in the Pole Offset X, Y, or Z fields for the desired effect.

Chain IK constraint settings

The Chain IK constraint uses Inverse Kinematics to constrain the movement of the elements in a bone chain, or hierarchy, so that the end node reaches toward the position of another object, defined as the object assigned to the constraint's Effector cell.

For more on configuring elements of the bone chain, see Chain IK properties on page 1061.



Chain IK constraint

First Joint

The first node or the root of the IK chain.

End Joint

The last node in the IK chain.

Effector

The object that the IK chain tries to reach. Clicking Snap in the constraint settings moves the effector object to the position of the last node of the chain.

Pole Vector Object 1

The Pole object is used to specify an object that the chain is to aim at. For example, in a leg chain, you can use an object to orient the bending of the knee in a specific direction.

NOTE You can assign multiple Pole objects and weight their influence independently. See Multiple Pole Vector objects on page 1060.

Properties settings

The following Chain IK constraint settings are found only in the Properties window:

First Joint

Use the Asset list to select a First Joint. The first node or the root of the IK chain. This is the same setting as the First Joint cell in the Chain IK constraint settings.

End Joint

Use the Asset list to select an End Joint, the last node in the IK chain. This is the same setting as the End Joint cell in the Chain IK constraint settings.

Effector

Use the Asset list to select an Effector, the object that the IK chain tries to reach. This is the same setting as the Effector cell in the Chain IK constraint settings.

Setup

Click the Setup button to re initialize the solver.

Solver Type

There are two solver types: ikRPSolver and ikSCSolver.

Solver Type	Description
ikRP Solver	Lets you use and customize a Pole Vector. RP stands for "Rotation Plane". Uses a Pole Vector or Pole Object to orient the chain. Scaling the effector object does not alter the constrained object.
ikSC Solver	Lets you adjust the orientation of the bone chain. SC stands for "Single Chain". Uses the rotation of the effector to orient the chain instead of a Pole Vector or Pole Object. Scaling the effector object does not alter the constrained object.

Twist

Lets you adjust the difference in orientation between the reference plane and the joint chain plane.

NOTE The Twist settings are only available when ikRPSolver is set as the Solver Type.

Pole Type

Lets you specify whether a specific vector or the position of the pole object computes the vector.

NOTE The Pole Type menu is available only when ikRPSolver is set as the Solver Type.

Pole Vector X/Y/Z

Lets you specify the absolute point in space at which the chain is aiming.

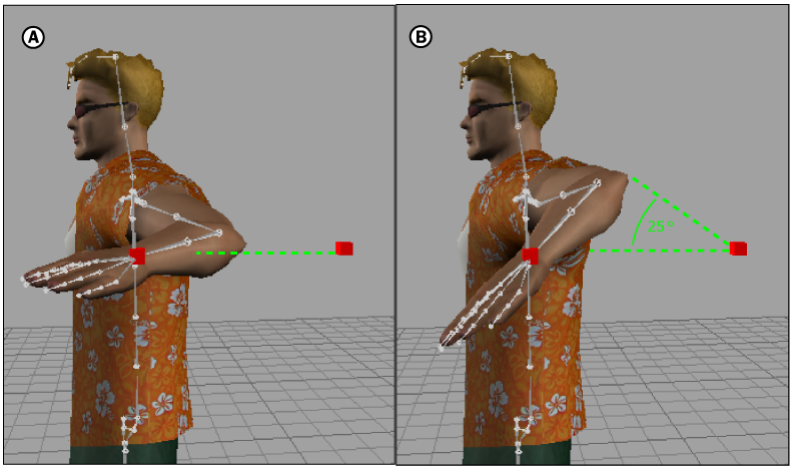
NOTE The Pole Vector XYZ fields are available only when ikRPSolver is set as the Solver Type, and the Pole Vector Type is set as Vector. Click Snap to set the Pole Vector so the chain does not move and automatically computes the Pole Vector.

Pole Object

Use the Asset list to select a Pole Vector Object(s). This is the same setting as the Pole Vector Object cell in the Chain IK constraint settings.

Pole Offset X/Y/Z

Use this setting to offset the Pole relative to the Pole object's position. You can use more than one Pole Vector object to create an offset. See Multiple Pole Vector objects on page 1060.



Pole Vector offset *A.* **No offset** *B.* **Y-value offset to 25 degrees**

NOTE This property can only be used with the ikRP solver using a Pole object.

Evaluate TS Anim menu

Lets you select a method for the Chain IK constraint to evaluate Translation and Scaling animation of each object in the chain.

Evaluating Translation and Scaling animation is done by pre-solving the IK chain at every frame, which causes significant delays in performance.

Setting	Description
Never	Does not calculate translation or scaling animation on the chain. This method is fastest, and is recommended if you need the constraint only to calculate chain rotation or have a very complex chain. Select

Setting	Description
	this option when there is no translation or scaling animation on any object in the chain, or you do not want the solver to take the translation and scaling animation into consideration. This provides you with consistent and fast CPU performance. If there is any Translation or Scaling animation on the nodes, the chain will not reach its effector.
Auto	Detects if there is Translation or Scaling animation and pre-solves it so that the chain always reaches its effector.This option is the default setting. By selecting this option, rendering performance may vary during playback depending the detection of Translation and Scaling animation.
Always	Always pre-solves the constraint so that the chain reaches its effector.Select this option to ensure consistent but slow, CPU performance.

If you have a scene with many IK chains that have translation and scaling animation, you may want to use the Never setting while you work on another part of the scene to benefit from the increased performance, reserving the Always setting for when you play back the whole scene.

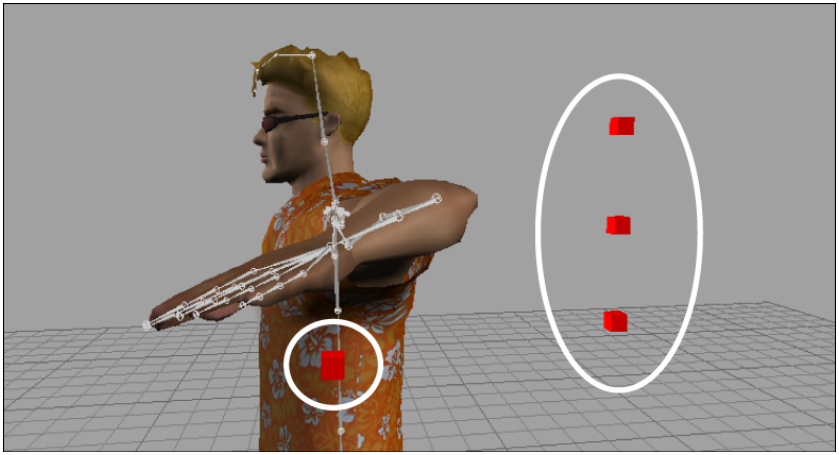
SourceObject.Weight

Use this setting to give different amounts of influence to pole vector objects.

■ Using Chain IK to constrain a chain of bones on page 1055

Multiple Pole Vector objects

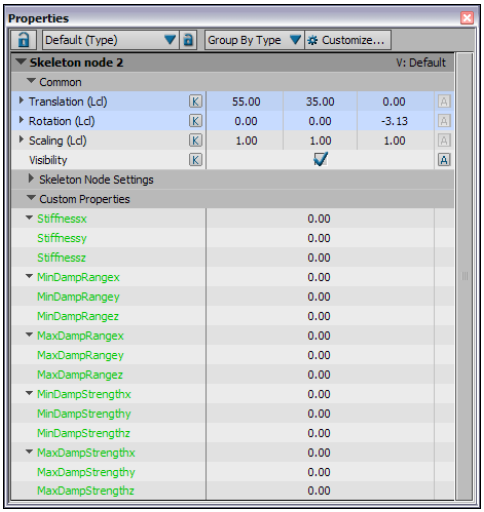
A pole vector is a constraint that makes an object follow the position of an object, or the average position of several objects. When you assign multiple objects as Pole Vector objects, the vector is drawn from a calculation of the Pole objects' average position, as illustrated in the following figure.



The Character's elbow position is derived from four markers.

Chain IK properties

The following Chain IK constraint properties are included with bones when you use the Chain IK constraint:



Chain IK constraint bone properties

Rotation Stiffness

Specifies the current node's resistance to movement.

Damp Min Range X/Y/Z

Sets an angle used by the IK chain to create resistance for joint movement when it approaches the lower boundary (the minimum) of its limits.

Use these settings to create slow joint motion until the joint reaches its movement limits, creating a gradual stop. Use Damp Min Strength to set the rate of deceleration.

NOTE You must have Degrees of Freedom (DOF) set in order to use this property.

Damp Max Range X/Y/Z

Sets an angle used by the IK chain to create resistance for joint movement when it approaches the upper boundary (the maximum) of its limits.

Use these settings to slow joint motion until the joint reaches its movement limits, creating a gradual stop. Use Damp Max Strength to set the rate of deceleration.

NOTE You must have Degrees of Freedom (DOF) set in order to use this property.

Damp Min Strength X/Y/Z

Used by the IK chain to create resistance to joint movement as it approaches the lower boundary, or minimum, of its limits.

Use these settings to define the Damp Min Range's deceleration.

Damp Max Strength

Damp Min Strength is used by IK to create resistance to joint movement as it approaches the upper boundary, or maximum, of its limits.

Use these settings to define the Damp Max Range's deceleration.

Preferred Angle X/Y/Z

Lets you specify an angle you want each joint to assume by default.

Click Snap in the Chain IK constraint settings to set all nodes to their current rotation value.

NOTE These settings work only with chains containing more than two bones.

Set Preferred Angle

Resets the bone to the angle specified in the Preferred Angle settings.

NOTE This setting is individual to each bone.

Expressions constraints

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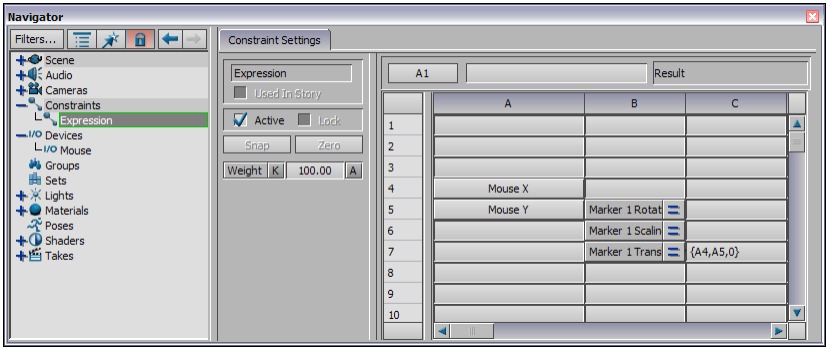
Expressions constraints, also known as Expressions, are similar to Relations constraints in that you create them to suit your needs, but instead use a spreadsheet-style interface to construct the expression. This spreadsheet interface is called the Expressions pane.



Expressions pane

The Expressions pane lets you use a more mathematical, and less graphic, method of constraining objects. This can be useful if you are familiar with commonly-used spreadsheet programs.

With an Expressions constraint, you enter data in cells instead of linking them together with connectors, as you do with Relations constraints. Once these elements are combined, they create an Expressions constraint that can be applied to a model.

Similar to Relations constraints, the Expressions method is useful for complex relationships, but in this case, they are helpful for creating more mathematically-based relationships.

- Creating an Expressions constraint on page 1066
- Expressions pane on page 1067

Creating an Expressions constraint

The Expressions pane lets you use a more mathematical, and less graphic, method of constraining objects.

To create an Expressions constraint:

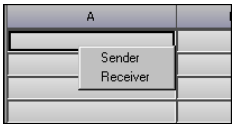
1. Drag the Expression constraint asset into the Viewer window from the Asset browser.

   The Navigator window displays the Expressions pane, and the constraint is added to the Scene browser.

   A new folder named "Constraints" appears in the Scene browser, with the new folder named Expressions added, and the Navigator window displays the Expressions pane.

2. *Alt*-drag assets and devices from the Viewer window and Scene browser into the Expressions pane.

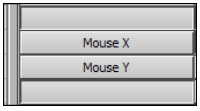
3. A dialog box appears asking you if you want to create the expression as a Sender or a Receiver.



Sender/Receiver dialog box

   - Select Sender to create the Expression as a Sender that transmits data
   - select Receiver to create the expression as a Receiver that is influenced by the data transmitted from the Sender.

   Each of the object's properties are split into separate cells.



Dragging the mouse device into the Expressions pane splits its properties into separate cells.

4 Double-click a cell and type a value to set a value in a cell.

5 Right-click in the cell and select a new data type from the Data editor to change the cell to a vector or another numerical type.

   Edit a cell's value by dragging left or right to increase or decrease the value.

For more information, see Setting basic constraint commands in the Root folder on page 1030 and Expressions reference on page 1072.

Navigating the Expressions pane

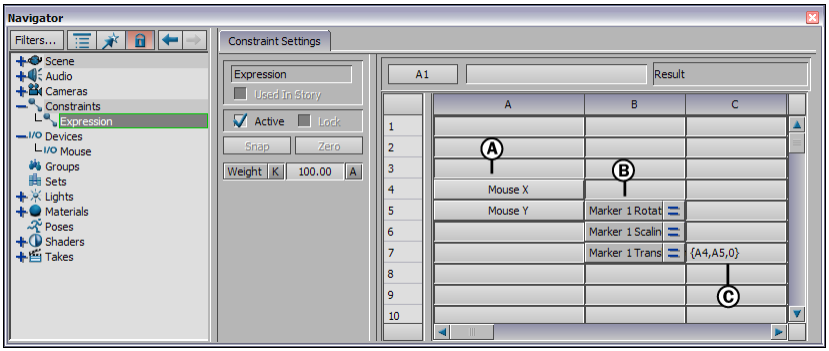
The Expressions pane contains a total of 100 rows and 26 columns (A-Z).

- Change the width of a column by dragging the border of the column heading.
- Scroll the Expressions pane by Shift-click-dragging.

For more information, see Creating an Expressions constraint on page 1066.

Expressions pane

The Expressions pane contains a total of 100 rows and 26 columns (A-Z).



Expressions constraint *A.* **Sender Cells** *B.* **Receiver Cells** *C.* **Expression**

Types of cells

When constructing Expressions constraints, a cell may contain one of the following:

Cell Type	Purpose
Senders	A Sender can be an input device or a model. Senders are used to send data to other cells. Senders only send data.
Expressions	An Expression is a recognized keyword that performs a mathematical operation using the cells or numbers within its parentheses or on either side of its operator. For example, an addition symbol (+) is an operator. The result of the operation is assigned to the Receiver cell to the left and to the cell itself. This means that you can reference the cell in other expressions.
Values	A cell may also contain a value referenced by an expression or Receiver. Before assigning a value to a cell, you should select the cell's data type.
Receivers	A Receiver cell assigns the results of an expression to the properties of a model or an output device.

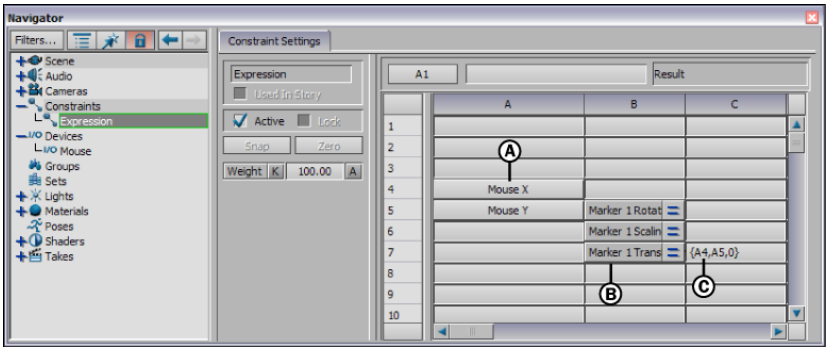
- Creating an Expressions constraint on page 1066
- Navigating the Expressions pane on page 1067
- Expressions reference on page 1072

Expressions constraints settings

When an Expressions constraint is selected, the Constraint settings display the Expressions pane, a spreadsheet where you construct the expression.

Expressions constraints let you constrain the translation, rotation, scaling, and other data of an object (models, lights, cameras, and so on) with that of

another object. Unlike other constraints, you construct your own Expressions constraints using a spreadsheet-like interface called the Expressions pane.



Expressions constraint *A.* **Sender Cells** *B.* **Receiver Cells** *C.* **Expression**

The Expressions pane spreadsheet gives you a mathematical method of constraining objects, as opposed to the Relations pane, which offers a more graphical approach.

An Expression is comprised of at least three cells. One cell contains a reference to a Sender while the other two cells are split into a Receiver cell and a mathematical expression cell.

An Expression constraint constrains the translation, rotation, scaling, and other data of an object (models, lights, cameras, and so on) with that of another object.

The following conventions are used to describe each type of expression used in an Expressions constraint:

Number

Refers to a numerical value or a cell that contains a numerical value.

Vector

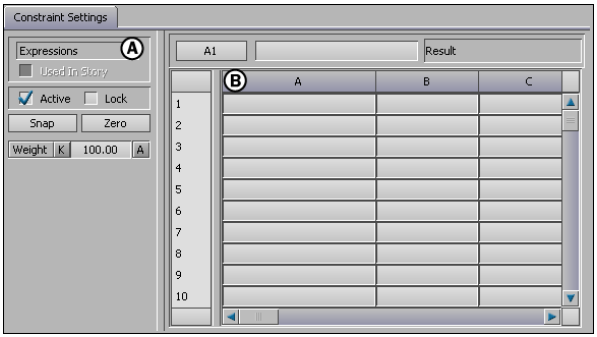
Refers to a vector (X, Y, Z) or a cell that contains a vector value.

Boolean (or Bool,)

Refers to a Boolean value (0 or 1) or a cell that contains a Boolean value.

An Expression constraint consists of at least three cells. One cell contains a reference to a Sender while the other two cells are split into a Receiver cell and a mathematical expression.

The cell sending the data can refer to an input device such as a mouse device, and the object receiving data can be a model, light, or an output device. For example, the figure below shows a mouse mapped to a marker in the Expressions pane.



Expressions constraint *A*. **Objects area** *B*. **Expressions pane**

Between the Sender and Receiver, a mathematical expression is used to convert the numerical data from the X and Y mouse values to a vector.

You can use an unlimited amount of mathematical expressions between the Sender cell and the Receiver cell.

For more information, see Creating an Expressions constraint on page 1066.

Data cells in Expressions constraints

Different properties may have different types of numeric fields. Make sure that when you reference cells you reference them with the proper numeric type.

The Expressions pane includes the following conversion syntax for converting between numbers and vectors:

D7[0]

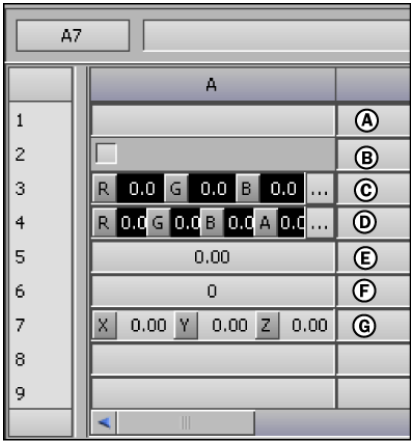
Extracts the value of the X co-ordinate of the vector in cell D7. Use 1 and 2 for the Y and Z co-ordinates respectively.

{A4,A5,0}

Uses the number in cell A4 as the X co-ordinate, and the number in A5 as the Y co-ordinate in a vector.

Data Types

There are seven possible data types shown in the Data editor:



Different data cell types *A.* **Default** *B.* **Boolean** *C.* **Color** *D.* **ColorAndAlpha** *E.* **Number** *F.* **Time** *G.* **Vector**

Data Type	Description
Default	Changes the data type to the default numerical value expressed as 0.00. Vectors and colors are expressed as {0.00,0.00,0.00,0.00}.
Bool	Changes the data type to a Boolean value (represented by a check box). This value is true (1.00) when the box is checked, and false (0.00) when it is not.
Color	Changes the data type to an RGB color vector. Separate data cells appear for each coordinate, and show the coordinate's color. Each coordinate holds a decimal value between 0 and 1.
ColorAndAlpha	Changes the data type to an RGBA color vector. Similar to the Color data type, but with an additional data cell for the Alpha channel.

Data Type	Description
Number	Changes the data type to 0.00. When switching from vectors and colors, the new number cell takes the first coordinate.
Time	Changes the data type to time code (000:00:00:00 (00)).
Vector	Changes the data type to an X, Y, Z vector. Separate data cells appear for each coordinate. When switching from a number cell, the number is placed in the vector's first coordinate.

■ Creating an Expressions constraint on page 1066

Expressions reference

This section lists the Expressions supported by MotionBuilder. Each is shown with an example that you can use as a guide when building your own Expressions.

Converters

The following expressions can be used as Converters:

HSB TO RGB	
Converts	HSB to RGB mode.
Syntax	HSB2RGB

NUMBER TO COLOR ALPHA	
Converts	Four numbers into a color vector.
Syntax	number2coloralpha

NUMBER TO VECTOR	
Converts	A number to a vector.

NUMBER TO VECTOR	
Syntax	num2vec

RGB TO RGBA	
Converts	RGB to RGBA mode.
Syntax	RGB2RGBA

RGB TO HSB	
Converts	RGB to HSB mode.
Syntax	RGB2HSB

RGBA TO RGB	
Converts	RGBA mode to RGB.
Syntax	RGBA2RGB

SECONDS TO TIME	
Converts	A number of seconds to a time format.
Syntax	seconds2time

TIME TO SECONDS	
Converts	A time format to a number of seconds. Use the time2seconds expression to convert time to a number of seconds in an Expressions constraint.
Syntax	time2seconds

Logical functions (Boolean)

The following are expressions of logical functions:

AND	
Returns	TRUE if all its arguments are TRUE.
Syntax	and(number1, number2) Number1 and number2 should be logical values.

EQUAL	
Returns	TRUE if its arguments are EQUAL.
Syntax	number1 = number2 (number, number) Number1 and number2 are the numbers that you want to test.

GREATER	
Returns	TRUE if the first argument is greater than the second argument.
Syntax	number1 >= number2 (number, number)Number1 and number2 are the numbers that you want to test.

GREATER OR EQUAL	
Returns	TRUE if the first argument is greater than or equal to the second argument.
Syntax	number1 >= number2 (number, number)Number1 and number2 are the numbers that you want to test.

IF	
Specifies	A logical test to perform)
Syntax	if (test, value1, value2)Test is any value or expression that can be evaluated to TRUE or FALSE. Value1 is the value that is re-

IF	
	turned if test is TRUE.Value2 is the value that is returned if test is FALSE.

IS BETWEEN	
Checks	Checks if one value is between two others)
Syntax	isbetween

LESS	
Returns	TRUE if the first argument is less than the second argument)
Syntax	number1 < number2 (number, number) Number1 and number2 are the numbers that you want to test.

LESS OR EQUAL	
Returns	TRUE if the first argument is less than or equal to the second argument.
Syntax	number1 <= number2 (number, number)Number1 and number2 are the numbers that you want to test.

NAND	
Returns	FALSE if all its arguments are TRUE.
Syntax	nand(number1, number2)Number1 and number2 should be logical values.

NOR	
Returns	FALSE if any argument is TRUE.

NOR	
Syntax	nor(number1, number2)Number1 and number2 should be logical values.

NOT	
Purpose	Reverses the logic of its argument.
Syntax	not(number) Number is a value or expression that can be evaluated to TRUE or FALSE. If number is FALSE, NOT returns TRUE.if number is TRUE, NOT returns FALSE.

NOT EQUAL	
Returns	TRUE if its arguments are NOT EQUAL.
Syntax	number1 <> number 2 (number 1, number 2)Number1 and number2 are the numbers that you want to test.

OR	
Returns	TRUE if any argument is TRUE.
Syntax	or(number1, number2)Number1 and number2 should be logical values.

Mathematical expressions

The following are mathematical expressions:

DISTANCE	
Purpose	Finds the distance between two vectors.

DISTANCE	
Syntax	distance(vector1, vector2)Point1 and point2 should be two positions in 3D space.

DISTANCE NUMBERS	
Sends	The distance between the two numbers.
Syntax	SetDistanceNumbers

GO TO BEGIN	
Purpose	When triggered (the value is changed from 0 to 1), the Transport Controls move to the start of the take.
Syntax	Gotobegin (A2)

GO TO END	
Purpose	When triggered (the value is changed from 0 to 1), the Transport Controls move to the end of the take.
Syntax	GotoEnd (bool)

GO TO POSITION	
Purpose	When triggered (the value is changed from 0 to 1), the Transport Controls move to a specified position.
Syntax	GotoPosition (cell)

LENGTH	
Purpose	Finds the length of a vector.

LENGTH	
Syntax	length(vector)

MIDDLE POINT	
Returns	The position vector dependent on the ratio between the two position's vectors.
Syntax	middlepoint(vector1,vector2,number)Vector1 is a position vector. Vector2 is a position vector. Number is a real number that represents the position ratio between the two positions' vectors.

NORM	
Returns	The normalized vector. Vector is the vector you want to normalize.
Syntax	norm(vector)

PLAY MODE	
Purpose	Changes the value of the playback mode.
Syntax	SetPlayMode

PLAY BACKWARD MODE	
Purpose	Changes the value of the playback mode.
Syntax	SetPlayBackwardMode

POW	
Returns	The result of a number raised to a power.
Syntax	number1^number2 Number1 is the base number. It can be any real number. Num-

POW	
	ber2 is the exponent, to which the base number is raised.

PRODUCT	
Purpose	Multiplies its arguments.
Syntax 1	number1*number2 Number1 is the number that you want to multiply with number2.
Syntax 2	vector1*vector2 Vector1 and vector2 combine to give you the cross product.

QUOTIENT	
Purpose	Number2 is the number by which you want to divide number1.
Syntax	number1 / number2

RECORD MODE	
Purpose	Changes the value of the Record mode.
Syntax	SetRecordMode

STEP FORWARD	
Syntax	StepForward (cell)When triggered (the value is changed from 0 to 1), the Transport Controls move one step forward.

STEP BACKWARD	
Purpose	When triggered (the value is changed from 0 to 1), the Transport Controls move one step backward.

STEP BACKWARD	
Syntax	StepBackward

SUM	
Purpose	Adds two arguments.
Syntax 1	number1 + number2 Number1 and number2 are the numbers or numerical cells that you want to add.
Syntax 2	vector1 + vector2Vector1 and vector2 are the vectors or vector cells that you want to add.

SUB	
Purpose	Substitutes arguments.
Syntax 1	number1 - number2 Number1 is the number that you want substituted by number2.
Syntax 2	vector1 - vector2 Vector1 is the vector that you want substituted by vector2.

Numerical functions

The following are expressions of numerical functions:

ABS	
Returns	The absolute value of a number or cell.
Syntax	abs(number)

ACOS	
Returns	The arccosine of a number. Number is the cosine of the angle you want.

ACOS	
Syntax	acos(number)

ASIN	
Returns	The arcsine of a number. Number is the sine of the angle you want.
Syntax	asin(number)

ATAN	
Returns	The arctangent of a number. Number is the tangent of the angle you want.
Syntax	atan(number)

ATAN2	
Returns	The arctangent from X and Y coordinates.Number1 is the X-coordinate of the point.Number2 is the Y-coordinate of the point.
Syntax	atan2(number1,number2)

COS	
Returns	The cosine of a number. Angle is the angle in radians for which you want the cosine.
Syntax	cos(angle)

DEG2RAD	
Converts	Degrees to radians. Angle is the angle in degrees that you want to convert.

DEG2RAD	
Syntax	deg2rad(angle)

EXP	
Purpose	Number is the exponent applied to the base value e.
Syntax	exp(number)

INTEGER	
Purpose	Rounds numerical values down to the next full digit.
Syntax	integer

LN	
Returns	The natural logarithm of a number. Number is the positive real number for which you want the natural logarithm.
Syntax	ln(number)

LOG	
Returns	The base-10 logarithm of a number. Number is the positive real number for which you want the base-10 logarithm.
Syntax	log(number)

ONEOVER	
Returns	The result of 1/number. Number is the positive real number for which you want 1/number.

ONEOVER	
Syntax	oneover(number)

PULL NUMBER	
Purpose	Continuously takes the value from the input parameter and stores the result in its internal buffer, which is then used as the Result value. This gives you the same value as the last evaluation.
Syntax	pull

PRECISION NUMBERS	
Purpose	Cuts the number at a specified precision value, for example, if a = 12.36 and the assigned precision value is 0.1, then the output is 12.30.
Syntax	precision(number)

RAD2DEG	
Purpose	Converts radians to degrees. Angle is the angle (in radians) that you want to convert.
Syntax	rad2deg(angle)

SIN	
Returns	The sine of the given angle. Angle is the angle in radians for which you want the sine.

SIN	
Syntax	sin(angle)

SQRT	
Returns	A positive square root. Number is the number for which you want the square root.
Syntax	sqrt(number)

TAN	
Returns	The tangent of a number.Number is the angle in radians for which you want the tangent.
Syntax	tan(number)

Other functions

The following are miscellaneous expressions:

BUFFER	
Returns	The old value when current value is off.
Syntax1	buffer(vector,number) Vector is a vector.Number is a Boolean number, and can be switched on or off.
Syntax2	buffer(number1,number2) Number1 is a real number.Number2 is a Boolean number, and can be switched on or off.

DAMPING	
Purpose	Applies damping to a numerical value.

DAMPING	
Syntax	damping(number)

DAMP (Clock based)	
Purpose	Similar to Damping, except this expression is based on the MotionBuilder clock instead of the refresh rate. This relation is recommended over the Damp relation, as that makes your scene identical on every computer.
Syntax	damp3dclockbased

DAMP (3D) (Clock based)	
Purpose	Similar to Damp (clock-based), except this expression is based on the Damp (3D) relation.
Syntax	damp3dclockbased

DAMPING (3D)	
Purpose	Damps the position of a vector using a specified damping factor.
Syntax	damping3d

PRECISION VECTOR	
Purpose	Use this constraint to apply a precise value to every component of the vector: X, Y, and Z can each have different precision values.
Syntax	precisionVector
Receives	a (Number) and Precision (Number)

PRECISION VECTOR	
Sends	Result (Number)

PULL VECTOR	
Purpose	Continuously pulls the vector from the input parameter and stores the result in the internal buffer, which is then used as the Result value. This value gives you the value of the last evaluation.
Syntax	pullVector

PULSE	
Purpose	Sends an alternating stream of zeroes and ones at the specified frequency, for example: 010101010101.
Syntax	pulse

TRIGGERED PLUS MINUS COUNTER	
Purpose	Creates a trigger to add the increment/decrement.
Syntax	triggeredplusminuscounter

TRIGGERED RANDOM	
Purpose	Generates a random number on demand.
Syntax	triggeredrandom

Rotation expressions

The following expressions are used for rotation functions:

3 POINTS ROTATION	
Returns	A rotation value.

3 POINTS ROTATION	
Syntax	point3rotation(vector1,vector2,vector3) Vector1, vector2, and vector3 are vectors that represent three discrete positions in 3D space. Example: point3rotation({0,0,0},{100,100,100},{100,0,-100})The rotation vector that this returns is: {-120,-35.26,45}.This rotation vector is derived by the axes (vector2-vector1) to spin the axes correctly on the third position vector (vector3).

ADD ROTATION	
Purpose	Adds two rotations. Vector1 and vector2 are vectors that represent discrete XYZ rotations.
Syntax	addrotation(vector1,vector2)

ANGLE DIFF POINTS	
Purpose	Calculates the angle between two vectors or points, using a supplied radius.
Syntax	anglediffpoints

ANGLE DIFF ROTATIONS	
Purpose	Calculates the difference between the rotation of two objects. The result can be scaled and offset.
Syntax	anglediffrotations (R1, R2)

ANGULAR ACCELERATION	
Returns	The angular acceleration of a rotation vector.

ANGULAR ACCELERATION	
Syntax	angularacc(vector) Vector is a vector that represents an XYZ rotation.

ANGULAR SPEED	
Returns	The angular speed of a rotation vector.
Syntax	angularspeed(vector)Vector is a vector that represents an XYZ rotation.

DERIVATIVE	
Returns	The derivative of a vector by time.
Syntax	derivative(vector)

GLOBAL TO LOCAL	
Purpose	Converts a rotation vector from global to local coordinates.
Syntax	globaltolocal (rotation)Vector is a vector that represents a position or a speed in 3D space.

GRAVITY MOVE	
Returns	A position.
Syntax	gravitymove(vector1, vector2, vector3)Vector1 is a vector that represents an initial position in 3D space.Vector2 is a vector that represents an initial speed. Vector3 is a vector that represents the acceleration that you want to give to your current position.

INTERPOLATE ROTATION	
Purpose	Interpolates between two rotations.

INTERPOLATE ROTATION	
Syntax	interpolaterotation(R1, R2)

LOCAL TO GLOBAL	
Purpose	Converts a rotation vector from local to global coordinates.
Syntax	localtoglobal(Rotation)

MOVE	
Returns	A position.
Syntax	move(vector1, vector2, vector3) Vector1 is a vector that represents an initial position in 3D space.Vector2 is a vector that represents an initial speed. Vector3 is a vector that represents the acceleration that you want to give to your current position.

ORBIT	
Returns	A position. Number is a real number that represents the acceleration constant (MorimobjG6.673E-11) between the origin and the current position (G = 6,672e-11 N m2/kg2).
Syntax	orbit(vector1, vector2, vector3, number) Vector1 is a vector that represents an initial origin position in 3D space (attractive point). Vector2 is a vector that represents the initial object position in 3D space. Vector3 is a vector that represents an initial speed of your object position.

POSITION DAMPING	
Returns	A position.Number1 is a number that represents the maximum speed. Number2 is

POSITION DAMPING	
	a number that represents the maximum acceleration. Number3 is a number that represents the damping ratio. (Includes Play Mode in-connector.)
Syntax	positiondamping(vector1, number1, number2, number3)Vector1 is a position vector in 3D space.

ROTATION DAMPING	
Returns	An XYZ rotation. Vector1 is an XYZ rotation vector. Number1 is a number that represents the maximum angular speed.Number2 is a number that represents the maximum angular acceleration. Number3 is a number that represents the damping ratio. (Includes Play Mode in-connector.)
Syntax	rotationdamping(vector1, number1, number2, number3)

ROTATION PRODUCT	
Returns	The rotation vector multiplied by a ratio number. Number is a real number that represents a multiplication ratio.
Syntax	multrotation(vector,number)Vector is a vector that represents an XYZ rotation.

SENSOR ROTATION HELPER	
Syntax	sensorrotationhelper

SUB ROTATION	
Purpose	Substitutes two rotations.

SUB ROTATION	
Syntax	subrotation(vector1,vector2)Vector1 and vector2 are vectors that represent discrete XYZ rotations.

SPEED	
Returns	The speed of a position vector.
Syntax	speed(vector)Vector is a vector that represents a position in 3D space.

Source functions

The following expressions are source functions:

HALF CIRCLE RAMP	
Syntax	ramphalfcircle(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.)

ISOCELES TRIANGLE RAMP	
Syntax	ramptriiso(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.)

PLAY PAUSE COUNTER	
Purpose	Lets you create a counter.
Syntax	playpausecounter

RANDOM	
Purpose	Creates a stream of random numbers at a specified frequency.

RANDOM	
Syntax	random

RIGHT TRIANGLE RAMP	
Syntax	ramptrirec(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.)

SINE RAMP	
Syntax	rampsine(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.)

SQUARE RAMP	
Syntax	rampsquare(Amplitude, Frequency, Phase)(Includes a Play Mode in-connector.)

START STOP COUNTER	
Purpose	Lets you create a counter.
Syntax	startstopcounter

Time functions

The following expressions concern time functions:

TIMETOSECONDS	
Purpose	Converts time to a number of seconds.
Syntax	timetosecond(number)Number is the time code that you want to convert to seconds.

Vector expressions

The following are vector expressions:

ACCELERATION	
Purpose	Returns the acceleration of a position vector.

ACCELERATION	
Syntax	acceleration(vector)Vector is a vector that represents a position in 3D space.

ANGLE	
Purpose	Finds the angle between the arguments.
Syntax	angle(vector1,vector2)Vector1 is a vector. Vector2 is a vector.

DETERMINANT VECTOR	
Returns	The determinant of a 3x3 column (I,J,K) matrix.
Syntax	determinantvec

DOT PRODUCT	
Purpose	Scalar product of the arguments. Returns the scalar product of vector1 and vector2.
Syntax	vector1^vector2

SCALE DAMPING	
Returns	Damping to a scaling vector. (Includes a Play Mode in-connector.)
Syntax	scaledamping

SCALE OFFSET VECTOR	
Purpose	Scales and offsets a vector.

SCALE OFFSET VECTOR	
Syntax	scaleoffsetvec

* (NUMBER*VECTOR)	
Purpose	Scales a vector.

* (VECTOR*NUMBER)	
Purpose	Scales a vector.

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- Expressions pane on page 1067
- Navigating the Expressions pane on page 1067

Mapping constraint

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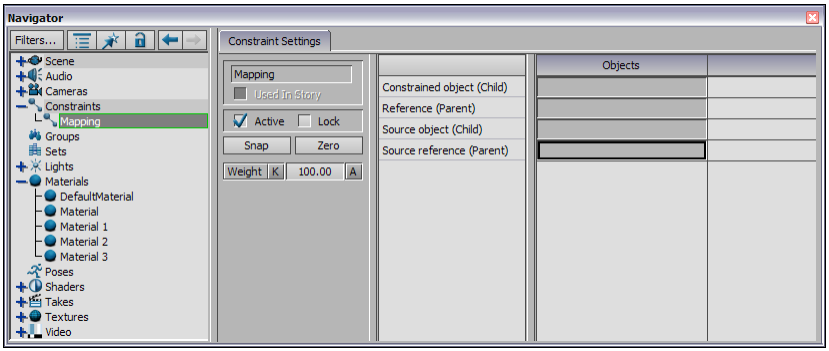
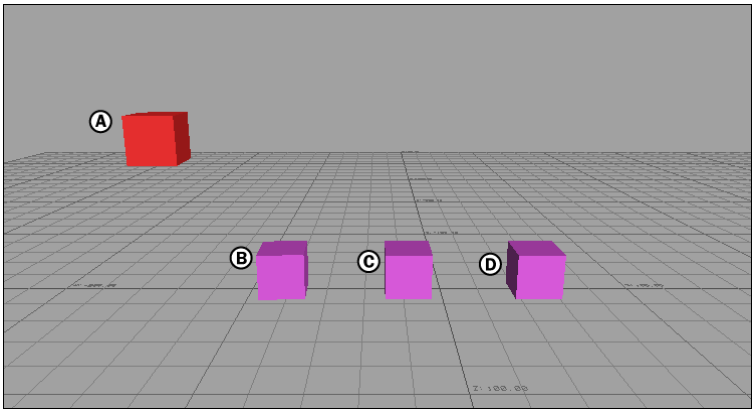
The Mapping constraint lets you map one Parent/Child relation to another Parent/Child relation. It is mainly used to scale movement between limbs or other structures of different sizes.

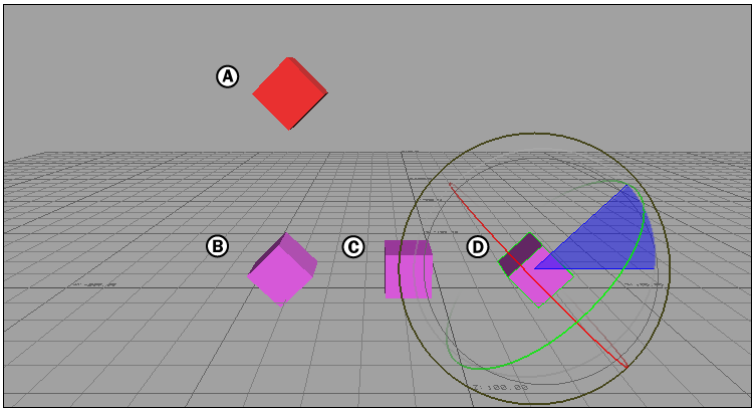


Mapping constraint

For example, in the following figure, a Mapping constraint is created using four cubes. When the constraint is activated, the constrained object moves when the reference, source object, or the Source reference is translated or rotated.



Mapping constraint *A.* **Constrained object (child)** *B.* **Reference (parent)** *C.* **Source Object (child)** *D.* **Source Reference Parent)**



Mapping constraint activated: rotating or translating B, C, and/or D creates motion in A.

- Mapping constraint settings on page 1098

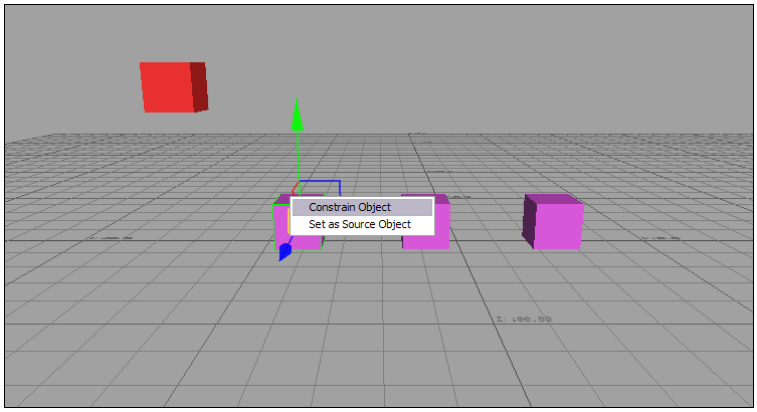
Mapping Parent/Child constraints to one another

The Mapping constraint lets you map one Parent/Child relation to another Parent/Child relation. You can use it to scale movement between limbs or other structures of different sizes.

To map Parent/Child constraints to one another:

1 Select a Mapping constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Mapping constraint template appears in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as either the Source (parent) or Constrained (child) object .



Constraint contextual menu

2 Assign the object that you want to be the Child object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation to the Constrained object (child) cell.

3 Assign the object that you want to be the Parent object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation to the Reference (parent) cell.

4 Assign the object that you want to be the Child object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation to the Source object (child) cell.

5 Assign the object that you want to be the Parent object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation to the Source reference (parent) cell.

6 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

7 Click Active to activate the constraint.

Mapping constraint settings

The Mapping constraint lets you map one Parent/Child relation to another Parent/Child relation.

The Mapping constraint requires the following objects:

Constrained object (child)

Child object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation.

Reference (parent)

Parent object of the Parent/Child relation that inherits translation and rotation from the source Parent/Child relation.

Source object (Child)

Child object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation.

Source reference (Parent)

Parent object of the Parent/Child relation that sends translation and rotation information to the constrained Parent/Child relation.

- Mapping Parent/Child constraints to one another on page 1096

Multi-Referential constraint

65

The Multi-Referential constraint is a way to create a type of complex Parent/Child constraint, capable of letting you use more than one transformation reference as a Source object. This lets you reassign the transformation reference of one object to any other.

Unlike other constraints, you can create a Multi-Referential constraint using the Key Controls.

The Multi-Referential constraint is useful whenever you want to change a model's reference point. This type of referential adjustment can occur in many different situations. Here are some examples:

Different locations

You can use the Multi-Referential constraint in a scene with vehicles so that a character can walk to a car model (Global referential), climb into it, and drive it to another location (Car referential).

The character can then get out of the car, get into an elevator model (Elevator referential), take it to another floor, and get aboard a moving sidewalk model (Sidewalk referential), and so on.

Props

You can use the Multi-Referential constraint to let characters manipulate props, for example making the character switch a prop from hand to hand, or carry props in a case strapped to the character's body, such as a gun in a holster. With this constraint props can be caught, thrown, and so on.

- Creating a Multi-Referential constraint on page 1100
- Key Controls settings on page 1104

Creating a Multi-Referential constraint

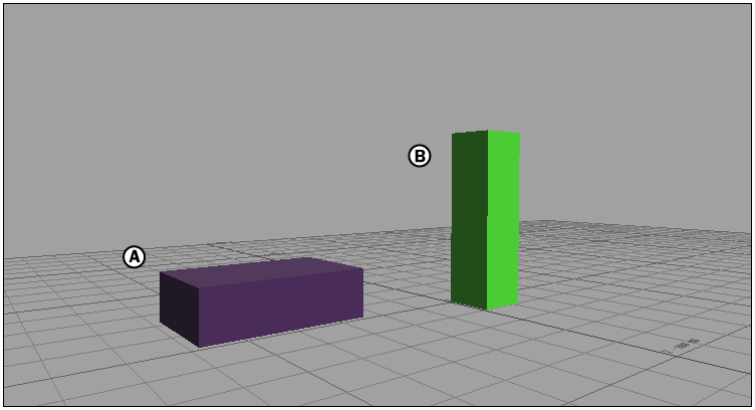
The Multi-Referential constraint lets you create a complex form of Parent/Child constraint that lets you use more than one transformation reference as a Source object.

To create a Multi-Referential constraint:

1 Select the model to be the Rigid object (or child) in the Scene browser or Viewer window and Alt-drag it into the Reference (Ref) field of the Key Controls.

NOTE Unlike other constraints, the Multi-Referential constraint is created automatically when you drag objects into the Key Controls Reference field.

In the following figure, the "Driver" (B) is assigned to the Reference (Ref) field.



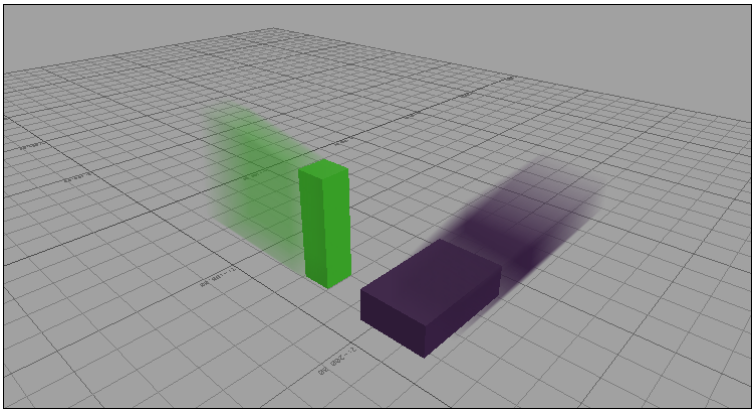
A basic Multi-Referential constraint example *A.* **"Car"** *B.* **"Driver"**

2 Next, select the model you want to assign as the Source object, in this case, the "Car", in the Scene browser or Viewer window, Alt-drag it into the Reference (Ref) field of the Key Controls, and select Set as Source object from the menu that appears.

NOTE When you drag a Source object into the Reference (Ref) field, the Reference field still shows the name of your Rigid object. If it does not, reselect the Source object in the Scene browser until you see it appear in the Reference (Ref) field.

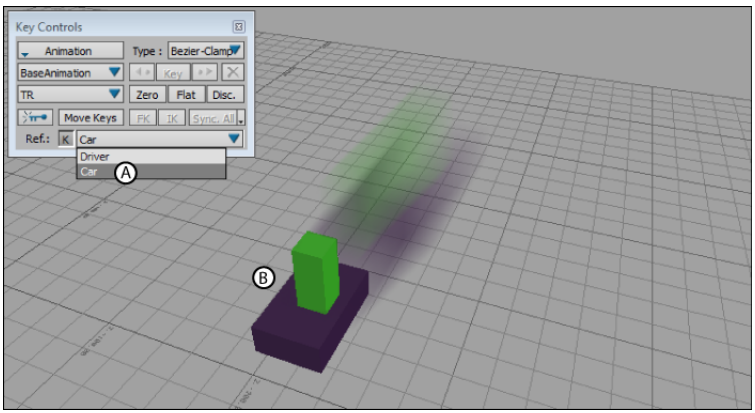
3 Click the Key (K) button next to the Reference field in the Key Controls to set a keyframe for the child object.

4 Advance the scene to the moment where the Rigid object is to join the Source object .



Advance the scene to the keyframe before the driver meets the car.

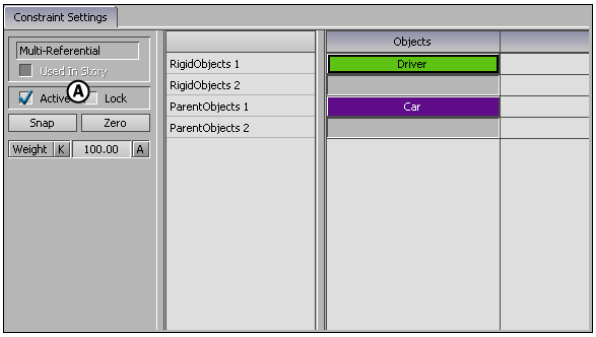
5 Select the Source object (Car) from the Key Controls Reference menu. A Key is automatically set.



A. **Select the Source object from the Reference menu.** *B.* **The "Driver" joins the "Car" and they drive off together.**

NOTE If you use the Key Controls window to create the constraint, the constraint is automatically activated.

6 To join the Rigid object to another source object, repeat Step 2 onwards, but select the other Source object from the Reference menu in the Key Controls.



Multi-Referential Constraint settings *A.* **Active option**

If there are any jumps in the animation, click Sync in the Key Controls to synchronize the animation of the two objects.

NOTE You can also use the Multi-Referential constraint with multiple Rigid objects and no Source object to create a multiple-pivot effect. The Rigid object currently selected in the Reference (Ref) field is used as the Source object.

---

7 To create another Multi-Referential constraint, simply drag a Multi-Referential constraint from the Asset browser into the Viewer window and assign new Rigid and Source objects.

- Creating offsets in a Multi-referential constraint on page 1102
- Sync button on page 1105

Creating offsets in a Multi-referential constraint

You can offset the position of a Source (parent) object in a Multi-referential constraint.

To create offsets in a Multi-referential constraint:

1 Expand the constraints folder in the Scene browser and double-click the Multi-Referential constraint to select it.

2 In the Properties window, expand (Parent object) Offset translation and (Parent object) Offset rotation.

3 Set the Offset translation and rotation for the Parent object you want to affect.

4 Do this for all the parent objects you want to adjust.

You can key and animate this offset by activating the Key and Animate buttons next to each setting you modify.

Multi-Referential constraint settings

The Multi-Referential constraint is a quick way to create a type of complex Parent/Child constraint, capable of letting you use more than one transformation reference as a Source object.

This section on Multi-Referential constraint settings is divided into three parts:

- Multi-Referential constraint settings on page 1103
- Properties settings on page 1104
- Key Controls settings on page 1104

Multi-Referential constraint settings

If you create a Multi-Referential constraint in the Navigator window, it requires the following objects:

Object cell	Function
Rigid Object 1	Assign the model you want as the source object into the Rigid object field. You can have multiple Rigid Objects.
Parent Object 1	Assign the model you want as the Parent object into the Parent object field. You can have multiple Parent Objects.

Properties settings

The following Multi-Referential constraint settings are found only in the Properties window when the constraint is select in the Scene browser:

Property	Description
Active Reference	Shows you when the Source (Parent) object takes over from the Reference (Child) object in the constraint.
Parent Object Offset Translation	Lets you view the translation offset of the Parent object,
Parent Object Offset Rotation	Lets you view the rotation offset of the Parent object

Key Controls settings

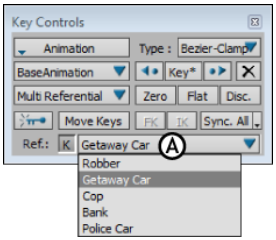
Unlike other constraints, you can quickly create a Multi-Referential constraint through the Key Controls by dragging models into the Key Controls Reference (Ref) field.

The following settings are required to create a Multi-Referential constraint in the Key Controls:

Reference field

The Key Controls Reference (Ref.) field is where you drag Rigid and Source objects to create a Multi-Referential constraint.

After you have assigned a source object to the Key Controls Reference (Ref) field, you can change the object's referential by selecting a new reference from the Reference (Ref) menu .



Expand the Reference menu to select a new Source object.

Dragging objects into the Reference field automatically creates a Multi-Referential constraint.

Click the arrow next to the Reference (Ref) field to expand a list of objects that have been set as Source objects.

Sync button

The Key Controls Sync button is used for both character and Multi-Referential constraint keyframing.

Use the Sync button when there is a switch between different references in a scene that creates “jumps” in the animation.

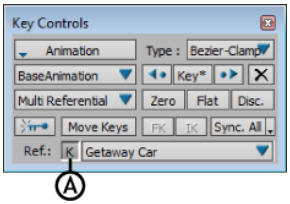
In situations where there is a reference change, such as a scene with a character moving from a car to the street, then to an elevator, jumps may be created if you change the timing or values of the keys of one of the references.

Jumps can be created whenever you make even a small element change, such as tweaking the rotation of the constrained object in the FCurves window.

NOTE The Rigid object should be selected when you click the Sync button, otherwise the animation is not changed. The Sync button tracks all the reference changes in the animation, correcting any inconsistencies by re-synchronizing the previous reference to the new one.

Keyframe button

Click the Keyframe (K) button next to the Reference (Ref.) field to set keyframes for objects in the Reference field .



Reference field *A.* **Keyframe button**

NOTE The K button appears only if an object has been dropped in the Reference (Ref.) field.

Clicking the Keyframe button twice disables the key you have set.

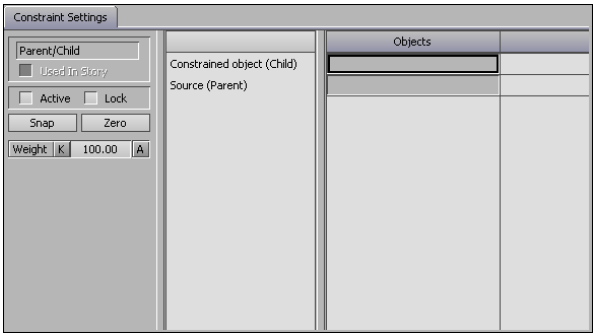
■ Sync button on page 1105

- Creating a Multi-Referential constraint on page 1100

Parent-child constraint

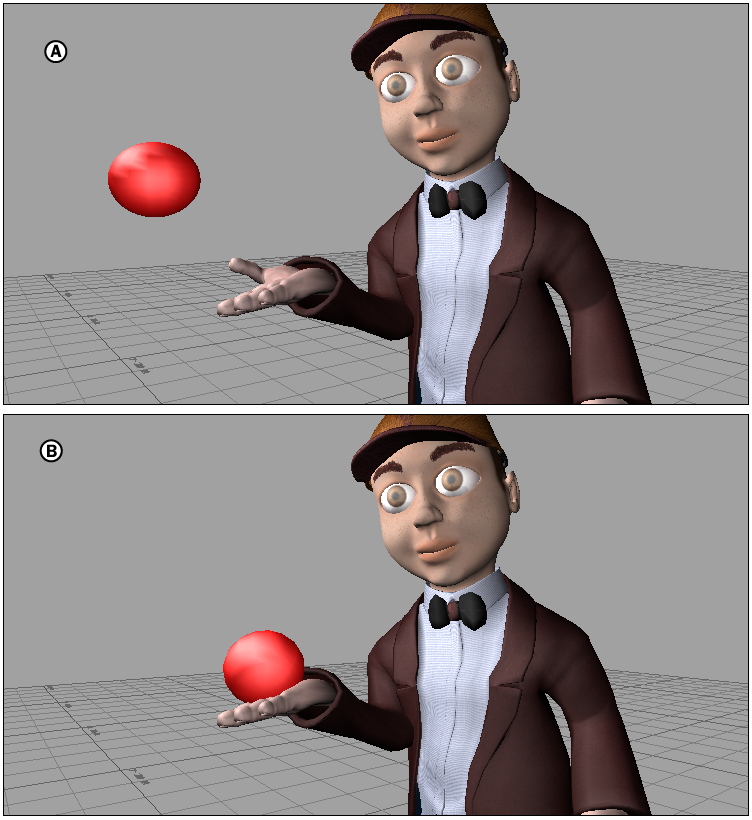
66

The Parent-Child constraint creates a parent-to-child relationship between any two objects, from any two hierarchies. It creates the same relationship as the parent-to-child relationships found in hierarchies.



Parent-Child constraint

Use this constraint to connect objects without changing hierarchies or making hard connections. For example, in the following figure, a model's hand effector is parented to a child-object sphere. Once the constraint is activated, any movement of the parent "hand" also occurs for the "ball" child in this way you can connect an object to the hand of a model without changing the model's hierarchy.



A. **Parent/Child constraint before activation** *B.* **Parent/Child constraint after activation**

It does not matter if the objects in the Parent/Child relationship are in different hierarchies.

You can also use the Story window to activate and disable scheduled Parent/Child constraints.

Normal Parent/Child connections are globally active.

- Creating a parent-child relationship between objects on page 1108

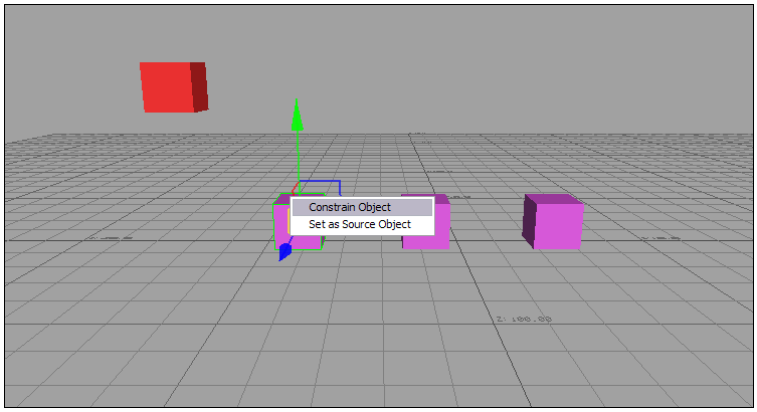
Creating a parent-child relationship between objects

Use the Parent/Child constraint to create a parent-to-child relationship between any two objects.

To create a Parent/Child relationship between objects:

1 Select a Parent/Child constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Parent/Child constraint template appears in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source or Constrained object.



Constraint contextual menu

2 Assign the object that you want to inherit translation and rotation from the source object (parent object) to the Constrained object (child object) cell.

3 Assign the object that you want to send translation and rotation information to the constrained object (child object) to the Source (parent object) cell.

4 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

5 Click Active to activate the constraint.

Creating an offset with multiple parents

You can use multiple parent-objects to define the position of an object constrained with the Parent/Child constraint.

To create an offset with multiple parents:

1. Expand the constraints folder in the Asset browser and select the Parent/Child constraint.
2. In the Properties window, expand Constraint Source Weight.
3. Set the Translation, Rotation, and Scaling offsets for the Parent object you want to affect.
4. Do this for all the parent objects you want to change.

You can key and animate this offset by activating the Key and Animate buttons next to each setting you modify.

■ Parent-child constraint settings on page 1111

Constraining individual axes (parent-child constraint)

You can have the source objects in a Parent/Child constraint affect only certain axes of a constrained object.

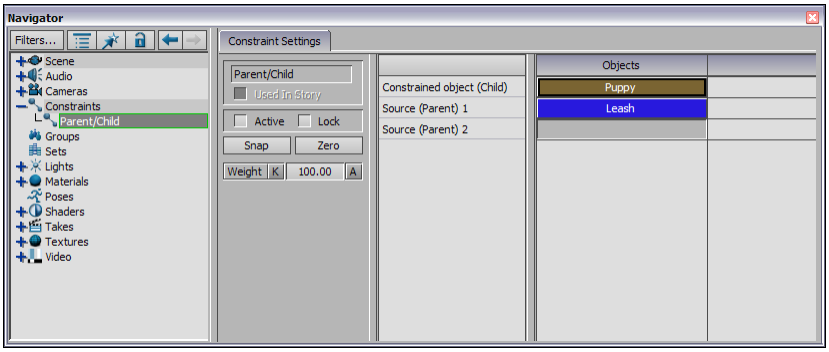
You can constrain an individual axis with the Parent Child constraint. For example you can have an object only parented on its Y-axis.

To constrain individual axes:

1. Double-click the Parent/Child constraint in the Scene browser to select it.
2. Open the Properties window. The constraint settings display.
3. Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.
4. To reactivate the unconstrained axes, activate the option.

Parent-child constraint settings

The Parent-Child constraint creates a parent-to-child relationship between any two objects, from any two hierarchies.



Parent Child constraint

The Parent/Child constraint requires the following objects:

Constrained object (child object)

Inherits translation and rotation from the source object (parent), but not scaling.

NOTE You can have multiple Constrained (child) objects in this constraint.

Source (parent object)

Sends translation and rotation information to the constrained object (child).

NOTE You can have multiple Source (parent) objects in this constraint.

Properties settings

The following Parent/Child constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

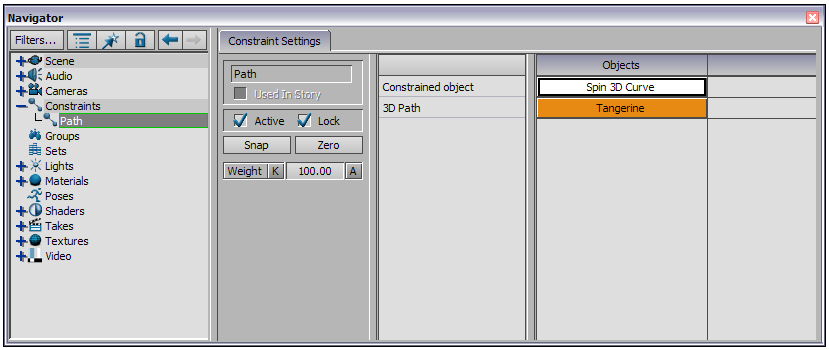
Setting	Description
Constraint Axes	The Constraint Axes settings in the properties window let you choose on which axis the Parent/Child constraint takes effect. For example, you can activate only the

Setting	Description
	translation on the X-axis and the rotation on the Y-axis, so that the constrained object is only affected when the Source (parent) object is moved from side to side or rotated up and down.You can also activate the Affect Scaling X, Y, and Z options so you can constrain the Scaling of the child object to the parent.
Scaling Affects Translation	Activate this option if you want the Child object's position to be affected when the Parent object is scaled.
(Parent) Offset T/R/S	The (Parent) Offset T/R/S settings let you offset the Source (parent) object's translation, rotation and scaling from the Child object. Expand each setting to enter values for the x, y, and z- positions.
(Parent) Weight	The Constraint Source Weight settings let you set the weighting for the Source (parent) object(s) or the entire constraint, letting you create blends. You can also use these setting to create an offset between the child and parent object(s).

Path constraint

67

The Path constraint lets you convert a 3D Curve created in the Viewer window into an animation path.



Path constraint

The time-length of the path animation is determined by the time set in the Transport Controls End field. For example, if the End field has a value of 300 frames, the constrained object takes 300 frames to reach the end point of the path.

- Creating a 3D curve on page 1119
- Creating an animated path with a 3D Curve on page 1113

Creating an animated path with a 3D Curve

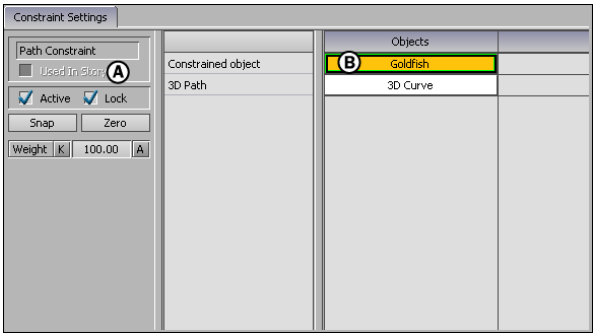
You can use the Path constraint to convert a 3D Curve created in the Viewer window into an animation path.

To create an animated path:

1 Drag a Path constraint into the Viewer window from the Asset browser's Constraints folder.

2 In the Path constraint settings, drag the 3D Curve into the 3D Path field.

3 Assign your light, camera, or object to the Constrained object field and click Active.



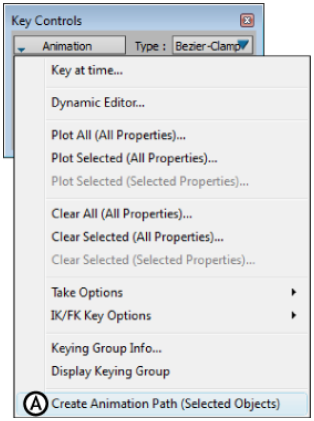
Path constraint settings *A.* **Object settings** *B.***Objects cells**

Your object is constrained to the start point of the 3D Path. Click play in the Transport Controls and the object travels along the curve.

To create an animated path using the Key Controls:

1 Select the object or objects that you want to constrain along the 3D Path in the Viewer window.

2 Open the Key Controls Animation Menu and select Create Animation Path (Selected Objects).



Key Controls Animation menu
A. **Create Animated Path option.**

3 Click OK in the resulting dialog box that asks you to confirm the creation of an Animation Path.

   A Path constraint is added to the Constraints folder in the Scene browser.

   This number is the start frame as specified in the Transport Controls Start field. A key also appears at this frame.

4 Advance the Transport Controls a few frames, and set a key frame. An Animation Path is created as you work, with a node appearing for every key that is set.

- Creating a 3D curve on page 1119
- Editing a 3D Curve on page 1119
- Viewing the trajectory of an object on page 1122

Offsetting Path constraint objects

You can create an offset between Constrained and Source objects using the translation offsets found in the Properties window.

To offset the Constrained and Source objects in a Path constraint:

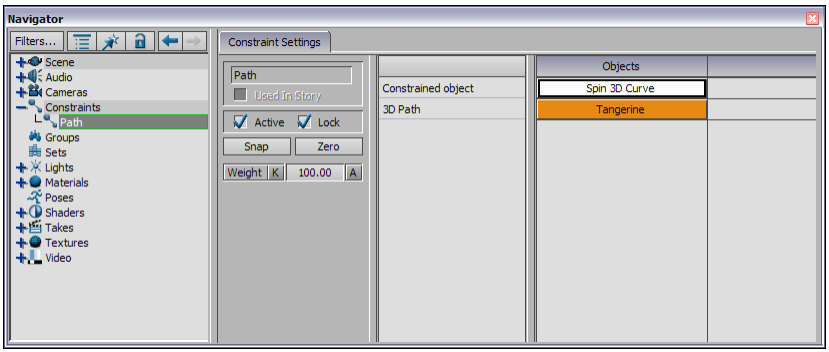
1 Double-click the constraint in the Scene browser to select it.

2 Open the Properties window. The Path constraint settings display.

3 Expand Path Settings > Offsets > Translation offset and set a value in the Roll, Pitch, or Yaw fields for the desired effect. See Offsets on page 1117 for more information on roll, pitch, and yaw.

Path constraint settings

The Path constraint lets you use a 3D Curve created in the Viewer window as an animation path.



Path constraint

The Path constraint requires the following objects:

Constrained Object

Assign the object that you want to follow the 3D Path to this cell.

3D Path

Assign the 3D Curve that you want to use as a path to this cell.

Properties settings

The following Path constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Warp Mode

Use the Warp Mode menu to select a method to evaluate your curve animation.

Warp method	Description
Percent	Evaluates the curve by percent, with 0 being the start and 100% being the end.
Segment	Evaluates the curve animation point by point.

Warp

Shows the progress of the Curve animation on a slider. Move the slider forward to advance the animation to a later point.

Follow Path

Aligns the constrained object's axes with the direction of the 3D path.

Up Vector

If Follow Path is activated, lets you select a different axis to orient the constrained object's Up vector.

Front Vector

If Follow Path is activated, lets you select a different axis for the constrained object to face.

Offsets

Offset type	Description
Translation Offsets XYZ	Use these fields to move the constrained object from the 3D Path. You can set key animation on any of these settings.
Roll	Use the Roll slider to rotate the constrained object around the X-axis.
Pitch	Use the Pitch slider to bank the constrained object up or down the Y-axis.

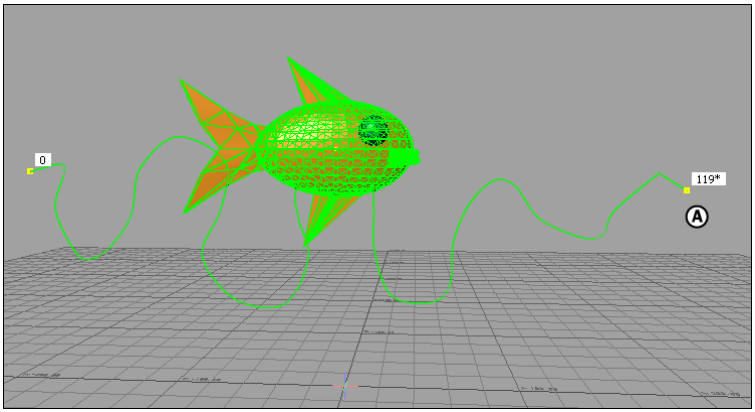
Offset type	Description
Yaw	Use the Yaw slider to spin the constrained object using the object's center as the axis.

Display

Display setting	Description
UI Color	Double-click to open the color window where you can set a color for the start and end points of the path.
Show warp key frame	Disable this setting to hide the warp key frame boxes in the Viewer window.

- Creating an animated path with a 3D Curve on page 1113

The duration of the path animation is determined by the time set in the Transport Controls End field. For example, if the End field has a value of 300 frames, the object takes 300 frames to travel to the end-point of the path.



A model with the Path constraint added. *A.* **The duration appears in a white field at either end of the path.**

TIP You can also create an instant animated path using the Key Controls, letting you animate with a Path instead of FCurves. See Creating an animated path with a 3D Curve on page 1113.

- Creating a 3D curve on page 1119

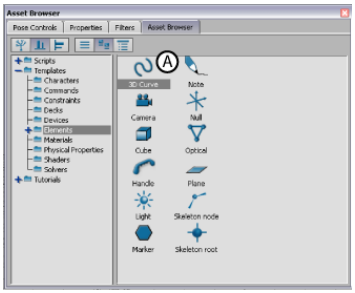
- Creating an animated path with a 3D Curve on page 1113

Creating a 3D curve

In order to create an animated path, you must first create the curve that is used to derive the animation.

To create a 3D curve:

1 Double-click 3D Curve in the Asset browser's Elements folder. The cursor becomes a cross hair.



Asset browser *A.* **3D Curve asset**

2 Click anywhere in the Viewer window to set red points that are connected by a green line. This line is a 3D curve.

Use the middle mouse button to create a point between the last two points, or click the right mouse button to add a point at the start point.

3 To accept the curve, press Enter. To undo a point, press Ctrl-Z. To delete the entire path, press Escape.

- Editing a 3D Curve on page 1119
- Creating an animated path with a 3D Curve on page 1113

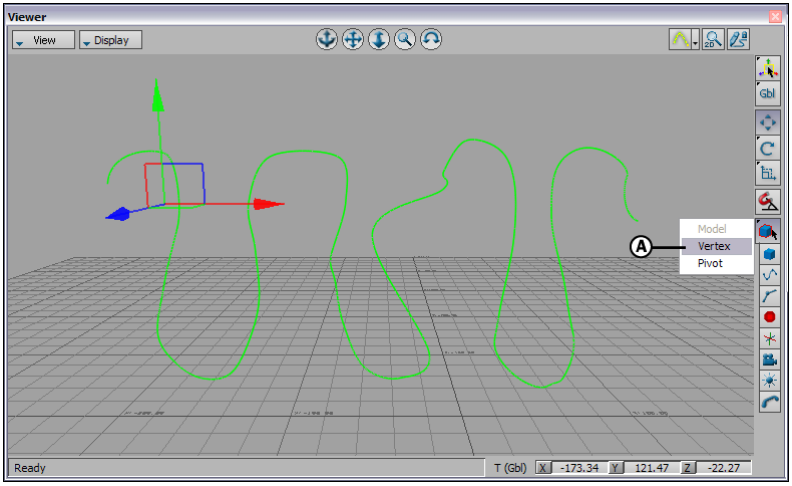
Editing a 3D Curve

There are several ways in which you can edit a 3D curve.

To adjust the placement of points on a curve:

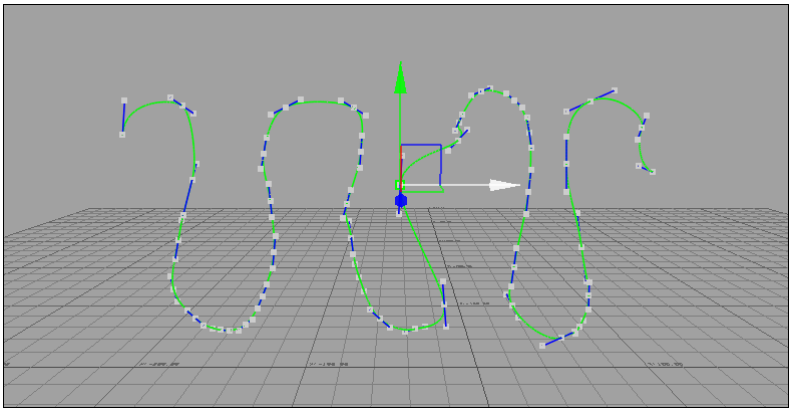
1 Select the curve and press T to activate Translation mode.

2 Select Vertex from the Viewer toolbar Object Selection menu.



Viewer window Object selection buttons *A.* **Vertex.**

The points on the curve transform into editable points with tangent handles.

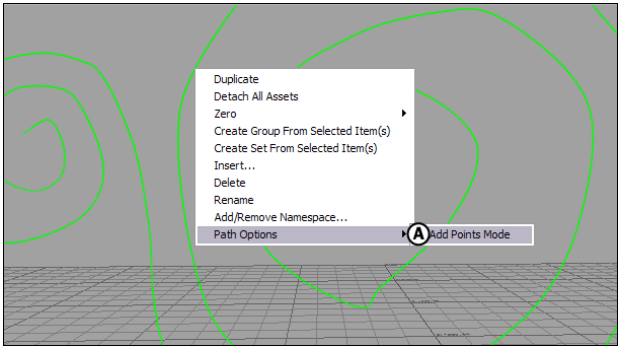


3D path in Edit/Delete Points mode.

3 Double-click any point on the curve and translate the point or its handles. Ctrl-click a point to deselect it.

To add points to a curve:

1 Right-click the curve and select Path Options > Add Points Mode from the contextual menu. The cursor becomes a crosshair.



3D path contextual menu *A.* **Add Points Mode**

2 Click the mouse in the Viewer window to add a point to the end of the curve.

- To add a point to the beginning of the curve, right-click instead.
- To add a point inside the curve, middle-click.

3 Press Escape to exit Add Points mode.

To delete points on a curve:

1 Select Vertex mode from the Viewer toolbar Object Mode menu.

2 Click the point to be deleted on the curve.

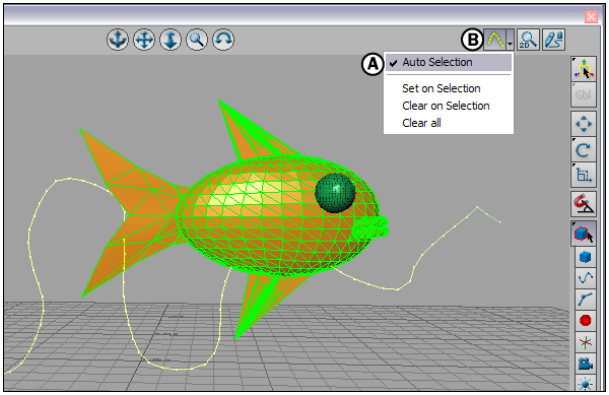
To select multiple points, Ctrl-click or Spacebar-drag.

3 Right-click the curve and select Path Options > Delete Selected Points from the contextual menu.

Viewing the trajectory of an object

To view the trajectory of an animated object:

1 Select the object, and click the Trajectories button at the top of the Viewer window.



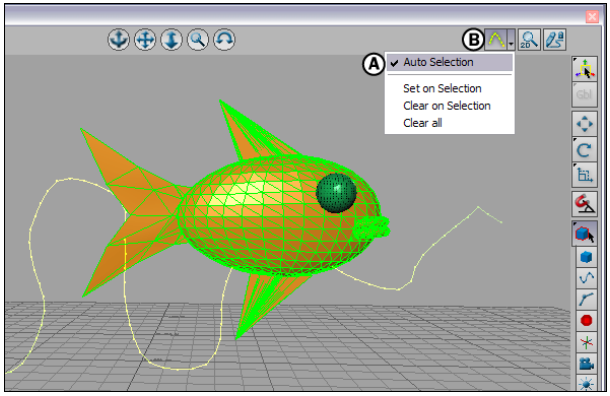
Viewer window *A.* **Trajectories menu** *B.* **Trajectories button**

2 Click the down arrow next to the Trajectories button to open the Trajectories menu and select one of the following:

- To view trajectories for all selected objects, select Auto-Selection.
- To view trajectories even when objects are not selected, select Set on Selection.
- To hide the trajectories of selected models, select Clear on Selection.
- To hide all trajectories, select Clear all.
  See also Motion trajectories settings on page 1122.

Motion trajectories settings

You can view the animation trajectory of objects in the Viewer window, including animated paths, using the Viewer window Trajectory button.



Viewer window *A.* **Trajectories menu** *B.* **Trajectories button**

Auto-Selection

When activated, shows the trajectories for all selected objects.

Set on Selection

When activated, continues to show trajectories even when their objects are not selected.

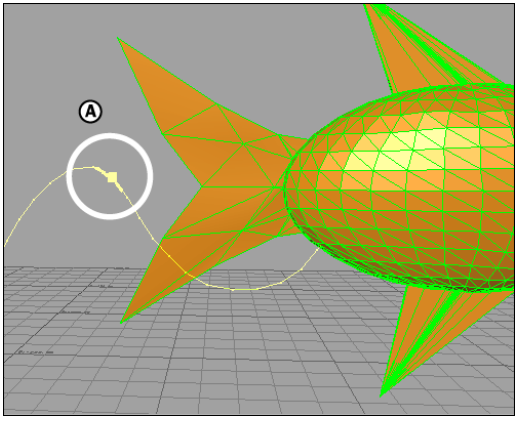
Clear on Selection

Hides the trajectories of the selected models.

Clear all

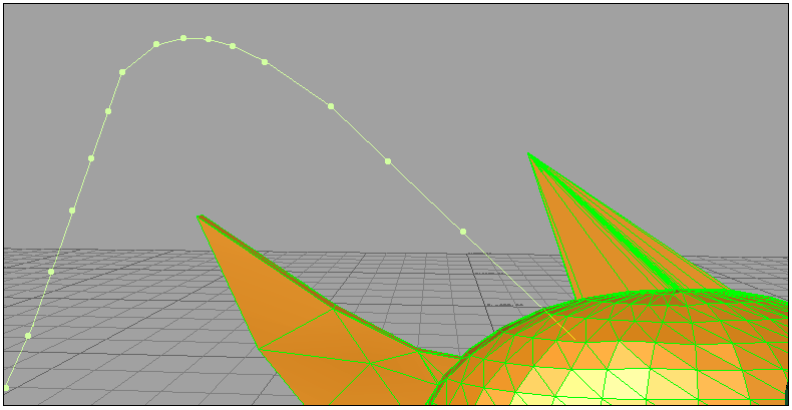
Hides all trajectories.

The trajectory of the animated object is shown as a yellow dotted line. Each dot represents a frame.



Trajectory *A.* **Each dot signifies a frame.**

If you change the velocity of the animation in the Key Controls window the dots move closer together or further apart, visually representing changes in the frame's activity.



Trajectory showing increased velocity.

NOTE To move the model with its trajectory, select the model's root.

■ Editing a 3D Curve on page 1119

Position constraint

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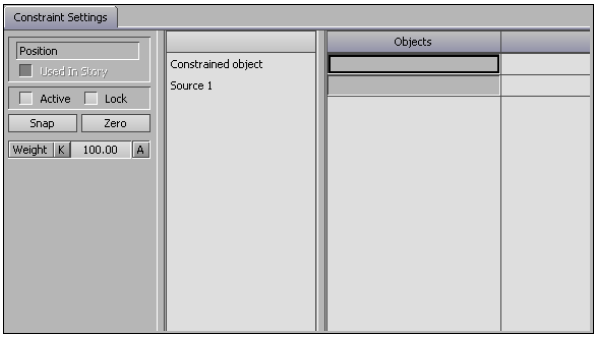
The Position constraint lets you apply a source object (or objects) to constrain the translation of a target object.

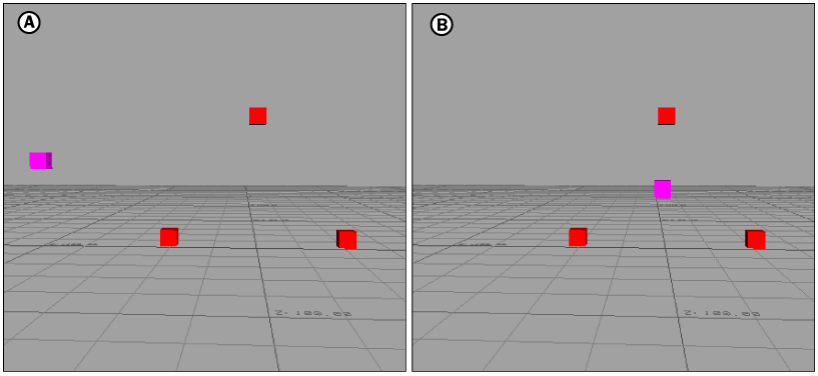


Position constraint

When you drag an object into the Source 1 field, another source (Source 2), is added to the Objects pane. If you drag a second source into Source 2, the position of the constrained object is derived from the position of the two source objects.

You can have as many sources as you want, which let you create complex Position constraints.

For example, in following figure, A, a constrained object to the left of three objects in a triangle formation is shown. When the constraint is activated, the constrained object moves to become equidistant from the three source objects to B.



Position constraint *A.* **Pink marker: a constrained object** *B.* **The Position constraint is activated**

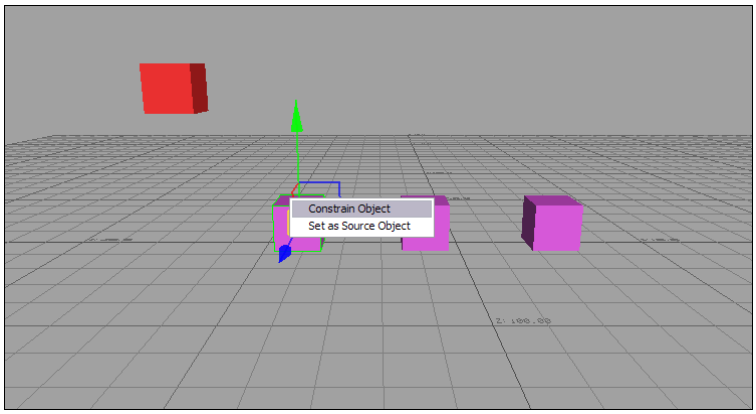
■ Constraining an object's translation with another's translation on page 1126

Constraining an object's translation with another's translation

1 Select a Position constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

   ■ If you drag it into an empty area of the Viewer window, the Position constraint template appears in the Constraint settings.

   ■ If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source or Constrained objects.



Constraint contextual menu

2 Assign the object that you want to position and translate in the scene based on the position and movement of one or multiple source objects to the Constrained (child) object cell.

3 Assign the object that you want to derive the translation information from for the constrained object to the Source 1 (parent) cell.

When you drag an object into the Source 1 cell, another source (Source 2), is added to the Objects pane. If you drag a second source into Source 2, the position of the constrained object is derived from the position of the two source objects.

You can have as many sources as you want, so you can create complex Position constraints.

NOTE When more than one source is specified, the constrained object is placed at the middle point between all source objects.

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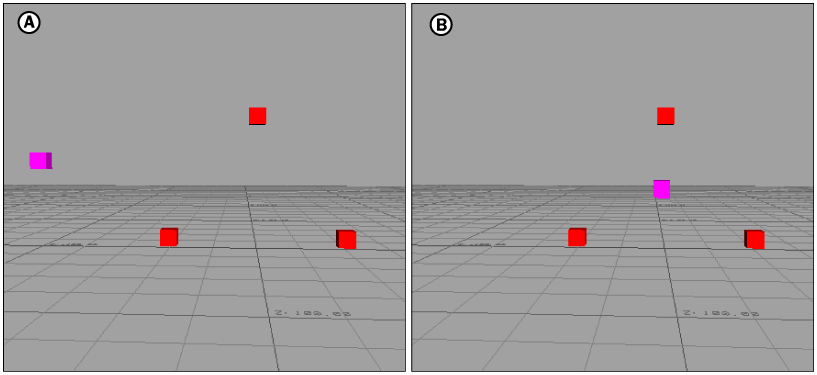
4 For example, in the following figure, A, illustrates a constrained object to the left of three objects in a triangle formation. When the constraint is activated, the constrained object moves to become equidistant from the three source objects, as shown in B.



Position constraint *A.* **Pink marker: a constrained object** *B.* **The Position constraint is activated**

5 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

6 Click Active to activate the constraint.

Constraining a single axis (Position constraint)

You can constrain an individual axis with the Position constraint. For example you can have an object only constrained on its Y-axis.

1 Create a Position constraint. See Constraining an object's translation with another's translation on page 1126 for more information.

2 Double-click the Position constraint in the Scene browser to select it.

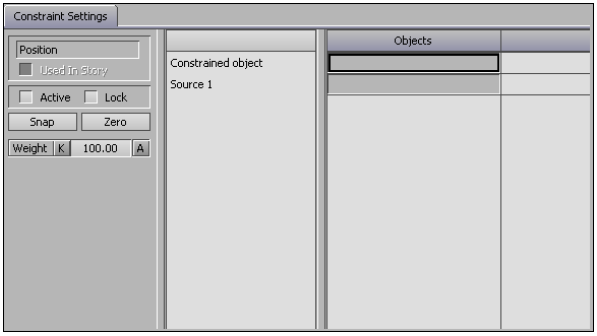
3 Open the Properties window. The constraints settings display.

4 Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.

5 To reactivate the unconstrained axes, activate the option.

Position constraint settings

The Position constraint lets you apply at least one source object to constrain the translation of a target object.



The Position constraint

The Position constraint requires the following objects:

Constrained object

An asset, model, or other object that is positioned and translated in the scene based on the position and movement of one or multiple source objects. Also known as the “child” object.

Source 1

Sends translation information to the constrained object. Also known as the “parent” object.

When more than one source is specified, the constrained object is placed equidistant from all source objects.

Properties settings

The following Position constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Translation Offsets XYZ

Use these fields to move the constrained object from the Source object(s). You can set key animation on any of these settings.

These fields are disabled if the Lock option is activated.

Constraint Axes

Activating or disabling these axes affects whether the constrained object is affected by the source objects' movement in this direction.

Axis setting	Description
Affect X	When active, the constrained object moves along the X-axis with the source object.
Affect Y	When active, the constrained object moves along the Y-axis with the source object.
Affect Z	When active, the constrained object moves along the Z-axis with the source object.

(Source Object) Weight

Use this setting to give different amounts of influence to source objects.

NOTE It is no longer necessary to drag the same object in the source field to create weighting for this constraint. If you are working on an earlier version of the Positions constraint where this has been done, this is compensated.

Range constraint

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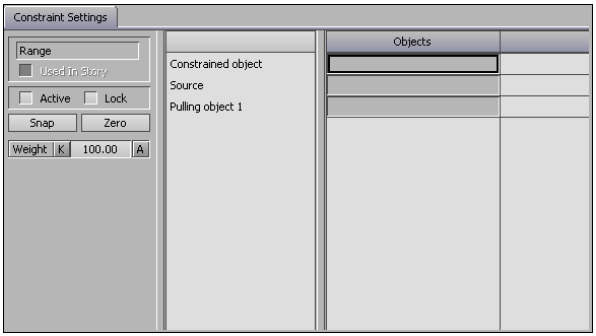
The Range constraint lets you influence a constrained object using one or more pulling objects. It limits the movement of an object relative to two or more objects. The object is not pulled past a specified range, which you can define using another object.



Range constraint

Limiting an object's range with the Range constraint

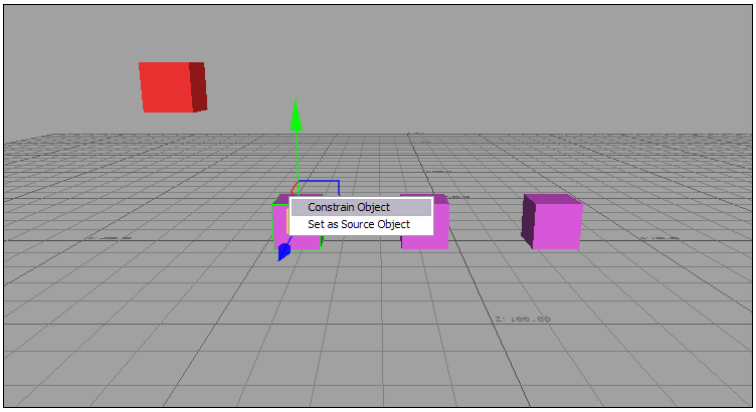
The Range constraint lets you influence a constrained object using one or more pulling objects.

To limit an object's range:

1 Select a Range constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Range constraint template appears in the Navigator window.

- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source (parent) or Constrained (child) object .



Constraint contextual menu

2. Assign the object that you want to constrain to the Constrained (child) object cell.
3. Assign the object that you want to define the limit or maximum range that the constrained object can be pulled to the Source (parent) cell.

   The limit is a radius centered on the pulling object.
4. Assign the object that you want to be the pulling object that affects the constrained object to the Pulling Object 1 cell.
5. Click Lock in the Constraint settings to lock the position of the objects to be constrained.
6. Click Active to activate the constraint.

- Range constraint settings on page 1133

Using the Range constraint for keyframe animation

This method lets you keyframe the movement of each effector without having to transform and key the root of the skeleton.

1. Set up a biped skeleton with Chain IK constraints for each leg.

2 Use each foot effector as the root in a Range constraint, the effectors being the source and the root being the constrained object.

   When you translate the effectors for each foot, the hips move as well.

- Range constraint settings on page 1133

Range constraint settings

The Range constraint lets you influence a constrained object using one or more pulling objects.

The Range constraint requires the following objects:

Constrained object

Object being pulled by the pulling objects. Also known as the “Child” object.

Source

An object defining the limit or maximum range that the constrained object can be pulled. Also known as the “parent” object.

The limit is a radius centered on the pulling object.

Pulling object 1

Pulling object that affects the constrained object.

- Limiting an object’s range with the Range constraint on page 1131

Relations constraints

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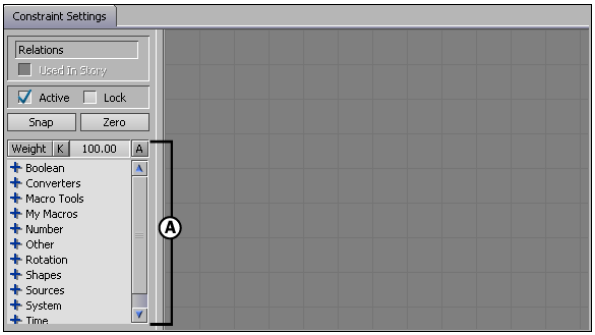
Relations constraints refer to constraints you create using a graphical interface, called the Relations pane in a connect-the-dots manner.

Elements of the relations constraint, known as objects, once they are added to the Relations pane, are connected to one another to form an equation. Once these elements are combined, they create a relations constraint that can be applied to a model.



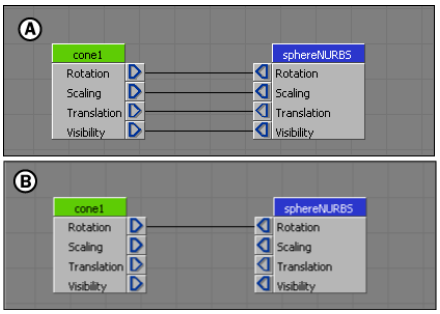
Relations pane *A.* **Objects area**

Unlike other constraints, Relations constraints come with mathematical operators that you can use as building blocks to create very specific actions for your models. These building blocks are called Operators.

When a Relations constraint is dragged into the Viewer window, the Constraint settings displays the Relations pane, which is the “drawing board” on which you construct the relation.

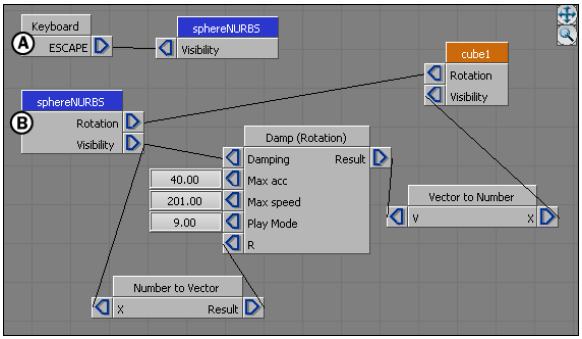
To show how Relations constraints let you create relationships between objects with more control than you can have with other constraint types, see the following figure. This figure shows what a Parent/Child constraint would resemble if it were constructed in the Relations pane.

Unlike a Parent/Child constraint, you can parent the object’s rotation only, so that when the source model moves, the target model is affected only if it rotates. This shows you the kind of precise control you have when you construct a Relations constraint.



Relations pane *A.* **version of a Parent/Child constraint** *B.* **With only rotation parented**

The constraint shown in the following figure shows an even more complex Relations constraint. The keyboard Escape key is used to trigger the visibility of the SphereNURBS model. The second constraint in the pane shows a complex relation that uses the visibility and Rotation of the SphereNURBs model to affect the behavior of the Cube model. For more information on working with complex relations, see Creating Macro relations on page 1142.



Complex Relation *A.* **Keyboard triggering the SphereNURB visibility** *B.* **Using SphereNURB's motion to constrain Cube**

When using more complex relations, such as the one shown in the previous figure, the Relations pane is helpful because it lets you visualize construction of the relationships between operators. This visualization makes it easy to create and change large constraint interactions involving multiple operators, models, and conditions.

- Creating a Relations constraint on page 1138

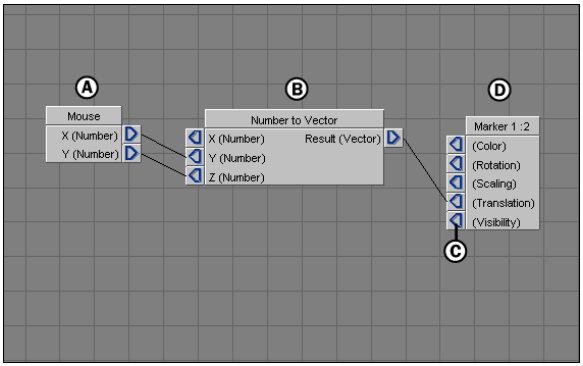
About the Relations pane

When a Relations constraint is selected, the Constraint settings display the Relations pane, a grid where you construct the relation.

Relations constraints map data to models, lights, cameras, and output devices. This data can be animation, a recorded take, or live movement captured from a magnetic system, glove, mouse, joystick, and so on.

A Relations constraint is basically a connection between an input device and a model, but they can also be made between input and output devices, or models and output devices. Unlike other constraints, you construct your own Relations constraint in a grid.

When you select Relations in the Scene browser, the Constraint settings window displays the Relations pane and the Object browser appears in the Constraint settings.



Relations constraint *A.* **Sender** *B.* **Operator** *C.* **Connector** *D.* **Receiver**

A Relations constraint consists of at least two objects. One object transmits data (Sender) while the other object interprets the sent data (Receiver).

For example, the relation in maps the movement of the mouse to a marker. Between the Sender and Receiver, an Operator converts the numerical data from the mouse to a vector for use by the marker. Operators are used to perform mathematical operations, comparisons, or conversions.

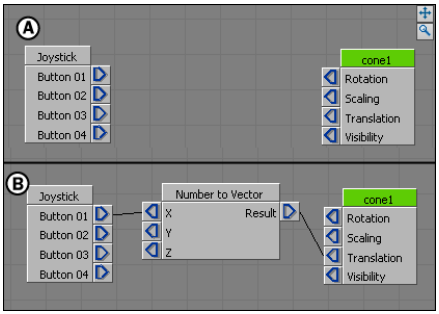
The Sender object can be an input device, such as a mouse, and the Receiver object data can be a model, light, or output device. See Connecting Senders, Operators, and Receivers on page 1140 for information on how to connect input and output boxes.

Conversion relations

Because Relations constraints are mathematical, you cannot connect operators that output different results, such as vectors and numbers.

This would be like trying to perform math functions using musical notes, or trying to spell with numbers. Some translation must occur before you can multiply the number 6 by the note B-flat.

Luckily, to save you time converting all of your operators to universals, MotionBuilder translates these into a common language by automatically inserting a converter between the mismatched operators.



When you try to connect two mismatched operators (*A*), MotionBuilder inserts a translator between them (*B*).

In the previous figure (A), the Joystick operator, which produces a numeric result, is about to be connected to the Cone model, which requires a vector result. When they are connected (B), a Number to Vector converter appears between them.

Creating a Relations constraint

To create a Relations constraint:

1 Drag the Relations constraint asset into the Viewer window from the Asset browser.

The Navigator window displays the Constraint settings, and the constraint is added to the Scene browser.

A new folder named “Constraints” appears in the Scene browser, with the new folder named Relations added, and the Navigator window displays the Relations Constraint settings.

2 Drag operators into the Relations pane from the Object browser.

   You can also Alt-drag materials, objects, and devices from the Scene browser or models from the Viewer window into the Relations pane.

3 Connect the Relations boxes together by clicking the arrow at one end of a constraint box and then clicking another arrow on a constraint box.

   If a converter is needed in order to correctly join the constraint, it is added automatically.

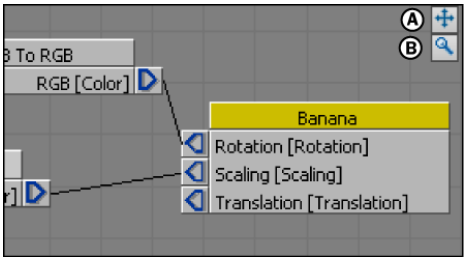
4 Keep dragging boxes into the Relations pane and connecting then until you have the constraint you want.

5 Click Active to activate the constraint.

Navigating the Relations pane

You can scroll and zoom in the Relations pane as you would in the Viewer window.

At the upper right of the Relations pane, there are two buttons you can use to move around the pane, the Travelling button and the Zoom button.



Relations pane Navigation buttons *A.* **Travelling** *B.* **Zoom**

- Dragging the Travelling button lets you pan around the Relations pane. You can also Shift-drag in the Viewer window to pan in the Relations pane. You can also Shift-click and drag to scroll through the pane.
- Dragging the Zoom button lets you zoom in and out of the Relations pane. You can also Ctrl-drag in the Relations pane to zoom. To zoom in on a specific area, Z-click and drag a box around the section you want to expand.
- Creating a Relations constraint on page 1138
- Relations reference on page 1150

Copying and pasting Relations constraints

You can cut, copy, and paste Relations constraint boxes, or entire connected constraints groups, in the Relations pane. You can also copy constraints to be used in a new relation.

To copy and paste Relations constraints:

1. Select a constraint box, or a group of constraints in the Relations pane, and press Ctrl-C to copy.
2. Press Ctrl-V (paste), and a duplicate of the selected constraint or constraint group appears.

NOTE You can only copy constraints using the Keyboard Ctrl-C and Ctrl-V commands.

For more information, see Changing constraint priority on page 1032.

Connecting Senders, Operators, and Receivers

You can connect, sever, or hide connectors on a Relations constraint. You can also set values for Receivers, view values for senders, and switch values from global to local.

When the Relations pane contains all necessary devices, assets, and models for creating a relation, connect the senders, operators, and Receivers. All Relations constraints must start with a Sender and end with a Receiver.

If you are showing values for a Sender, the values are not updated until the Sender is connected to a Receiver.

When you connect two Relations connectors that are different data types (for example, Number and Vector), a conversion relation is automatically created to connect the two Relations constraints.

To show or hide connectors:

1. Right-click in the Relations pane to display a contextual menu concerning all the connectors in the Relations pane.
2. Select Show Value of all Connectors.

   This option shows or hides the values of all connectors.

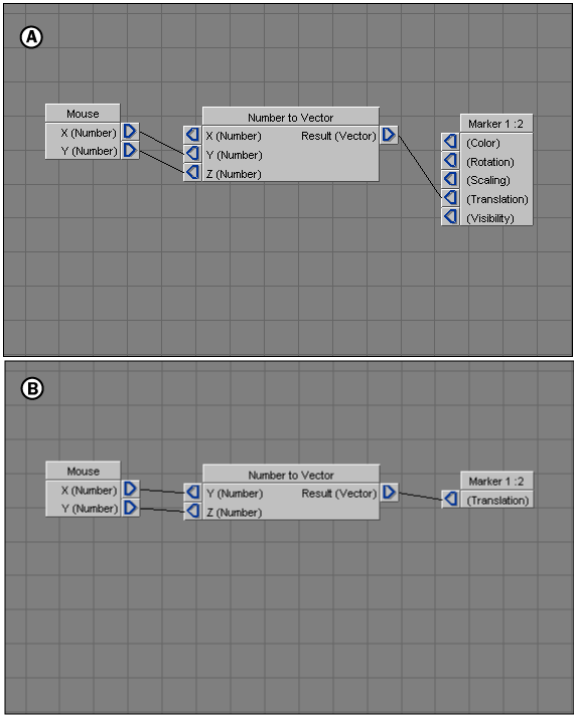
3 Select Hide all Unconnected Connectors.

This option shows or hides any connectors that are not used by the Relations constraints.

To sever connections, right-click either the Sender or the Receiver and select Disconnect from the contextual menu. The white line that displays between connectors disappears and the connection is broken.

Senders and Receivers have many connectors. Often, not all of these connectors are used within a relation.

To hide the unused connectors, right-click the Senders or Receiver's name and select Hide unconnected from the contextual menu to increase the amount of free window space.



Relations constraint *A.* Connectors showing *B.* Connectors hidden.

If you right-click an empty area in the Relations pane you can select an option from a contextual menu to show or hide all unused connectors.

To show the unconnected connectors, right-click the name of the Sender or Receiver that has its connectors hidden and select Show Unconnected.

■ Setting values for Senders and Receivers on page 1144

Creating Macro relations

When you create a new Relations constraint, it is automatically added to the operator's My Macros node. Every relation can be used as a Macro that can be renamed and used in another relation. You can add inputs and outputs to your Macro by selecting operators found in the Macro Tools node.

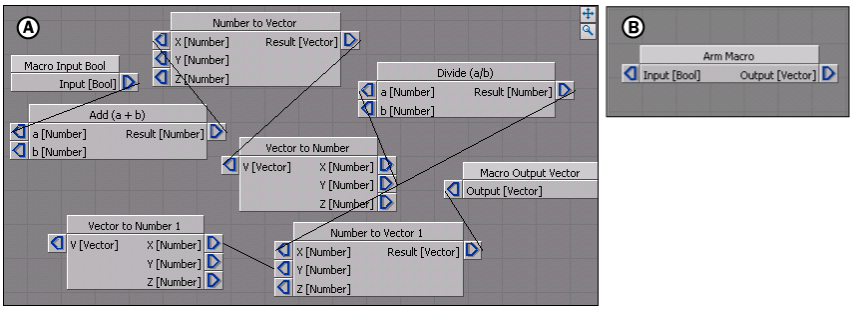
To create Macro relations:

1. In the Operators list, expand My Macros, and drag a Macro into the Relations pane.

   NOTE You must create a relation constraint for Macros to be in the folder.

2. Drag a Macro relation into another relation, a dialog box appears asking if you want to create the relation as a Sender, Receiver, or a Macro.
3. Select Macro to create a Relations constraint box that has both Sender and Receiver inputs and outputs, select Sender to create the Relations constraint box as a Sender that transmits data, or select Receiver to create the Relations constraint box as a Receiver that is influenced by the data transmitted from the Sender.

The Macro becomes a single relation, representing the entire set of constraints within that Macro. All the Input-Output Relations constraints used in your Macro become connectors on that relation.



Macro constraint *A.* A Relations constraint named "Arm Macro" *B.* "Arm Macro" used as a Macro in the Relations pane.

■ Editing Macro relations on page 1143

Editing Macro relations

You can modify a relation used in a Macro constraint by right-clicking it and selecting Edit from the contextual menu.

Edit the full constraint and click Close to return to the Macro constraint's compressed state.

Deleting Macro relations

Remove Macro relations from the Relations pane the same way you would remove any other Relations constraint.

To delete a Macro relation permanently, right-click it in the Scene browser and select Delete from the contextual menu.

If the Macro is being used in a relation, a warning dialog box appears with the message "The relation constraint x is being used by other Relations. Delete all references to this Macro?", where x is the name of the relation.

Select Yes to remove the Macro from all Relations constraints.

If the removal of the Macro creates gaps in a constraint, a conversion relation is automatically created to connect the unconnected Relations constraint.

NOTE Macros cannot be recursive. When you delete a Macro, you can choose to delete every reference to that Macro.

Refreshing Macro relations

You can refresh a Macro constraint to show its latest changes by clicking in an empty space in the Relations pane.

Macros are automatically refreshed every time you exit the Relations constraint editor, even if they have not been modified.

Renaming Macro relations

To change the name of your Macro, return to the Scene browser and double-click the Macro's name. Type the new name in the field and press Enter.

To change the name of a Macro's Input-Output connector, right-click its name and select Rename from the contextual menu.

Macros are automatically refreshed every time you exit the Relations constraint editor, even if they have not been modified.

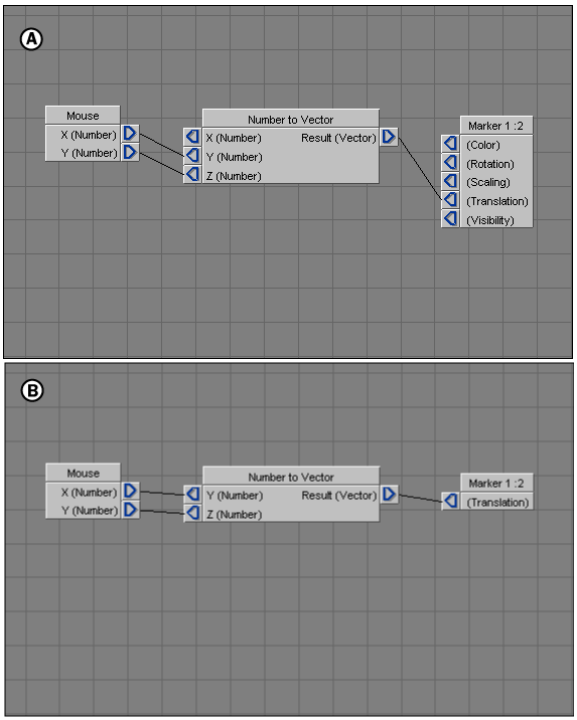
NOTE Macros cannot be recursive. When you delete a Macro, you can choose to delete every reference to that Macro.

Setting values for Senders and Receivers

To set values for Receivers:

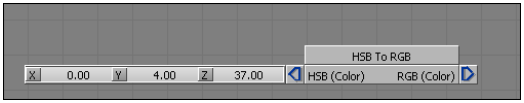
1. Right-click the connector and select Set Value.
2. Double-click the value field to enter a new value from the contextual menu. Set a value for a Receiver when you want a constant input value.

Setting values deletes any connections previously attached to that connector.



Hiding Connectors *A.* **All connectors shown** *B.* **Hide all unused connectors**

To show Sender values, right-click the output connector and select Show Value from the contextual menu. White values appear over the connecting lines and change as objects in your constraint change.

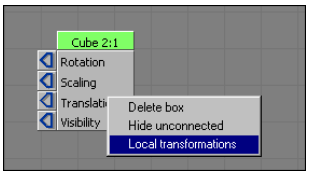


Receiver with values set

When using models in a relation, the values in Relations constraints are expressed in global coordinates (relative to the center of the scene) by default.

You can switch a Sender or Receiver to use local coordinates (relative to its parent).

To do this, right-click the Sender's or Receiver's name and select Local transformations from the contextual menu. The menu item changes to Global transformations which lets you switch to global values.



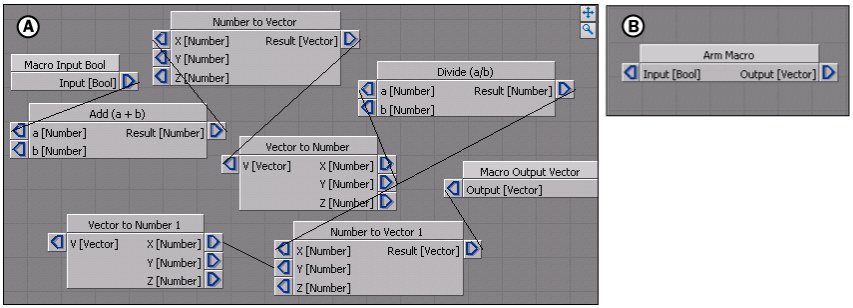
Select Local transformations from the contextual menu

Macro relations

When you create a new Relations constraint, it is automatically added to the operator's My Macros node. Every relation is a Macro that can be renamed and used in another relation. You can add inputs and outputs to your Macro by selecting operators found in the Macro Tools node.

When you drag a Macro relation into another relation, a dialog box appears asking if you want to create the relation as a Sender, Receiver, or a Macro.

Select Macro to create a Relations constraint box that has both Sender and Receiver inputs and outputs, select Sender to create the Relations constraint box as a Sender that transmits data, or select Receiver to create the Relations constraint box as a Receiver that is influenced by the data transmitted from the Sender.



Macro constraint *A.* **A Relations constraint named "Arm Macro"** *B.* **"Arm Macro" used as a Macro in the Relations pane.**

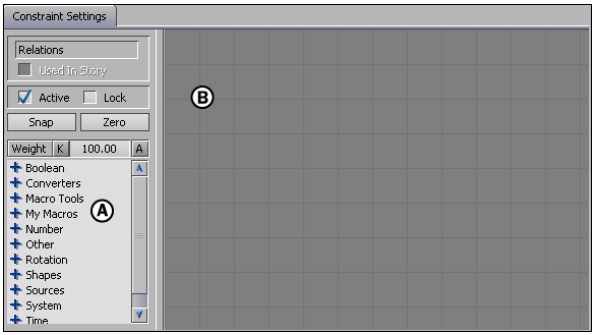
The Macro becomes a single relation, representing the entire set of constraints within that Macro; all the Input-Output Relations constraints used in your Macro become connectors on that relation.

■ Macro relations on page 1146

■ Editing Macro relations on page 1143

Relations constraint Object browser

The Object browser in the Relations pane appears with operators beneath the Constraint settings only when a Relations constraint is selected.



Relations constraint *A*. Object browser *B*. Relations pane

The Object browser lets you insert operators, devices, characters, materials, textures, and shaders that form a Relations constraint when connected.

The Object browser contains the following operators:

Boolean

Lists Boolean operators for evaluating Boolean expressions.

Converters

Lists converters for conversion between numerical and vector types.

Macro Tools

Lists Macro Tools with inputs and outputs for creating customized Macro Relations.

My Macros

Lists any existing Relations constraints. You can rename constraints in the Scene browser, and use the My Macros operator to store your custom Relations.

Number

Lists operators for evaluating mathematical expressions involving numbers.

Other

Lists miscellaneous operators, such as trigger controls and FCurve values.

Rotation

Lists operators used specifically for rotation values.

Shapes

Lists operators for use with models that have shape animations (also known as morph targets).

Sources

Lists operators for creating automatic movement, rotation, and shape animation by providing an oscillating data source.

System

Lists operators so you can use a time code and the play or record state in your Relations.

Time

Lists operators for comparing two different times expressed in either SMPTE time code or frames per second. These operators can be used, for example, to trigger rotations, translation, or animation based on the current time code.

Vector

Lists Vector operators for evaluating vector mathematics and other calculations involving vectors. All translation, rotation, and scaling values for models and assets are expressed as vectors.

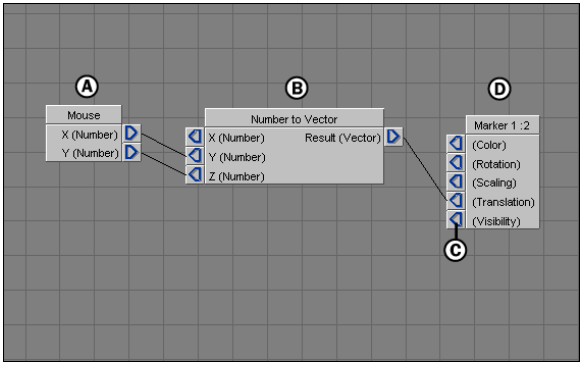
Types of objects used in Relations constraints

The objects used to create a Relations constraint can be broken down into three types:

Senders

A Sender can be an input device or a model. Senders are used to transmit data to operations and Receivers. Senders only send data.

In the following figure, “A” is the mouse Sender, which means that the data used in the constraint is created by the mouse’s X and Y position.



Relations constraint *A.* **Sender** *B.* **Operator** *C.* **Connector** *D.* **Receiver**

Operators

An Operator is an object that performs mathematical operations, comparisons, or conversions. It is placed between a Sender and a Receiver. Operators receive and send data.

In the previous figure, the Operator, “B”, takes the mouse’s Y and Z data and interprets the result into vector information to be read by the marker.

Receivers

A Receiver can be a model or an output device. Receivers receive data transmitted from Operators and Senders. In the previous figure, “D” is the Receiver, in this case a Marker, which moves according to the mouse’s (Sender) position, which is modified by the Operator.

■ Connecting Senders, Operators, and Receivers on page 1140

Relations reference

This section lists the Relations operators supported by MotionBuilder. The list of operators used in a Relations constraint is further divided by numeric type or usage. Operators are shown only in the Relations pane.

Boolean

Use Boolean operators to evaluate Boolean expressions. The following Boolean expressions are supported by MotionBuilder:

AND	
Purpose	Evaluates the Boolean expression (a and b).
Receives	Two Boolean values.
Sends	(1) when both (a) and (b) equal (1). Otherwise, (0) is sent.(a)(b)(Result) 000 010 100 111.

Flip flop	
Purpose	This is a special box that acts like a switch.
Receives	Two Boolean values, (b) and (Clear).
Sends	When (b) is equal to (1) the (result) is reversed (0). For example, the first time (b) equals (1) the (result) is (1). The second time the (result) is (0). The third time the (result) is (1), and so on.When (Clear) equals (1), (result) is reset to (0).

Memory (B1 when REC)	
Purpose	Boolean trigger operator which keeps triggering while a second trigger is received.
Receives	Two Boolean values, (b1) and (REC).

Memory (B1 when REC)	
Sends	The value (b1) is sent to (result) when (REC) equals (1).

Memory (last trigger)	
Purpose	Boolean trigger operator which keeps the last trigger until a new trigger is received.
Receives	Ten Boolean values: (b1-b10) and (Clear).
Sends	Ten Boolean output values (Out1-Out10) and a result number.When any (bn) is set to (1), its relative (Outn) is set to (1) and kept until another (bn) receives a (1).If any (Outn) equals (1), (result) equals (1).When (Clear) equals (1), all (Outn) are reset to (0).If you need to use more than ten entry connectors, you can connect two of these operators together by sending the (result) of the first operator into the (Clear) of the second operator. You also have to connect the (Clear) of the second into the (result) of the first.

NAND	
Purpose	Evaluates the Boolean expression not ((a) and (b)).
Receives	Two Boolean values.
Sends	(0) when (a) and (b) equals (1). Otherwise, (1) is sent.(a) (b) (Result) 0 0 1 0 1 1 1 0 1 1 1 0

NOR	
Purpose	Evaluates the Boolean expression not ((a) or (b)).
Receives	Two Boolean values.

NOR	
Sends	(0) when (a) or (b) equals (1).(a) (b) (Result) 0 0 1 0 1 0 1 0 0 1 1 0

NOT	
Purpose	Evaluates the Boolean expression not (a).
Receives	A Boolean value.
Sends	The opposite of (a). (a) (Result) 0 1 1 0.

OR	
Purpose	Evaluates the Boolean expression (a or b).
Receives	Two Boolean values.
Sends	(1) when (a) or (b) equals (1). (a) (b) (Result) 0 0 0 0 1 1 1 0 1 1 1 1.

XNOR	
Purpose	Evaluates the Boolean expression (a is equivalent to b).
Receives	Two Boolean values.
Sends	(0) when (a) and (b) are different.(a) (b) (Result) 0 0 1 0 1 0 1 0 0 1 1 1.

XOR	
Purpose	Evaluates the Boolean expression not (a is equivalent to b).
Receives	Two Boolean values.
Sends	(1) when (a) and (b) are different.(a) (b) (Result) 0 0 0 0 1 1 1 0 1 1 1 0.

Converters

Use converters to convert between numerical and vector types. MotionBuilder supports the following converters:

Deg to rad	
Purpose	Converts an angle from a degree to a radian.
Receives	A numerical value.
Sends	A numerical value.

HSB to RGB	
Purpose	Converts HSB to RGB mode.
Receives	Three numerical values (h), (s), and (b), where h = hue, s = saturation, and b = brightness.
Sends	Three numerical values: (x), (y), and (z).

Number to RGBA	
Purpose	Converts four numbers into a color vector.
Receives	Four numerical values: (r), (g), (b), and (a).
Sends	A color vector as (result) = {r,g,b,a}. Where (r) = red, (g) = green, (b) = blue, and (a) = alpha.

Number to vector	
Purpose	Converts three numbers into a vector.
Receives	Three numerical values: (x), (y), and (z).

Number to vector	
Sends	A vector as (result) = {x,y, z}.

Rad to deg	
Purpose	Converts representation from a radian to a degree.
Receives	A numerical value.
Sends	A numerical value.

RGB to HSB	
Purpose	Converts RGB to HSB mode.
Receives	Three numerical values: (x), (y), and (z).
Sends	Three numerical values (h), (s), and (b), where h = hue, s = saturation, and b = brightness.

RGB to RGBA	
Purpose	Converts RGB to RGBA with Alpha channel mode.
Receives	Three numerical values: (r), (g) and (b).
Sends	Four numerical values: (r), (g), (b), and (a).

RGBA to number	
Purpose	Converts a color vector into four numbers.
Receives	A color vector: {r, g, b, a}.

RGBA to number	
Sends	Four numerical values (r), (g), (b), and (a) where (r) = red, (g) = green, (b) = blue, and (a) = alpha.

RGBA to RGB	
Purpose	Converts RGB with Alpha channel to RGB mode.
Receives	Four numerical values: (r), (g), (b), and (a).
Sends	Three numerical values: (r), (g) and (b).

Seconds to Time	
Purpose	Converts a number of seconds to a time format.
Receives	Number of seconds.
Sends	Time in time format.

Time to Seconds	
Purpose	Converts time to a number of seconds.
Receives	Time in time format.
Sends	Number of seconds.

Vector to Number	
Purpose	Converts a vector into three numbers.
Receives	A vector: {x, y, z}.
Sends	Three numerical values: (x), (y), and (z).

Macro Tools

Use the Macro Tools to create customized relation boxes. Any input and output boxes you drop into your Macro become connectors on your customized Relations box.

Change the name of your connectors by right-clicking the input or output boxes, and selecting Rename from the contextual menu

Macro Input Bool	
Sends	Input (Boolean).

Macro Input ColorAndAlpha	
Sends	Input (ColorAndAlpha).

Macro Input Number	
Sends	Input (number).

Macro Input Time	
Sends	Input (time).

Macro Input Vector	
Sends	Input (vector).

Macro Output Bool	
Receives	Output (Boolean).

Macro Output ColorAndAlpha	
Receives	Output (ColorAndAlpha).

Macro Output Time	
Receives	Output (time).

Macro Output Vector	
Sends	Output (vector).

My Macros

Any new Relations constraint you create appears in the My Macros operators. You can rename the constraint in the Scene browser and use the My Macros operator to store your custom Relations constraints.

Drag custom Macro constraints from Operators into the Viewer window. For more on macros, see Creating Macro relations on page 1142.

Number

The Number operators evaluate mathematical expressions involving numbers. If you want to evaluate vector mathematics, use the appropriate rotation or vector operator.

Absolute (|a|)	
Purpose	Sends the absolute value of a received number.
Receives	A numerical value: (a).
Sends	The positive value of the received number.For example, if (a) = -3, the (result) is 3.

Add (a + b)	
Purpose	Adds two numbers.
Receives	Two numbers: (a) and (b).
Sends	The sum of the two numbers. (result) = (a) + (b).

arccos (a)	
Purpose	Performs the arccosine function on a numerical value.
Receives	A numerical value: (a).

arccos (a)	
Sends	The arccosine of a. (result) = arccos(a).

arcsin (a)	
Purpose	Performs the arcsine function on a numerical value.
Receives	A numerical value (a).
Sends	The arcsine of a. (result) = arcsin(a).

arctan (a)	
Purpose	Performs the inverse of a tangent function.
Receives	A numerical value: (a).
Sends	The inverse tangent of (a).

arctan2 (b/a)	
Purpose	Performs the arctangent function using two numerical values.
Receives	Two numerical values: (a) and (b).
Sends	The arctangent of (b) divided by (a). (result) = arctan(b/a).

Cosine cos (a)	
Purpose	Performs the cosine function on a numerical value.
Receives	A numerical value: (a).

Cosine cos (a)	
Sends	The cosine of a. (result) = cos(a).

Damp	
Purpose	Applies damping to a numerical value.
Receives	Two numerical values. The first value (a) is the value to be damped. The second value (Damping Factor) is the damping factor.
Sends	(result) = (a) with damping.

Damp (clock-based)	
Purpose	Similar to Damp, except this relation is based on the MotionBuilder clock instead of the refresh rate. This relation is recommended over the Damp relation, as it makes your scene identical on every computer.
Receives	A (number), Damping Factor (number) and Play Mode (number).
Sends	Result (number).

Distance Numbers	
Purpose	Calculates the distance between two positions.
Receives	Two numbers: (a) and (b).
Sends	The distance between (a) and (b).

Divide (a/b)	
Purpose	Divides two numbers.
Receives	Two numerical values: (a) and (b).

Divide (a/b)	
Sends	The quotient of the first number (a) divided by the second number (b). (result) = (a/b).

Exp (a)	
Purpose	Multiplies the base value [e] by itself (a) times. [e=2.718].
Receives	A numerical value: (a).
Sends	(result) = (e^a). For example (e^2) is 2.718 x 2.718 = 7.3875.

Exponent (a^b)	
Purpose	Multiplies the numerical value (a) by itself (b) times.
Receives	Two numerical values: (a) and (b).
Sends	(result) = (a^b), or (a) to the power of (b).

If Cond Then A Else B	
Purpose	Evaluates an If, Then, Else statement.
Receives	Two numerical values: (a) and (b), and a condition: (bool).
Sends	If Cond is non-zero, the (a) input is output as the Result. If the Cond is zero, the (b) input is output as the Result.

Integer	
Purpose	Rounds numerical values down to the next full digit.
Receives	A numerical value: (a).

Integer	
Sends	The numerical value rounded down to the next full digit.

Invert (1/a)	
Purpose	Inverts a numerical value.
Receives	a numerical value (a).
Sends	1 divided by a numerical value. (result) = (1/a).

Is between A and B	
Purpose	Checks if one value is between two others.
Receives	Two numerical values: (a) and (b).
Sends	(result) = true (1) if the first value (a) is between the second value (b). Otherwise, (result) is false (0).

Is different (a != b)	
Purpose	Checks if two values are not equal.
Receives	Two numerical values: (a) and (b).
Sends	(result) = true (1) if the first value (a) is not equal to the second value (b). Otherwise, (result) is false (0).

Is greater (a > b)	
Purpose	Checks if one value is greater than another.
Receives	Two numerical values: (a) and (b).

Is greater (a > b)	
Sends	(result) = true (1) if the first value (a) is greater than the second value (b). Otherwise, (result) is false (0).

Is greater or equal (a >=b)	
Purpose	Checks if one value is greater than or equal to another.
Receives	Two numerical values: (a) and (b).
Sends	(result) = true (1) if the first value (a) is greater than or equal to the second value (b). Otherwise, (result) is false (0).

Is identical (a == b)	
Purpose	Checks if two values are equal.
Receives	Two numerical values: (a) and (b).
Sends	(result) = true (1) if the first value (a) is equal to the second value (b). Otherwise, (result) is false (0).

Is less (a < b)	
Purpose	Checks if one value is less than another.
Receives	Two numerical values: (a) and (b).
Sends	(result) = true (1) if the first value (a) is less than the second value (b). Otherwise, (result) is false (0).

Is less or equal (a <= b)	
Purpose	Checks if one value is less than or equal to another.

Is less or equal (a <= b)	
Receives	two numerical values: (a) and (b).
Sends	(result) = true (1) if the first value (a) is less than or equal to the second value (b). Otherwise, (result) is false (0).

ln(a)	
Purpose	Calculates the natural logarithm.
Receives	A numerical value: (a).
Sends	The natural logarithm of (a). (result) = ln(a).

Log(a)	
Purpose	Calculates the base-10 logarithm of a number.
Receives	A numerical value: (a).
Sends	The base-10 logarithm of (a). (result) = log(a).

Max Pass-thru	
Purpose	Given a set of numbers, returns the maximum number.
Receives	Multiple numerical values.
Sends	The maximum value of the inputs.

Memory (a when REC)	
Purpose	The value (a) is sent to (result) when (REC) equals (1). Use this operator to send a value when a trigger is received (REC).

Memory (a when REC)	
Receives	A numerical value: (a) and a Boolean value: (REC which is either 0 or 1).
Sends	(a) when (REC) is true (1).

Min Pass-thru	
Purpose	Given a set of numbers, returns the minimum number.
Receives	Multiple numerical values.
Sends	The minimum value of the inputs.

Modulo mod (a,b)	
Purpose	Divides two values and sends the remainder.
Receives	Two numerical values: (a) and (b).
Sends	The quotient of dividing the first value (a) by the second value (b).

Multiply (a)(b)	
Purpose	Multiplies two values.
Receives	Two numerical values: (a) and (b).
Sends	The product of multiplying the first value (a) by the second value (b). (result) = (a)(b).

Precision numbers	
Purpose	Cuts the number at a specified precision value, for example, if a = 12.36 and the assigned precision value is 0.1, then the output is 12.30.

Precision numbers	
Receives	(a)(number) and Precision (number).
Sends	Result (number).

Pull number	
Purpose	Continuously pulls the value from the input parameter and stores the result in the internal buffer, which is then used as the Result value. Gives you the value of the last evaluation, which is useful if you need to constrain an object with its own data.
Receives	(a)(number)
Sends	Result (number)

Scale and offset (Number)	
Purpose	Scales and offsets a numerical value.
Receives	Five numerical values: a maximum clamping number (Clamp Max), a minimum clamping number (Clamp Min), an offset (Offset), a scaling factor (Scale Factor), and the original value (x).
Sends	The original value (x) multiplied by the scaling factor (Scale Factor) and offset by an offset value (Offset). If the result is greater than the maximum clamping value (Clamp Max), the maximum clamping value is sent.If the result is lower than the minimum clamping value (Clamp Min), the minimum clamping value is sent. (result) = [(x) multiplied by (Scale) + (Offset)].

Scale and offset (Number)	
	(result) is no less than (Clamp Min) and no greater than (Clamp Max).

Sine sin(a)	
Purpose	Performs the sine function on a numerical value.
Receives	A numerical value: (a).
Sends	The sine of (a). (result) = sin(a).

sqrt(a)	
Purpose	Finds the square root of a numerical value.
Receives	A numerical value: (a).
Sends	The square root of the received value. (result) = sqrt(a).

Subtract (a-b)	
Purpose	Subtracts two numerical values, (a) and (b).
Receives	Two numerical values: (a) and (b).
Sends	The result of the first number subtracted by the second number. (result) = (a) - (b).

Sum 10 numbers	
Purpose	Adds 10 to a numerical value.
Receives	Ten numerical values: (a),(b),(c),(d),(e),(f),(g),(h),(i),(j).

Sum 10 numbers	
Sends	Numerical value + 10. (result) = (a)+10.

Tangent tan(a)	
Purpose	Performs the tangent function on a numerical value.
Receives	A numerical value: (a).
Sends	The tangent of (a). (result) = tangent(a).

Triggered delay (Number)	
Purpose	Delays sending a numerical value.
Receives	A delay in time format, the number to be sent following the delay, a panic button, and an "Enabled" button that starts the counter.
Sends	The received number after a time delay, which starts counting when the box is enabled. Trigger the panic button to send the number before the time delay is reached.

Triggered Delay with Memory (Number)	
Purpose	Delays sending a numerical value.
Receives	A delay in time format, the number to be sent following the delay, and a toggle switch.
Sends	The received number after a time delay.

Other

These are miscellaneous operators.

Bezier curve	
Purpose	Creates spline behavior, like “Paths” in other 3D applications.One box creates one segment if a spline.Join multiple boxes to create a spline with many segments. Four objects are required to serve as control points.
Receives	Four translations (Control points 1-4 and previous segment’s result), Position ratio (0-100%. Represents the position on the curve sent to the result. If you use multiple segments connected to the same source value for every bezier curve boxes), Segment count (the number of segments, or Bezier curve boxes, used), and Segment index (the order of this box when used in a series of segments, starting at 1.
Sends	Result (Number)

Clip trigger	
Receives	Three translations (Front, Source, and Target) and a Stop Range.
Sends	Accel, Decel, Forward, Left 45, Left 90, Right 45, Right 90, Turn 180.

Damping (3D)	
Purpose	Damps the position of a vector using a specified damping factor.
Receives	A numerical damping factor (Damping Factor) and the vector to be dampened (P).

Damping (3D)	
Sends	A vector after applying damping.

Damp (3D) (Clock-based)	
Purpose	Similar to Damp (clock-based), except this relation is based on the Damp (3D) relation.
Receives	P (Point), Damping Factor (Number) and Play Mode (Number).
Sends	Result (Number).

FCurve number (%)	
Purpose	Right-click and select Edit from the contextual menu to edit the FCurve manually. Shown as a percentage relative to the length of the curve.
Receives	Percentage 0-100% (number).
Sends	Value (number).

FCurve number (Time)	
Purpose	Right-click and select Edit from the contextual menu to edit the FCurve manually. Sends a value relative to the current time.
Receives	Position % (number).
Sends	Value (number).

Triggered plus minus counter	
Purpose	Creates a trigger to add the increment/decrement. (You must specify the value of the increment/decrement.) Also contains a Loop option.

Triggered plus minus counter	
Receives	Increment, Max, Min (numbers) and Loop, Trigger Increase, Trigger Decrease (Boolean).
Sends	Number. (result) = (a)+ or (a)-.

Triggered random	
Purpose	Generates a random number on demand.
Receives	Max, Min, Precision, Seed (number) and Trigger Get Number (Boolean.)
Sends	Number.

Rotation

The Rotation operators are used specifically for rotation values. All rotation values are vectors.

Add (R1 + R2)	
Purpose	Adds two rotation vectors together.
Receives	Two rotation vectors: (Ra) and (Rb).
Sends	A vector sum. (result) = (Ra) + (Rb).

Angle difference (Points)	
Purpose	Calculates the angle between two vectors, or points, using a supplied radius.
Receives	Two vectors for the position of each point: (P1) and (P2), and the radius (Radius).

Angle difference (Points)	
Sends	The angle as a numerical value.

Angle difference (Rotations)	
Purpose	Calculates the difference between the rotation of two objects. The result can be scaled and offset.
Receives	The scaling factor (Mult. Factor) and numerical offset (Offset) followed by the two rotations to be compared (R1 and R2).
Sends	The angle difference between the two rotations, scaled and offset.

Angular acceleration	
Purpose	Returns the angular acceleration of a rotation vector.
Receives	Rotation value (R).
Sends	Result (vector).

Angular speed	
Purpose	Returns the angular speed of a rotation vector.
Receives	Rotation value (R).
Sends	Result (vector).

Damp (Rotation)	
Purpose	Applies damping to a rotation vector.
Receives	Damping (number), Maximum acceleration (Max acc), Maximum speed (Max speed), and rotation vector (R).

Damp (Rotation)	
Sends	Dampened rotation vector.

Global to local	
Purpose	Converts a rotation vector from global to local coordinates.
Receives	A base rotation vector (Base) and a Global rotation vector (Global Rot).
Sends	The converted local rotation.

Interpolate	
Purpose	Interpolates between two rotations.
Receives	A numerical ratio (c) and two rotation vectors: (Ra) and (Rb).
Sends	The difference between rotation vectors (Ra) and (Rb). The difference is sent as a vector. (result) = (Ra) + c[(Rb) - (Ra)].

Local to global	
Purpose	Converts a rotation vector from local to global coordinates.
Receives	A base rotation vector (Base), and Local rotation vector (Local Rot).
Sends	The converted global rotation.

Rotation scaling	
Purpose	Scales a rotation vector based on a numerical ratio.
Receives	A numerical ratio (b) and the rotation vector to be scaled (Ra).

Rotation scaling	
Sends	A scaled rotation vector. (result) = (b)(Ra).

Sensor rotation helper	
Receives	A rotation vector from the model (Model), a rotation offset (Offset), the rotation vector from the sensor (Sensor), and a numerical scaling factor for each coordinate (X factor, Y factor, and Z factor).
Sends	A rotation vector.

Subtract(R1 - R2)	
Purpose	Subtracts two rotation vectors.
Receives	Two rotation vectors: (Ra) and (Rb).
Sends	The result of the first rotation vector subtracted by the second rotation vector. (result) = (Ra) - (Rb).

Three-point constraint	
Purpose	Creates a rotation from three vectors.
Receives	Three position vectors: (Pa, Pb, and Pc).
Sends	A rotation vector based on the three received vectors.

Shapes

Shape operators are special operators for use with models that have shape animations (also known as morph targets).

Select exclusive	
Purpose	Calculates the shape's values relative to the ratio (percent / [SUM shape n]) only when [SUM shape n] is greater than (Percent).

Select exclusive	
Receives	A percentage (Percent) and six shapes as well as a Default Shape.
Sends	Result (shapes) = (percent / [SUM shape n]) x (shape n). Result (Default Shape) = (percent - [SUM shape n]).For example, (percent = 80), (Shape 1= 60), (Shape 2= 50) and (Shape 3= 90). Result is (Shape 1= 24), (Shape 2= 20) and (Shape 3= 36).

Select exclusive 24	
Purpose	Same as Select exclusive, except it offers twenty-four shapes.
Shape calibration	Calculates the percentage of a value interpolated between a minimum and a maximum value.
Receives	A maximum numerical value (Max), a minimum numerical value (Min), a Boolean reverse value (0 or 1), and the value to be calibrated (Value).
Sends	A percentage. If (reverse) is 1, the result is reversed. (result) = 100 - (result).

Sources

You can use source operators to create automatic movement, rotation, and shape animation by providing an oscillating data source. For example, the Sine Ramp creates a sine wave that can be used to make a model's eyes blink.

Counter with play pause	
Purpose	Similar to Counter with Start Stop, this source operator also lets you create a counter.
Receives	Bounce (bool), Loop (number), Max (number), Min (number), Play Mode, Speed, Trigger (Bool), and Trigger Reset.

Counter with play pause	
Sends	Count (number). The counter begins counting when the Trigger connector receives a non-zero value. The counter increases from the Start value to the Stop value.If the Bounce connector is set to true (1), the counter decreases back to the Start value. Use the Freq value to set the number of times the count is performed.

Counter with start stop	
Purpose	This source operator lets you create a counter.
Receives	Bounce (bool), Freq (number), Start (number), Stop (number), and Trigger (Bool).
Sends	Count (number).The counter begins counting when the Trigger connector receives a non-zero value.The counter increases from the Start value to the Stop value. If the Bounce connector is set to true (1), the counter decreases back to the Start value. Use the Freq value to set the number of times the count is performed.

Half circle ramp	
Purpose	Applies the input values to a half circle ramp.
Receives	Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %).

Half circle ramp	
Sends	A half circle ramp based on the received amplitude, frequency, and phase percentage.

Isosceles triangle ramp	
Purpose	Applies the input values to an isosceles triangle ramp.
Receives	Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %).
Sends	An isosceles triangle ramp based on the received amplitude, frequency, and phase percentage.

Pulse	
Purpose	Sends an alternating stream of zeroes and ones at the specified frequency. For example: 010101010101. Use the Enabled connector to activate and disable the Pulse constraint.
Receives	Enabled (Bool), Freq Hz (number), Play Mode.
Sends	Result (number).

Ramp	
Purpose	Applies the input values to a ramp.
Sends	A numerical count. Starts at zero when the Ramp operator is first added to the Rela-

Ramp	
	tions window and continues counting upwards.

Random	
Purpose	Creates a stream of random numbers at a specified frequency.
Receives	Freq, Max, Min, Play Mode, Precision, Seed (number).
Sends	Result (number).

Right triangle ramp	
Purpose	Applies the input values to a right triangle ramp.
Receives	Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %).
Sends	A right triangle ramp based on the received amplitude, frequency, and phase percentage.

Sine ramp	
Purpose	Applies the input values to a sine ramp.
Receives	Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %).
Sends	A sine wave ramp based on the received amplitude, frequency, and phase percentage.

Square ramp	
Purpose	Applies the input values to a square ramp.

Square ramp	
Receives	Three numerical values: the amplitude (Amp), frequency (Freq), and phase percentage (Phase %).
Sends	A square wave ramp based on the received amplitude, frequency, and phase percentage.

System

System operators let you use a time code and the play or record state in your Relations constraints.

Current time	
Purpose	Uses the current time code.
Sends	The current time code.

Local time	
Purpose	Uses the local time code.
Sends	The local time code shown in the Local Time code field.

Play Mode	
Purpose	Verifies that MotionBuilder is in playback mode.
Sends	A Boolean value: true (1) if MotionBuilder is in playback mode. Otherwise, sends false (0).

Reference Time	
Purpose	Uses the reference time code.

Reference Time	
Sends	The reference time code shown in the Reference Time code field.

System Time	
Purpose	Uses the computer's system clock.
Sends	The system time in SMPTE time code.

Transport Control	
Purpose	Acts like buttons on the Transport Controls.
Receives	Play (Bool), Play Backward (Bool), Record (Bool), Step Forward (Bool), Step Backward (Bool), Goto Beginning (Bool), Goto End (Bool), Goto Position Trigger (Bool), and Goto Position Value (Time).
Sends	Play (Bool), Play Backward (Bool), and Record (Bool).

Time

Use the Time operators to compare two different times expressed in either SMPTE time code or frames per second. These operators can be used, for example, to trigger rotations, translation, or animation based on the current time code.

If Cond Then T1 Else T2	
Purpose	Evaluates an If, Then, Else statement based on Time (T1).
Receives	Three values: Cond (bool) and T1 and T2 (Time).

If Cond Then T1 Else T2	
Sends	If Cond is non-zero, the (T1) input is output as the Result. If the Cond is zero, the (T2) input is output as the Result.

Is Different (T1!= T2)	
Purpose	Checks if Time (T1) is different than (T2).
Receives	Two time values: (T1) and (T2), measured in frames per second or SMPTE.
Sends	A Boolean value: true (1) if (T1) does not equal (T2) and sends false (0) if (T1) equals (T2).

Is Greater (T1 > T2)	
Purpose	Checks if Time (T1) is greater than (T2).
Receives	Two time values: (T1) and (T2), measured in frames per second or SMPTE.
Sends	A Boolean value: True (1) if (T1) is greater than (T2) or sends false (0) if (T1) is less than or equal to (T2).

Is Greater or Equal (T1 >= T2)	
Purpose	Checks if Time (T1) is greater than or equal to (T2).
Receives	Two time values: (T1) and (T2), measured in frames per second or SMPTE.

Is Greater or Equal (T1 >= T2)	
Sends	A Boolean value: True (1) if (T1) is greater than and equal to (T2) or sends false (0) if (T1) is less than (T2).

Is Identical (T1 == T2)	
Purpose	Checks if Time (T1) is equal to (T2).
Receives	Two time values: (T1) and (T2), measured in frames per second or SMPTE.
Sends	A Boolean value: True (1) if (T1) is equal to (T2) or sends false (0) if (T1) does not equal (T2).

Is Less (T1 < T2)	
Purpose	Checks if Time (T1) is less than (T2).
Receives	Two time values: (T1) and (T2), measured in frames per second or SMPTE.
Sends	A Boolean value: True (1) if (T1) is less than (T2) or sends false (0) if (T1) is greater than or equal to (T2).

Is Less or Equal (T1 <= T2)	
Purpose	Checks if Time (T1) is less than or equal to (T2).
Receives	Two time values: (T1) and (T2), measured in frames per second or SMPTE.
Sends	A Boolean value: true (1) if (T1) is less than or equal to (T2). Sends false (0) if (T1) is greater than (T2).

Vector

The Vector operators evaluate vector mathematics and other calculations involving vectors. All translation, rotation, and scaling values for models and assets are expressed as vectors.

Acceleration	
Purpose	Calculates the acceleration of a vector (Position) based on how fast the vector's values change over time. You can use this operator to calculate, for example, how fast an object is translated or rotated.
Receives	A vector (Position).
Sends	A vector indicating the acceleration of the supplied vector (Position).

Add (V1 + V2)	
Purpose	Adds two vectors.
Receives	Two vectors: (V1) and (V2).
Sends	Sum of two vectors. (result) = (V1) + (V2).

Angle	
Purpose	Creates the angle between two vectors (expressed in degrees).
Receives	Two vectors (V1) (V2).
Sends	Number. (result) = (V1) - (V2).

Center of Mass	
Purpose	Computes the center of a set of vectors (expressed as 3D space coordinates).
Receives	Two vectors (V1) (V2).

Center of Mass	
Sends	Computed center point (average) as a vector.

Damp position	
Purpose	Applies damping to a position vector.
Receives	A numerical damping factor (Damping), a numerical maximum acceleration (Max acc), a numerical maximum speed (Max speed), and a position vector (T).
Sends	Dampened vector.

Derive	
Purpose	Derive with reset. The Reset connector only accepts Boolean values (either 0 or 1). Send 1 to the Reset connector to reset the Derive operator to its original vector (Initial Vector).
Receives	Reset (Bool), V1 (Initial vector), and V2 (vector).
Sends	A vector derived from the two vectors. If the Reset (bool) connector is sent a 1, Derive is reset to its original vector (Initial Vector).

Determinant	
Purpose	Gives the determinant of a 3x3 column (I, J, K) matrix.
Receives	Three vectors: I, J, and K.

Determinant	
Sends	A number.

Distance	
Purpose	Calculates the distance between two positions.
Receives	Two vectors: (V1) and (V2).
Sends	The distance between the two vectors, expressed as a numerical value.

Dot product (V1 . V2)	
Purpose	Calculates the dot product of two vectors.
Receives	Two vectors: (V1) and (V2).
Sends	Dot product of two vectors, expressed as a numerical value. (result) = (V1). (V2).

Gravity	
Purpose	Returns a position.
Receives	Three vectors: (Acceleration, Position and Speed).
Sends	A number. (result)= (a)(b)(c).

If cond then A else B	
Purpose	Evaluates an If, Then, Else statement.
Receives	Two vectors: (a) and (b), and a condition (bool).
Sends	If Cond is non-zero, the first vector (a) is output as the Result. If the Cond is zero,

If cond then A else B	
	the second vector (b) is output as the Result.

Is different (V1 != V2)	
Purpose	Checks if vector (V1) is different than vector (V2).
Receives	Two time values: (V1) and (V2), measured in frames per second or SMPTE.
Sends	A Boolean value: True (1) if (V1) does not equal (V2) and sends false (0) if (V1) equals (V2).

Is identical (V1 == V2)	
Purpose	Checks if vector (V1) is equal to vector (V2).
Receives	Two time values: (V1) and (V2), measured in frames per second or SMPTE.
Sends	A Boolean value: True (1) if (V1) is equal to (V2) and sends false (0) if (V1) does not equal (V2).

Length	
Purpose	Calculates the distance between a vector and the world zero point.
Receives	A vector: (V1).

Length	
Sends	The distance between the vector and the world zero point, expressed as a numerical value.

Memory (V1 when REC)	
Purpose	Use this operator to send a vector when a trigger is received (REC).
Receives	]A vector (V1) and a Boolean value (REC, which is either 0 or 1).
Sends	(result) = (V1) when (REC) is true (1).

Middle point	
Purpose	Interpolates between two vectors relative to a given ratio.
Receives	Two vectors: (V1) and (V2), and a ratio (Ratio) between 0 and 1.
Sends	An interpolated vector. (result) = V1 + ratio[(V2) - (V1)].

Normalize	
Purpose	Normalizes a vector.
Receives	A vector.
Sends	A normalized vector where each coordinate is normalized between 0 and 1.

Orbit attraction	
Purpose	Returns a position.
Receives	A number (Acceleration) and three vectors: (Origin, Position, and Speed.)

Orbit attraction	
Sends	A vector. (result)= (a)(b)(c)(d).

Precision vectors	
Purpose	Use this constraint to apply a precise value to every component of the vector: X, Y, and Z can each have different precision values.
Receives	A (number) and Precision (number).
Sends	Result (number).

Pull vector	
Purpose	Continuously pulls the value from the input parameter and stores it in the internal buffer, which is then used as the Result value. This gives you the value of the last evaluation. This is useful when you need to constrain an object with its own data.
Receives	V (Vector).
Sends	Result (Vector).

Scale (a x V)	
Purpose	Scales a vector by a numerical value.
Receives	A scaling factor (number) and a vector (Vector).
Sends	The scaled vector. (result) = (number) x (Vector).

Scale and offset (Vector)	
Purpose	Scales and offsets a vector.

Scale and offset (Vector)	
Receives	A maximum clamping vector (Clamp Max), a minimum clamping vector (Clamp Min), an offset vector (Offset), a scaling factor expressed as a numerical value (Scale), and the original vector (x).
Sends	The original vector (x) multiplied by the scaling factor (Scale) and offset by the offset vector (Offset).If the result is greater than the maximum clamping vector (Clamp Max), the maximum clamping vector is sent. If the result is lower than the minimum clamping vector (Clamp Min), the minimum clamping vector is sent. (result) = (x) multiplied by [(Scale Factor) + (Offset)]. (result) is no less than (Clamp Min) and no greater than (Clamp Max).

Scale damping	
Purpose	Applies damping to a scaling vector.
Receives	A numerical damping factor (Damping), a numerical maximum acceleration (Max acc), a numerical maximum speed (Max speed), and a scaling vector (S).
Sends	A scaled vector with damping.

Speed	
Purpose	Calculates the speed of a vector based on its change of position over time.
Receives	A vector (Position).

Speed	
Sends	The speed of the vector expressed as a vector (Translation).

Subtract (V1 - V2)	
Purpose	Subtracts two vectors.
Receives	Two vectors: (V1) and (V2).
Sends	The result of the first vector subtracted by the second vector. (Result) = (V1) - (V2).

Sum 10 vectors	
Purpose	Adds 10 to a numerical value.
Receives	Ten vectors: (a),(b),(c),(d),(e),(f),(g),(h),(i),(j).
Sends	Vector + 10. (result) = (a)+10.

Triggered delay (Vector)	
Purpose	Delays sending a vector value.
Receives	A delay in time format, the vector to be sent following the delay, a panic button, and an "Enabled" button that starts the counter.
Sends	The received vector after a time delay, which starts counting when the box is enabled.Trigger the panic button to send the vector before the time delay is reached.

Triggered delay with memory (Vector)	
Purpose	Delays sending a vector value.

Triggered delay with memory (Vector)	
Receives	A delay in time format, the vector to be sent following the delay, and a toggle switch.
Sends	The received vector after a time delay.

Vector product (V1 x V2)	
Purpose	Multiplies two vectors.
Receives	Two vectors: (V1) and (V2).
Sends	The product of two vectors. (result) = (V1) x (V2).

Rigid Body constraint

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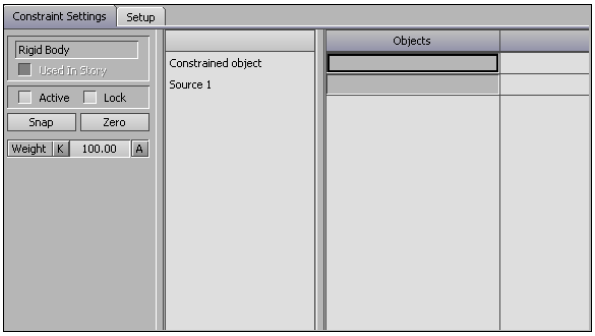
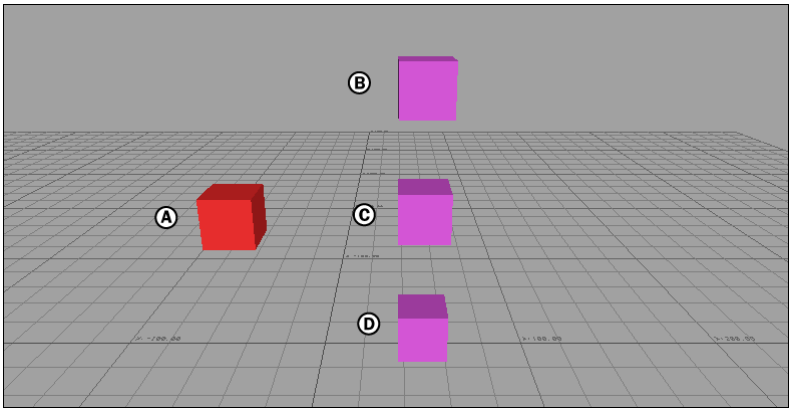
The Rigid Body constraint creates a Rigid body using the specified sources. This is the same as creating Rigid bodies in the Optical settings, only the constrained object is placed at the center of the source objects. The positions of two or more objects are used to adjust the translation and rotation of a constrained object.



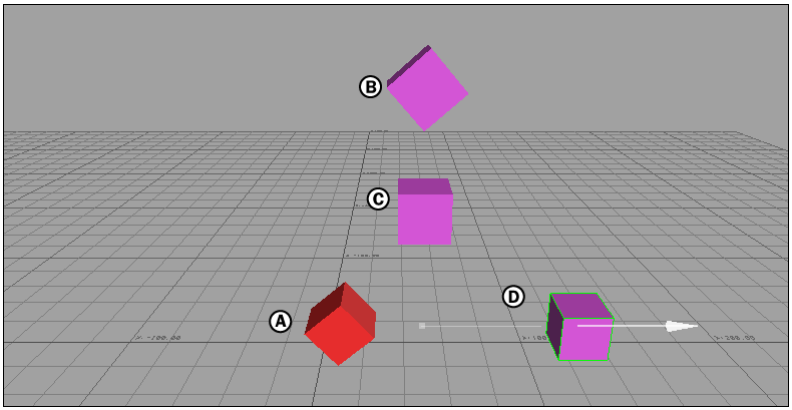
Rigid Body constraint

When you drag an object into the Source 1 cell, another source is added to the Objects pane. If you drag a second source into Source 2, the position and rotation of the constrained object is derived from the position of the two source objects.

The Rigid Body constraint is similar to the Position constraint, except that rotation is also applied to the constrained object. For example, if the Source 1 marker is translated, the constrained object is rotated ( ).



Rigid Body constraint with three source objects. Before activation, the constrained object (A) does not move B, C, and D.



The constrained object (A) and Source objects B and C are automatically translated and rotated based on the new position of Source object D.

- Rigid Body constraint settings on page 1196
- Damping the speed of Rigid Body transformation on page 1196

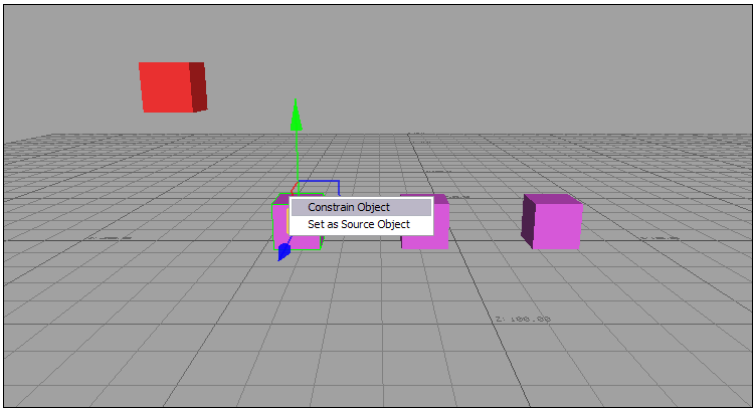
Using a constraint to create a Rigid Body

You can use the position of two or more objects to adjust the translation and rotation of a constrained object with the Rigid Body constraint.

To use a constraint to create a Rigid body:

1 Select a Rigid Body constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Rigid Body constraint template appears in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constrained or source object .



Constraint contextual menu

2 Assign the object that you want to position and translate in the scene based on the position and movement of one or multiple source objects to the Constrained object (child object) cell.

3 Assign the object that you want to derive the translation information from for the constrained object to the Source 1 (parent object) cell.

When you drag an object into the Source 1 cell, another source (Source 2), is added to the Objects pane. If you drag a second source into Source 2, the position of the constrained object is derived from the position of the two source objects.

You can have as many sources as you want, so you can create complex Position constraints.

NOTE When you specify more than one source, the constrained object appears at the middle point between all source objects.

4 Click Active to activate the constraint.

Damping the speed of Rigid Body transformation

You can use the Rigid Body setup pane to create delays or to smooth jerky movements in animation created by constraints.

To damp (or slow) the rotation/translation speed that the constrained object transforms the parent object:

1 Create a Rigid Body constraint. See Using a constraint to create a Rigid Body on page 1194 for more information.

2 Once you have assigned Source and Constrained objects to a Rigid Body constraint, click the Setup tab in the Constraint settings.

Rigid Body Setup pane

3 Enter a value in the Time Before Recovery field.

4 Enter a value in the Recovery Damping Time field.

NOTE MotionBuilder measures these fields in frames per second or timecode format, depending on the settings in the Global Controls.

Rigid Body constraint settings

The Rigid Body constraint creates a Rigid body using the specified sources.

The Rigid Body constraint requires the following objects:

Constrained object

An asset, model, or other object to be placed at the center of all source objects. This is also known as the “Child” object.

Source 1

Sends translation information to the constrained object. This is also known as the “parent” object.

When more than one source is specified, the constrained object is placed at the mid-point between all source objects. Although the sources do not send rotation information, the placement of each source affects the translation and rotation of the constrained object.

Rigid Body Setup pane

The Rigid Body constraint is the only constraint that has a Setup pane . To access it, create a Rigid Body constraint and click the Setup tab in the Constraint settings.

Rigid Body Setup pane

There are two fields found in the Rigid Body Setup pane:

- Time Before Recovery
- Recovery Damping Time

These fields let you damp (or slow) the speed at which the constrained object rotates and translates with its sources. Use them to create delays or to smooth jerky movements in animation created by constraints.

- Damping the speed of Rigid Body transformation on page 1196

Rotation constraint

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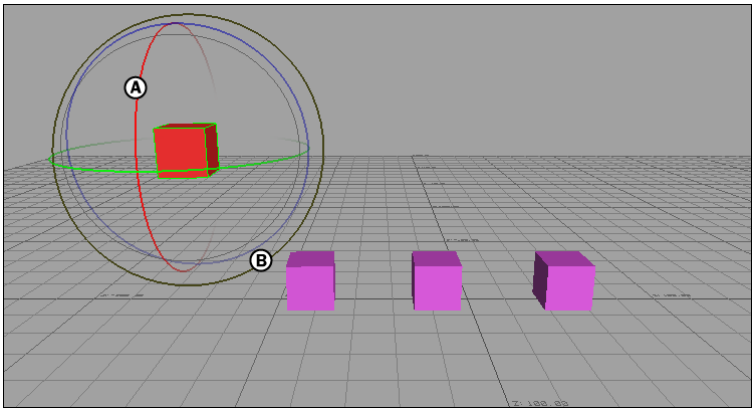
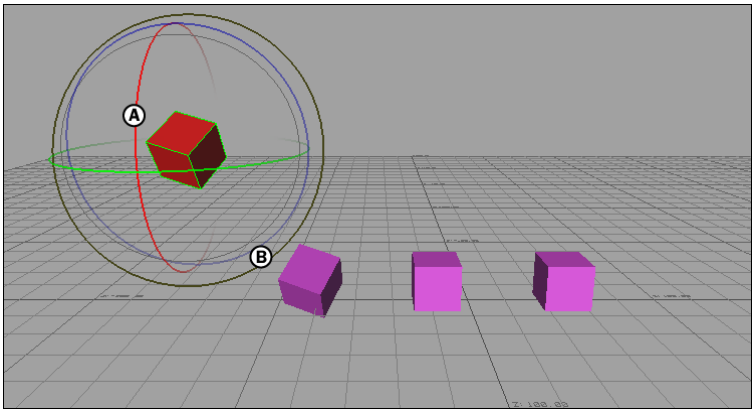
The Rotation constraint transfers rotation between two objects. This constraint uses the position of a source object or objects to constrain the rotation of another object.

For example, in the following pictures, one cube (source) rotates and the other cube (constrained object) rotates with it.



Rotation constraint *A.* **Source object** *B.* **Constrained object**

The constraint source rotates with the constrained object.



When the Source (A) is rotated, the constrained object (B) rotates with it.

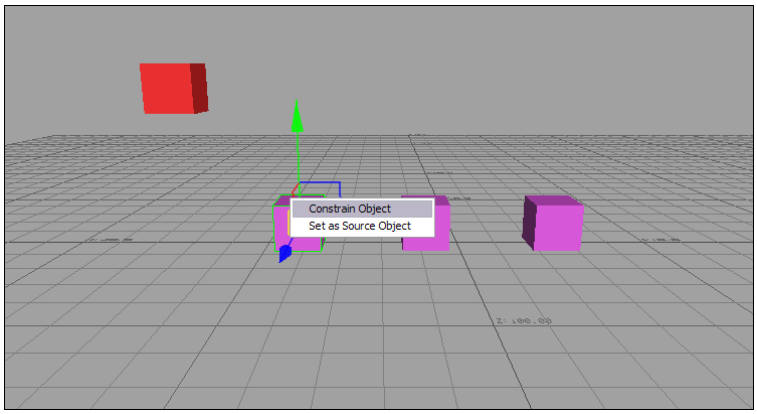
■ Transferring rotation between objects on page 1200

Transferring rotation between objects

To transfer rotation between objects:

1 Select a Rotation constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Rotation constraint template appears in the Constraint Settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as one of the constraint's operators.



Constraint contextual menu

2 Assign the object that you want the rotation of another object to affect into the Constrained object cell.

3 Assign the object that will send rotation information to the constrained object to the Source cell.

NOTE The limit is a radius centered on the pulling object.

4 Click Lock in the Constraint settings to lock the position of the objects to be constrained.

■ Rotation constraint on page 1199

Constraining a single axis (Rotation constraint)

You can use the Rotation constraint to constrain an object's individual axis. For example, you can make an object rotate only on its Y-axis, no matter which way the source object spins.

To constrain a single axis:

1 Create a Rotation constraint. See Transferring rotation between objects on page 1200 for steps on how to do this.

2 Double-click the Rotation constraint in the Scene browser to select it.

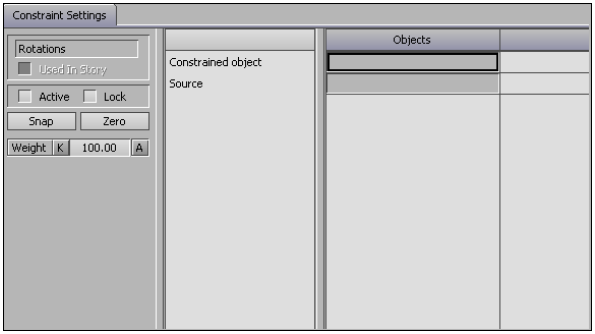
3 Open the Properties window. The Rotation constraint settings display.

4 Expand Constraint Axes and disable the axis (X, Y, or Z) for the translation effect you want to inhibit.

5 To reactivate the unconstrained axes, activate the X, Y, or Z axis option(s).

Rotation constraint settings

The Rotation constraint transfers the rotation between two objects.



Rotation constraint

The Rotation constraint requires the following objects:

Constrained object

An asset, model, or other object whose rotation is based on the rotation from a single source object. Also known as the “Child” object.

Source

Sends rotation information to the constrained object. You can have multiple source objects for this constraint. Also known as the “Parent” object.

Properties window settings

The following Rotation constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Rotation X/Y/Z

Use these fields to offset the constrained object from the Source object(s). You can set key animation on any of these settings.

These fields are disabled if the Lock option is activated.

Constraint Axes

Activating or disabling these axes affects whether the constrained object is affected by the source objects' movement in this direction.

Axis	Description
Affect X	When active, the constrained object moves along the X-axis when the source object is rotated.
Affect Y	When active, the constrained object moves along the Y-axis when the source object is rotated.
Affect Z	When active, the constrained object moves along the Z-axis when the source object is rotated.

(SourceObject).Weight

Use this setting to give different amounts of influence to source objects.

NOTE You no longer have to drag the same object in the source field to create weighting with this setting. If you are working on an earlier version of the positions constraint where this has been done, this is compensated.

- Rotation constraint on page 1199
- Transferring rotation between objects on page 1200

Scale constraint

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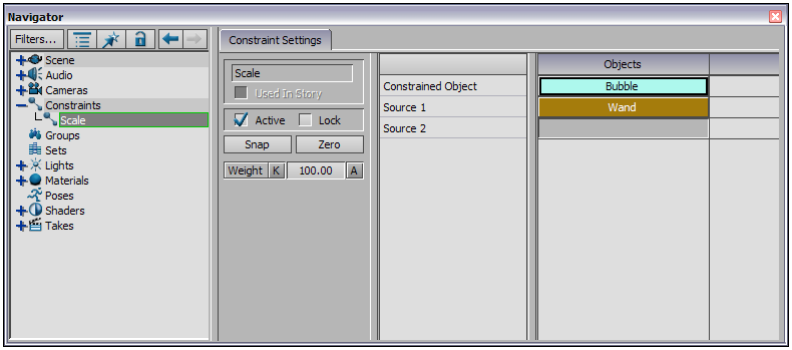
Use the Scale constraint to transfer the scaling from one or more objects to another.



Scale constraint

This is done by using the scaling coordinates of the Source object to calculate the scale of another object.

- Scaling a constrained object on page 1205
- Constraining individual axes (Scale constraint) on page 1207

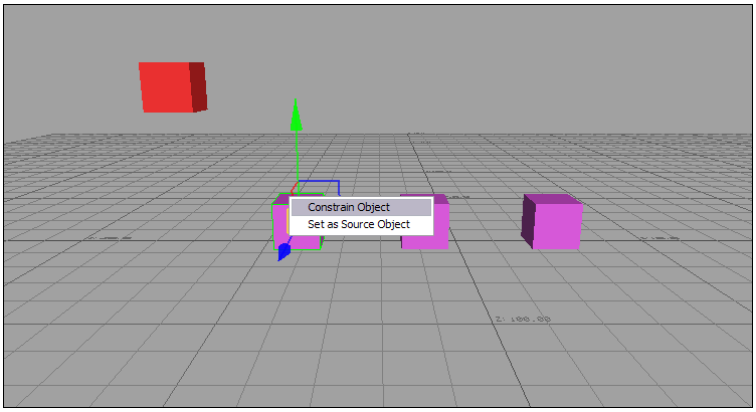
Scaling a constrained object

You can use the Scale constraint to transfer the scaling from one or more objects to another.

To scale a constrained object:

1 Select a Scale constraint from the Asset browser's Constraints folder and drag it into the Viewer window.

- If you drag it into an empty area of the Viewer window, the Scale constraint template appears in the Constraint settings.
- If you drag the constraint on top of an object, a contextual menu appears asking if you want to assign the object as the constraint's Source (parent) or Constrained (child) objects .



Constraint contextual menu

2 Assign the object that you want affected by the scaling to the Constrained Object cell.

3 Assign the object that you are using to create the scaling effect to the Source 1 cell.

NOTE You can have more than one object provide the scaling information to the constrained object by assigning new objects to the resulting Source cells.

4 Adjust the size of the Constrained object, if necessary, with the Scale fields.

NOTE Disable the Lock option to activate the Scale settings.

5 Click Lock in the Constraint settings to lock the position of the objects to be constrained and click Snap.

6 Click Active to activate the constraint.

7 Deactivate the Affect XYZ options in the Properties window Scale constraint settings to disable the scaling effect per axis.

8 Weight the effect of the individual Source objects, if necessary, with the Sale constraint's Source Weight slider(s).

9 Select either Geometric or Average as the Blend Method from the Properties window Blend Method menu.

- Scale constraint settings on page 1207
- Constraining individual axes (Scale constraint) on page 1207

Constraining individual axes (Scale constraint)

You can constrain an individual axis with the Scale constraint. For example, you can scale only an object's Y-axis.

To constrain a single axis:

1 Double-click the Scale constraint in the Scene browser to select it.

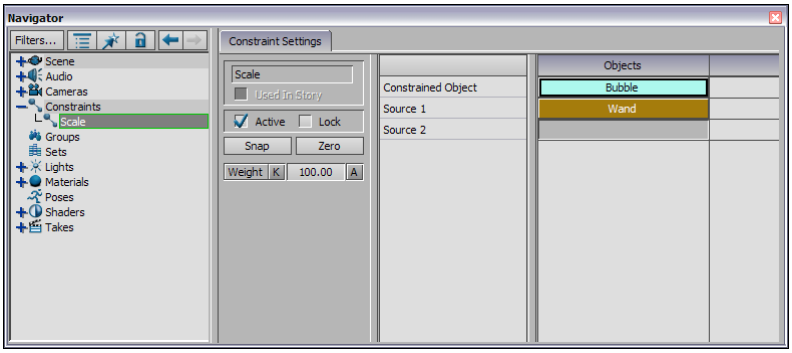
2 Open the Properties window. The Scale constraint settings display.

3 Expand Constraint Axes and disable the X, Y, or Z axis for the desired translation effect you want to inhibit.

4 To reactivate the unconstrained axes, activate the option.

Scale constraint settings

The Scale constraint lets you constrain the scaling of one object relative to the scaling of one or many other objects.



Scale constraint

Constrained Object

An asset, model, or other object whose orientation derives its size from the Source object(s). Also known as the “child” object.

Source

Sends scaling information to the constrained object. You can have multiple source objects for this constraint. Also known as the “parent” object.

Properties settings

The following Scale constraint settings are found only in the Properties window when the constraint is selected in the Scene browser:

Property	Description
Scaling Offsets XYZ	Use these fields to move the constrained object from the Source object(s). You can set key animation on any of these settings.These fields are disabled if the Lock option is activated.
Blend Method	The Blend Method menu lets you specify a way in which the Scaling is calculated when you are using multiple Source objects. There are two options:Geometric: a logarithmic method compatible with Maya’s scaling constraints.Average: which calculates based on the average scale of the objects.

Property	Description
Constraint Axes	Activating or disabling these axes affects whether the constrained object is affected by the source objects' movement on this axis. Affect X: When active, the constrained object is transformed along the X-axis with the constrained object. Affect Y: When active, the constrained object is transformed along the Y-axis with the constrained object. Affect Z: When active, the constrained object is transformed along the Z-axis with the constrained object.
(Source Object) Weight	Use this setting to give different amounts of influence to source objects.

- Scaling a constrained object on page 1205
- Constraining individual axes (Scale constraint) on page 1207

Part 9: Animating with Devices

A device is either a special software component (such as the Voice and Sound devices) or a separate piece of hardware (joystick, mouse, or keyboard) that connects to your computer using a serial, ethernet, or other connection.

Devices react to either recorded data or live input directly from the device itself. An input device feeds data to MotionBuilder, and an output device receives data from MotionBuilder.

For example, the keyboard and the mouse are input devices, and the MIDI device is both an input and output device.

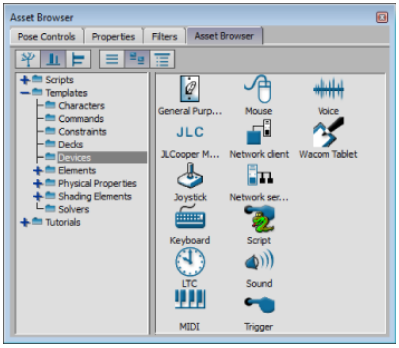
To find information on specific software components and hardware that are used with MotionBuilder, see MotionBuilder devices on page 1219.

Only devices developed by Autodesk and shipped with either MotionBuilder are documented in this chapter. For information on devices developed by third party vendors, consult their Web site or documentation.

- MotionBuilder devices on page 1219
- Viewing device settings on page 1212
- Adding a device on page 1212

Device assets

In the Asset browser, the Device folder contains devices supported by MotionBuilder.



Asset browser, Devices folder

See Adding a device on page 1212, Assets on page 379, and Viewing device settings on page 1212 for more information.

Viewing device settings

To view the settings for a device:

Select the device in the Scene browser. The active device's settings display in the Navigator window letting you configure the device, record takes, and set recording options.

These Device Settings vary according to the device you select in the Scene browser and are covered their corresponding device topics.

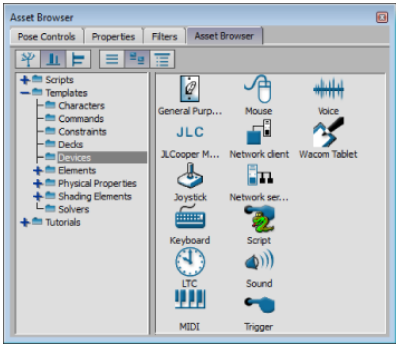
To view information for all devices:

Click on the Devices folder in the Scene browser to see the Device Statistics pane.

See Deck Statistics pane on page 1226 and Animating with Devices on page 1211 for more information.

Adding a device

Drag a device asset from the Asset browser into the Viewer window or Scene browser. All added devices display in the Scene browser in the Devices folder. The device's settings display in the Navigator window.



You can add a device to the scene by dragging it from the Asset browser.

- MotionBuilder devices on page 1219

Device Settings

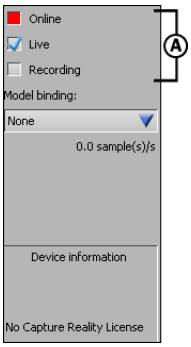
The Device Settings contain information required to configure, monitor and run the selected device, and displays whenever you select a device in the Scene browser.

The Device Settings are split into two areas, the Record and Play options, and the device's specific Settings area.

The Record and Play options are described in this topic, while each device's specific Settings area is described in the topic that corresponds with it in the MotionBuilder devices on page 1219 section of the help.

Record and Play Options

Devices behave relative to live data or recorded takes. When a device is active, the Record and Play options display with the device's settings, letting you set the device's online, live, and recording state.



A. **Record and Play options in the Device settings.**

These options determine whether the device is being used live, is being recorded, or is using previously recorded data. You can set options for an entire device, or for selected properties of a device.

NOTE We recommend that you also read the section about the specific device you are using for more precise information about recording.

Online

Use the Online option to activate and disable each device. When a device is Online, it is active and ready to be used by MotionBuilder.

Disabled devices do not send live data to MotionBuilder. If a device keeps switching off when you are trying to turn it on, it means that MotionBuilder cannot find the device, or its port is being used by another device.

Live

There are two different types of play modes: Live and Recorded. Disabling the Live mode sets the play mode to Recorded, and takes the data from the current take, from the device, or its bound model. The current take displays in the Transport Controls window.

Activating the Live mode sets the play mode to Live, and inputs data directly from the device instead of a recorded take.

NOTE The Live and Recording play modes are not available to devices designated as output only.

Recording

When the Recording option for a device is active, you can record the data from the device to the current take. You can record all the data from a device, or you can choose individual attributes to record.

For example, if you are recording data from a mouse device and you only want to capture the data from the Y-axis, activate Recording for the Y-coordinate, and disable Recording for the X-coordinate.

Model Binding

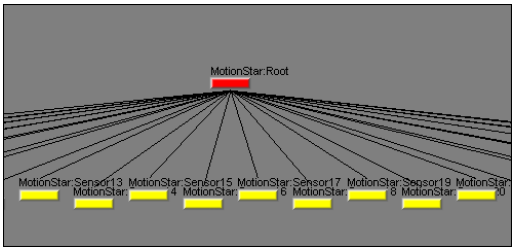
The Model binding area appears below the Record and Play options for certain devices.

Some devices let you link the device to a special model, which is referred to as device binding. If the selected device supports device binding, the heading “Model binding” and a menu appear beneath the Record and Play options.

When you bind a device, all the data recorded from the device applies to the bound model. Each device that supports device binding includes similar options for binding. Setting these options is the same, regardless of the device you are using.

To bind a selected device, select a bound model from the Model binding field, or choose Create to create a model. Choosing Create creates and selects a binding model as the bound model. This model is named for the device and is sequentially numbered.

Depending on the device, the bound model displays as a group of sensors, as a single null, or as a skeleton structure in the Viewer window. The bound model displays as a hierarchy in the Schematic view.



Bound model in the Schematic view.

Device Information

The Device Information area appears in the settings of every device communicating with MotionBuilder.

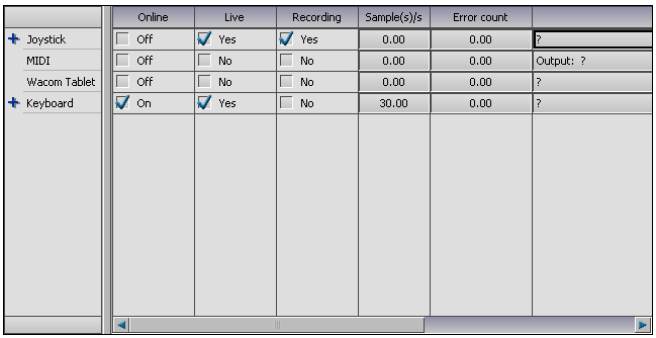
It shows the status of the connected device. If an error occurs or a device cannot be found, the appropriate message appears in this area, for example “Offline” or “Recording”.

The same messages are shown in the Status Messages column of the Device Settings pane. See Status on page 1217.

Device Statistics pane

The Device Statistics pane lets you keep track of all the devices you are using, letting you configure general settings and view any status messages.

To open the Device Statistics pane in the Navigator window and view information for all added devices, click the Devices root folder in the Scene browser.



	Online	Live	Recording	Sample(s)/s	Error count	
Joystick	Off	Yes	Yes	0.00	0.00	?
MIDI	Off	No	No	0.00	0.00	Output: ?
Wacom Tablet	Off	No	No	0.00	0.00	?
Keyboard	On	Yes	No	30.00	0.00	?

Device Statistics pane

NOTE There must be at least one device added to the scene in order for the Device Statistics pane to appear in the Navigator window.

Device Statistics Columns

The following are the data columns common to all devices:

Sample(s)

Shows the sample rate (per second) of each device. If the number of samples is zero, then either the sample line is not applicable for the connected device, or the device is not sending data.

Delay

Shows the delay between the time when the device sends the data and when the results are received by MotionBuilder.

Error Count

Gives the number of time-outs and other errors related to device input and output. If you have an error count, check your devices to make sure they are connected properly.

For a successful capture session, the error count must remain at zero.

The Error Count columns in the Device Statistics pane indicate whether the device is initialized and working properly. If the device cannot be found, it sends an initialization error.

Status

Shows the status of the connected device. If an error occurs or a device cannot be found, the appropriate message appears in this column.

The Status column is important when attempting to connect to external hardware devices since it gives feedback on any errors, time-outs, licensing conflicts, and so on.

The messages in the Status are device-specific and are read from the device, not generated by MotionBuilder.

NOTE Some devices use the Device Information area in the Device Settings to provide constant feedback. See Device Information on page 1215 for more information.

MotionBuilder devices

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MotionBuilder supports the following devices:

- Decks on page 1220
- JLCooper MCS-3800 on page 1227
- Joystick Device on page 1228
- Keyboard Device on page 1228
- LTC device on page 1229
- MIDI device on page 1229
- Mouse Device on page 1233
- Network Client device on page 1234
- Network Server device on page 1235
- Sound device on page 1236
- SpaceBall Device on page 1237
- Trigger device on page 1243
- Wacom Tablet on page 1244

In addition to the devices mentioned in this list, MotionBuilder includes the Open Reality SDK, a developer's kit for creating your own devices. For more information, see the Open Reality SDK documentation.

For information on devices developed by third party vendors not listed in this section, contact either Autodesk or the third party vendor.

- MotionBuilder devices on page 1219
- Adding a device on page 1212

Decks

Decks let you control, monitor, and synchronize the recording or playback of a VTR (Video Tape Recorders) from within MotionBuilder. You can use the Deck settings to record rough takes or video backups of a capture session to a VTR, or play video from a VTR during a capture session.

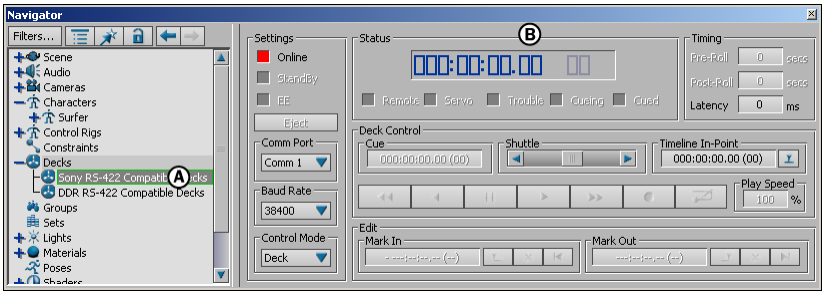
MotionBuilder supports two decks:

- DDR RS-422 Compatible
- Sony RS-422 Compatible

To use decks in MotionBuilder, drag a deck into the Viewer window from the Asset browser Decks folder. See Decks Limitations on page 1226, Deck Settings on page 1220, and Deck Statistics pane on page 1226 for more information.

Deck Settings

The Deck settings contain the various controls for your external VTR. The selected VTR can be Online and/or set to Remote Control mode.



Navigator window *A.* **Selected deck** *B.* **Deck settings**

When the selected VTR is set to Online, the VTR is being controlled outside of MotionBuilder. The status and mode indicators as well as the VTR time codes are displayed.

When the selected VTR is in Remote Control mode, the Decks Transport Controls are active and MotionBuilder controls the VTR.

NOTE Many Deck settings cannot be edited; they are only status or mode indicators and are specific to the selected VTR. In addition, some Master specific settings, such as Time In and Time Out, are disabled when in Slave mode.

Settings area

The Settings area lets you change the selected deck's settings. The following table lists the settings that can be changed.

Setting	Description
Online	Sets the communication with the VTR to on or off.
Standby	Switches the VTR to Standby mode.
EE	Sets the VTR to EE (electronics-to-electronics) mode.
Eject	Ejects the tape.

Comm Port Menu

Lets you select an available Serial Port. The Comm port is the port used to communicate with the VTR.

Control Mode

Lets you specify whether the current VTR is in Slave or Deck mode. Slave mode is synchronized to MotionBuilder, while Deck mode is used for independent control.

Status Area

The Deck settings Status area lets you see the status of the deck and view the timecode.

Timecode

At the top of the Status area is the Deck timecode display. This indicates the timecode given from the deck and cannot be altered.

Deck Status Indicators

A row of status indicators provides feedback concerning the status of your VTR. Each status indicator is described in the following table:

Indicator	Description
Remote	Indicates that your VTR is in Remote mode. When your VTR is in Remote mode, MotionBuilder controls the VTR. If the Remote indicator is red, it indicates that the VTR is in local mode.
Servo	Indicates that your VTR tape has reached the exact speed (frames per second) and the reading head is locked in.
Trouble	Indicates that your VTR is malfunctioning. The malfunction is VTR model dependent; consult your VTR manual.
Cueing	Indicates that your VTR is currently cueing. Cueing occurs during the time in which your tape is catching up to the time indicated by a changed timecode in MotionBuilder.
Cued	Indicates that your VTR is cued. This occurs when the video reaches the timecode specified in MotionBuilder and is awaiting a new command.

Timing

The Timing area of the Deck settings lets you set the Pre- and Post-roll for the deck and specify a Latency setting to compensate for the data transfer speed.

Pre/Post Roll fields

Let you specify the amount of pre-roll and post-roll when controlling your VTR (expressed in seconds).

Latency

Lets you set an additional time offset (in milliseconds) to synchronize your VTR and MotionBuilder. Latency depends on tape speed, your VTR model, hardware response time/inertia and other device-related factors.

Deck Control Area

The Deck Control area contains the controls for operating the deck from MotionBuilder.

Cue Field

Use the Cue field to navigate through the tape. To move quickly to different areas of the tap, double-click the timecode and enter the time that you want to cue the tape.

Shuttle Slider

Drag the Shuttle slider to the right to move forward through the timecode and to the left to move backward through the timecode.

The shuttle speed is determined by how far you move the slider in either direction.

Click the arrow keys at either end of the Shuttle slider to jog. Click and hold the slider to continue jogging.

Timeline In Point

The Timeline In Point field lets you enter a different In point for the Timeline, rather than using the take's start point.

Click the Set button to set the Timeline In Point to local (software) time.

Transport Controls

The following table lists and describes the function of each VTR Transport button:

Button	Function
	Rewind.

Button	Function
	Play the VTR backward.
	Still. Pauses the VTR.
	Play the VTR forward.
	Fast forward.
	Record. (Disabled).
	Loops the VTR between the Time In and Time Out time codes. (Not available on all decks.)

Play Speed

Indicates the VTR play speed (in percent). The number and its meaning depends on your VTR. Consult your VTR documentation for more information. (Not available on all decks.)

Edit Area

The Edit Area contains the Mark In and Out fields, where you can perform editing functions, such as wiping the data from audio tracks or setting in and out marks for the tape.

Edit Commands

Select the Edit commands to wipe out audio or video data from a specific track:

Command	Function
Assemble	Wipes all data from all tracks.

Command	Function
V	Wipes data from the video track.
A1	Wipes data from Audio 1 track.
A2	Wipes data from Audio 2 track.
A3	Wipes data from Audio 3 track.
A4	Wipes data from Audio 4 track.

Start/Edit

Click Start/Edit to activate the wiping of audio or video from a track.

Mark In/Out fields

The Mark In/Out fields let you set the Time In and Time Out time codes for a section of VTR tape. Once the tape is in position, click the Mark In/Out buttons to set a Mark In or Mark Out timecode.

Mark In/Out Buttons

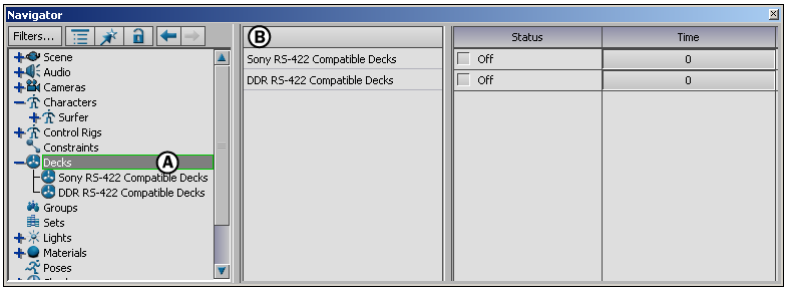
The following table lists and describes the function of each Mark In/Out button:

Button	Function
	Set the Mark In point.
	Clear the Mark In/Out timecode.
	Cue tape to the Mark In point.
	Set the Mark Out point.
	Cue tape to the Mark Out point.

Deck Statistics pane

Click the Decks folder in the Scene browser to open the Statistics pane. The Statistics pane contains additional information about each VTR that has been added to the Decks list.

The Statistics pane lets you set a selected VTR status on or off and set the time offset for each VTR. You can also distinguish each VTR by entering a description.



Navigator window *A.* **Decks folder** *B.* **Statistics pane**

Option	Function
Status option	Click to activate the VTR. When disabled, the VTR is not controlled by MotionBuilder.
Time field	Use the Time field to set a time offset for the VTR.
Description field	Use this field to enter a description that distinguishes each VTR.

Decks Limitations

Before using the Deck settings, you should be aware of the following limitations:

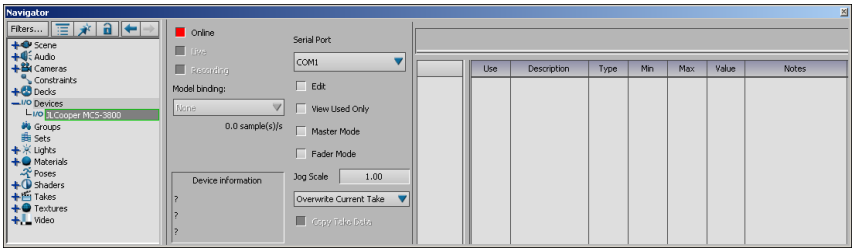
- Only one deck can be controlled at a time.
- Only Sony 9-Pin compatible VTRs are supported.
- The VTR does not cue at a negative timecode. The minimum timecode allowed is 00:00:00.00.

- The maximum end point for recording is 23:59:59:01.
- Tape must be striped with CONTINUOUS timecode.
- The VTR can be in slave mode or independent.
- MotionBuilder cannot drive the VTR unless the VTR is set to Remote Control mode.
- MotionBuilder does not wait for the VTR to complete cueing. You must wait for cue commands to complete before sending other commands. If you do not wait for the VTR to cue, sync errors between the VTR and MotionBuilder occur.
- VTR pre-roll and latency is not taken into account when cueing at a specific timecode. The VTR cues at the same timecode as MotionBuilder, not at the timecode minus pre-roll and latency. Latency is always taken into account.
- The RS-422 protocol is a common serial port protocol. If your VTR uses the RS-422 protocol and your computer has an RS-232 port, use an RS-232 to RS-422 converter.

See Decks on page 1220 for more information.

JLCooper MCS-3800

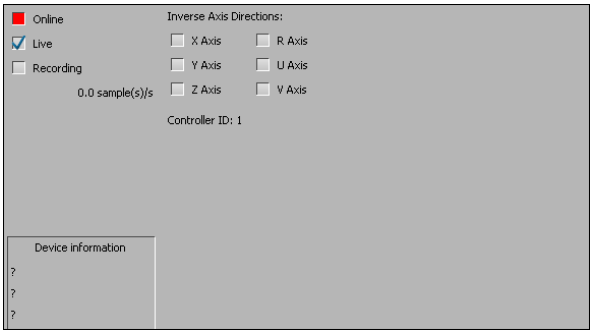
Use the JLCooper MCS-3800 device settings to configure the JLCooper MCS-3800 hardware controller as an input device. You can also connect this hardware controller as a MIDI device.



JL Cooper MCS-3800 device settings

Joystick Device

Use the Joystick device to connect any standard joystick as an input device. Before you use this device, make sure the joystick is properly installed and calibrated.



Joystick device settings

Consult the documentation that accompanies the joystick for installation, calibration, and driver information pertaining to your system.

See MotionBuilder devices on page 1219 for more information.

Keyboard Device

Use the Keyboard device to configure your keyboard as an input device. There is no additional configuration for the Keyboard device since it is automatically configured by your computer system. The Keyboard device uses the following keys:

- Numerical keys: zero (0) through nine (9)
- Function keys: F1 through F12
- Up, Down, Left, and Right arrow keys
- Escape, Space, and Return
- Home, End, Page Up, and Page Down

Each keystroke acts as a trigger that can be used by a Relational constraint to change cameras or trigger movement.

LTC device

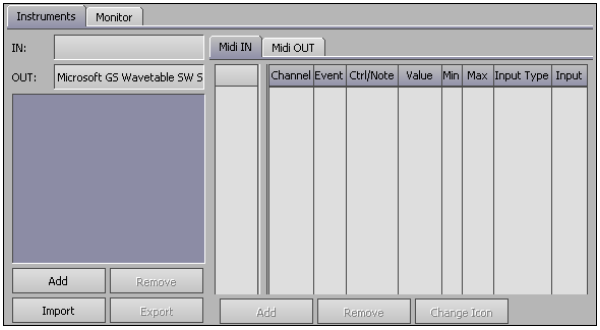
Use the LTC (Longitudinal Timecode) device to synchronize MotionBuilder to an external timecode source. To activate the LTC as a timecode source, you must add the LTC device, then select it as the reference timecode source in the Timing Controls. You must have the LTC card installed to use the LTC device.

Add the LTC device and select the sound card connected to your computer from the InputDevice pull-down menu. The longitudinal timecode automatically becomes the reference timecode.

LTC device settings *A.* **Select a sound card from the Input device menu**

MIDI device

The MIDI device supports MIDI In and MIDI Out for connecting with MIDI hardware (slider boxes, MIDI mixers, synthesizers, and so on). The MIDI device is both an input and an output device, as it sends and receives data.



MIDI device

MotionBuilder sends and receives MIDI data on 16 MIDI channels. The following table lists supported and unsupported MIDI events:

Supported	Not supported
Note on, Note off, Velocity, and Continuous controllers 0 through 127.	System exclusive messages, Program change messages, MIDI start, stop, and continue.

In a studio, there can be many devices receiving and sending MIDI data. For example, you could have a MIDI mixer that controls audio levels, a MIDI slider for controlling a character within MotionBuilder, and a synthesizer for creating music using MIDI.

Each external MIDI device can send and receive MIDI data, and must be connected to your computer using a MIDI interface and MIDI cables.

Within MotionBuilder, you need to add at least one MIDI device to connect to external MIDI hardware. Each piece of external MIDI hardware is represented in the MIDI device as an instrument.

To control external MIDI hardware from MotionBuilder or to control models, lights, and cameras in your scene using external MIDI hardware, you need to add a MIDI device, add instruments (Instrument list), then add and define inputs and outputs (MIDI IN and MIDI OUT panes).

MIDI device settings

This topic describes the Instruments pane and the Monitor pane of the MIDI device settings.

Instruments pane

The following describes the columns in the Midi IN and Midi OUT tabs found on the Instruments pane of the MIDI device settings.

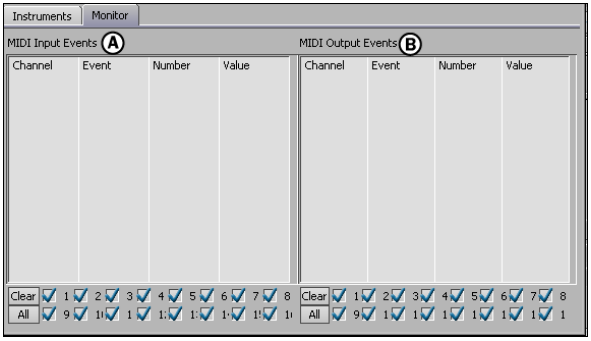
Column	Description
Channel	**MIDI IN**: Selects the channel (between 1 and 16) on which the MIDI data is received. **MIDI OUT:** Selects the channel (between 1 and 16) sending the MIDI data.

Column	Description
Event	Selects the type of event being received (MIDI IN) or sent (MIDI OUT).
Ctrl/Note	**MIDI IN**: Sets either the Controller number (when Event is set to Ctrl) or Note number (when Event is set to Note) being received. **MIDI OUT**: Sets either the Controller number or Note number to be sent out the MIDI Out port.
Value	**MIDI IN**: Displays the controller value (when Event is set to Ctrl) or the note's velocity (when Event is set to Note) being received. **MIDI OUT**: Sets either the Controller value or the note's velocity.
Min and Max	**MIDI IN**: Scales the value received to fit within a minimum and maximum value. For example, if you set Min to 50 and Max to 100, the input value (between 0 and 127) is adjusted to a value between 50 and 100. **MIDI OUT**: Adjusts the range of the value sent (Value column). For example, if you set Min to 50 and Max to 100, and a value of 200 is sent, the value is clamped to 100. The adjusted value is then scaled to fall within acceptable MIDI values (0-127) before being output.
Input/Output Type	**Value:** Receives (MIDI IN) or sends (MIDI OUT) controller value for Ctrl events, or Velocity for Note events.**Number:** Receives (MIDI IN) or sends (MIDI OUT) the controller number for Ctrl events, or Note number for Note events.**N&V:** Receives (MIDI IN) or sends (MIDI OUT) both the Value and Number. Two connectors are added to the MIDI instrument's relation box.

Column	Description
Input/Output	Shows the result of scaling the Value field using the Min and Max settings. This is the value input.

Monitor pane

The Monitor pane shows MIDI data as it is received and sent. Two separate tables show the MIDI data being received (MIDI Input Events) and sent (MIDI Output Events). Each table contains similar columns.



Monitor pane *A.* **MIDI Input filtering options** *B.* **MIDI Output filtering options**

Channel

Displays the channel number of the received or sent event.

Event

Displays the event type. An event type can be either Note On or Control:

- **Note On:** An event containing note data. The Number column displays the note number between 0-127 and the Value column shows the note's velocity. Each Note On event is immediately followed by a Note Off event which is equivalent to, and shown as, a Note On event with a velocity of zero.
- **Control:** An event containing controller data. The Number column displays the controller number, (0-127) and the Value column provides the controller value.

Number

The value shown in the Number column changes depending on whether the event is a controller or a note. If the event is a controller, the Number column shows the controller number. If the event is a note, the Number column shows the note number. Each note is assigned a number between 0 and 127. For example, C4 (C octave 4) displays as 60.

Value

The value shown in the Value column changes depending on whether the event is a controller or a note. If the event is a controller, the Value column displays the controller value. If the event is a note, the Value column displays the note's velocity.

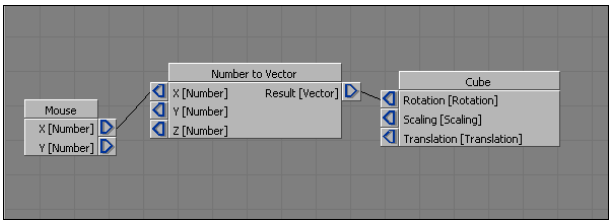
See MIDI device on page 1229 for more information.

Mouse Device

Use the Mouse device to configure your mouse as an input device. There is no additional configuration for the Mouse device since it is automatically configured by your computer system.

The Mouse device tracks the movement of the mouse; it gives an X-coordinate for horizontal movement, and a Y-coordinate for vertical movement. These coordinates can be used in the Relations pane to control models, cubes, lights, shaders, and so on.

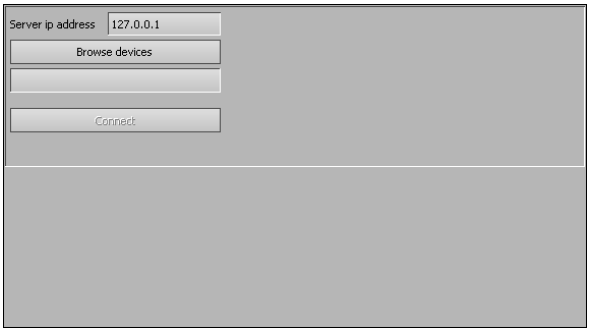
For example, to use the mouse device to change the X and Y position of a cube, you can use a converter (Number to Vector) to change the single X- and Y-coordinates of the mouse position into a vector for the cube.



Mouse device used in a Relations constraint.

Network Client device

Add the Network Client device to connect MotionBuilder to another computer that has MotionBuilder running with a Network Server device.



Network Client device

Once the Network Client device is added, you can use devices from other MotionBuilder applications running Network Servers. See Connecting to a network server on page 1234, and Network Client device settings on page 1235 for more information.

Connecting to a network server

To connect to a network server:

➤ In the Network Client device settings, enter the IP address of the server and click Online.

If the connection is successful, the Online indicator turns yellow and the message “Server found” appears in the Device information area.

To connect to more than one device:

➤ Create a separate Network Client for each device you want to use.

Network Client device settings

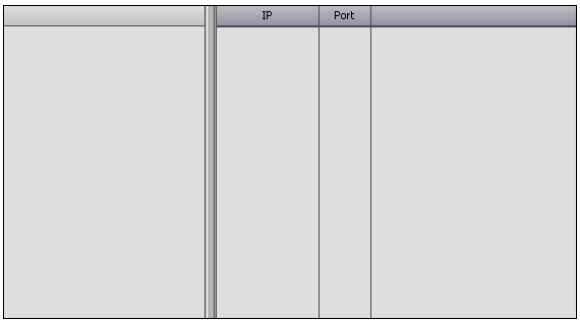
This topic explains the options in the Network Client device area and their uses.

Option	Description
Server IP address	Address of the machine running Motion-Builder with the Network Server device.
Browse devices	Click to view a list of all the devices added to the MotionBuilder Network Server.
Device menu	Click Browse devices to list all the Network Server's devices in this menu. Select the device to which you want to connect this Network Client.
Connect Device	Connects the device selected in the Device menu to the Network Client.
Reset	Re-establishes the connection. (Click Reset if you lose the connection.)

■ Network Client device on page 1234

Network Server device

Add the Network Server device to use MotionBuilder as a server to which you can connect other computers running MotionBuilder. The devices connected to the Network Server computer can be used by all other computers that are connected and running MotionBuilder.

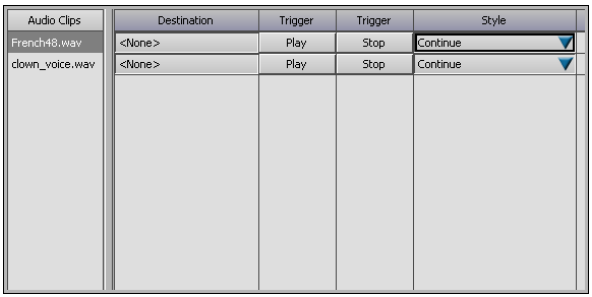


Network Server device settings

For the Network Server to function properly, MotionBuilder must be running on a computer connected to a LAN or another network with an IP address.

Sound device

The Sound device lets you trigger sounds using another device, such as the Keyboard device.



Sound device

The file path and name of loaded sound files appears in the Audio Clips column. You can specify a *.wav* file by typing the file name and path in the Destination field. The default entry <None> means that no destination is specified, and the path is taken from the Audio Clips column entry.

The Sound device supports up to twelve different *.wav* files for use in MotionBuilder. If you need more sounds, add a second Sound device.

SpaceBall Device

Use the SpaceBall device as a simple input device to manipulate cameras and selected objects in the Viewer window.

In order to use the SpaceBall device in MotionBuilder, the SpaceBall device and its driver must be installed.

SpaceWare software is installed with the SpaceBall driver and has settings that can override MotionBuilder. Be sure that the SpaceWare settings do not conflict with the SpaceBall device settings in MotionBuilder.

See Manipulating Objects with a SpaceBall Device on page 1237, Playing Recorded Spaceball data on page 1237, Recording with a SpaceBall on page 1238, SpaceBall Settings on page 1240, and SpaceBall Recording Limitations on page 1239 for more information.

Manipulating Objects with a SpaceBall Device

Hold the SpaceBall in your left hand, select an object in the Viewer window with your mouse in your right hand, then rotate the object using the SpaceBall device. When no objects are selected, you can move the camera freely in the Viewer window.

Consult the SpaceBall documentation for more information about configuring the SpaceWare software.

Playing Recorded Spaceball data

To play data recorded with Spaceball as a device:

1. Disable Live.
2. Create a new Relations constraint using the SpaceBall device box.
3. Connect the connectors to your other boxes in the relation.
4. Click Play to preview the animation.
5. Select Animation > Plot All (All Properties) from the menu bar to apply the animation to the constrained objects.

To play data recorded with SpaceBall as a manipulator:

1. Disable Live.
2. Select the object or camera to receive the recorded data.

3 Click the “Constrain selected object with recorded data” button.

   This is the same as creating a new Relations constraint and connecting the connectors of the selected object with the SpaceBall connectors. Clicking this button again removes the constraint.

4 Click Play to preview the animation.

5 Select Animation > Plot All (All Properties) from the menu bar to apply the animation to the constrained object.

See SpaceBall Device on page 1237, and Manipulating Objects with a SpaceBall Device on page 1237 for more information.

Recording with a SpaceBall

To record as a device:

1 Make sure the SpaceBall device is Online, and activate Live and Recording.

2 Disable Use SpaceBall to manipulate the camera and objects in the viewer options.

3 Click Record, then click Play to start recording.

4 Move the SpaceBall, and click Stop to end the recording.

To record as a manipulator:

1 Activate the Online, Live, and Recording options.

2 Activate either Use SpaceBall to manipulate camera in Viewer, or Use SpaceBall to manipulate objects in Viewer

3 Select an object. Select none if you want to manipulate the current camera.

4 Make sure there are no constraints connected to the selected object or camera.

5 Click Record, then click Play to start recording.

6 Move the SpaceBall, and click Stop to end recording.

See SpaceBall Device on page 1237, and SpaceBall Recording Limitations on page 1239 for more information

SpaceBall Recording Limitations

You can record data from a SpaceBall as a device or as a manipulator. The way each method records data is outlined in the following topic.

Recording data as a device

When using the SpaceBall as a device, the data is only recorded in the following connectors.

Connector	Function
ButtonX (Bool)	The state of the button (0 is Up, 1 is Down).
Device Rotation Offset (Vector)	The rotation offset given by the SpaceBall.
Device Translation Offset (Vector)	The rotation offset given by the SpaceBall.
Device Total Lcl Rotation (Vector)	The total rotation computed with all the rotation offsets since the last reset.
Device Total Lcl Translation (Vector)	The total translation computed with all the translation offsets since the last reset. Note: You can reset the Total values by pressing Button 3 of the SpaceBall. The button numbers shown in MotionBuilder correspond to "Function" numbers from the SpaceWare Configuration User Interface.

Recording Data as a Manipulator

When using the SpaceBall as a manipulator, the data is also recorded in the following connectors.

Connector	Function
Manipulator Camera Rotation (Vector)	Rotation vector applied to the manipulated camera.
Manipulator Camera Translation (Vector)	Translation vector applied to the manipulated camera.
Manipulator Camera Lcl Rotation (Vector)	Local rotation vector applied to the manipulated camera.

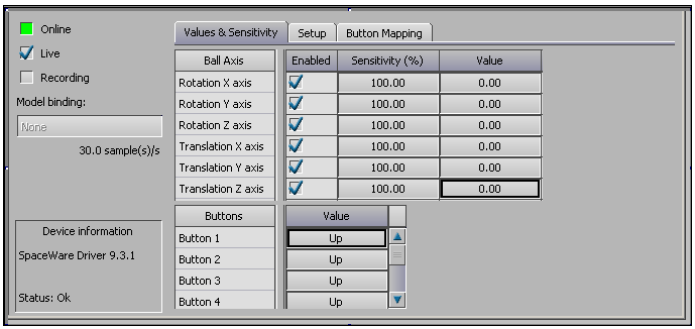
Connector	Function
Manipulator Camera Lcl Translation (Vector)	Local translation vector applied to the manipulated camera.
Manipulator Camera Roll (Number)	Roll value applied to the manipulated camera.
Manipulator Interest Translation (Vector)	Translation vector applied to the interest of the manipulated camera.
Manipulator Interest Lcl Translation (Vector)	Local translation vector applied to the interest of the manipulated camera.
Manipulator Model Rotation (Vector)	Rotation vector applied to the manipulated model.
Manipulator Model Translation (Vector)	Translation vector applied to the manipulated model.
Manipulator Model Lcl Rotation (Vector)	Local rotation vector applied to the manipulated model.
Manipulator Model Lcl Translation (Vector)	Local translation vector applied to the manipulated model.

SpaceBall Settings

Aside from the standard device settings, the SpaceBall device Settings include three different panes.

Values & Sensitivity Pane

The Values & Sensitivity pane contains the following options:

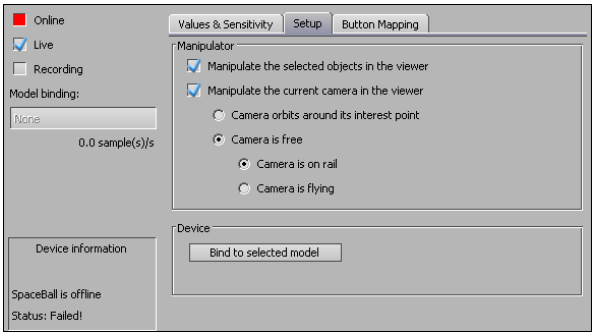


SpaceBall device settings, Values & Sensitivity pane

Column	Description
Enabled	Use the Enabled column in the Ball Axis area to activate or disable the selected axis.
Sensitivity (%)	Use the Sensitivity fields to adjust the sensitivity of the selected axis. A negative sensitivity value inverts the current axis.

Setup Pane

The Setup pane contains the following camera options:



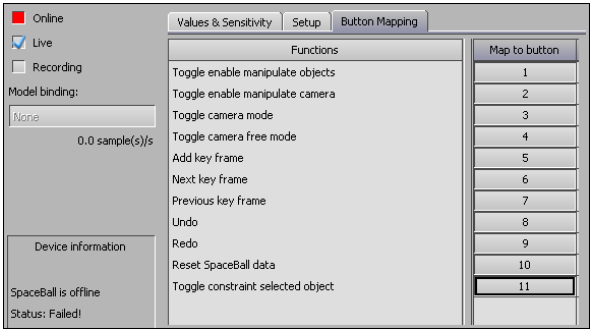
SpaceBall device settings, Setup pane

Option	Description
Manipulate the selected objects in the Viewer window	Lets you manipulate selected objects with the SpaceBall device. To manipulate ob-

Option	Description
	jects, make sure the device is Online, activate this option, select an object, then move the SpaceBall device. Make sure there are no constraints connected to this object.
Manipulate the current camera in the Viewer window	Lets you manipulate the camera when no objects are selected. To manipulate the current camera with the SpaceBall device, make sure the SpaceBall is Online, activate the Online option, set camera mode options, then move the device to manipulate the current camera in the Viewer window.
Camera orbits around its interest point	The camera moves around its interest point. If the camera has no interest point (except for the default perspective camera), it behaves as in the "Camera is free" mode.
Camera is free	The camera and camera interest, if any, move together.
Camera is on rail	The camera moves like a camera on a rail (dolly track), in which it can move forward with the head down.
Camera is flying	The camera moves forward in the direction it is facing.

Button Mapping Pane

Use the Functions column in the Button Mapping pane to map special functions to the SpaceBall buttons by assigning a button number to each function.



SpaceBall device settings, Button Mapping pane

Trigger device

The Trigger device lets you map a keyboard or joystick to another device for triggering motion clips using the Animation Trigger window. For more information, see Animation Trigger window on page 1920.

- Trigger device settings on page 1243
- MotionBuilder devices on page 1219

Trigger device settings

Source Name

Lets you choose the trigger source, which can be a keyboard or one of 16 joysticks. The Rename button lets you enter a new name for the source.

Trigger (List)

Displays the name of the trigger associated with the control.

Trigger (Edit)

Edits the name of the trigger selected in the Trigger (List) column.

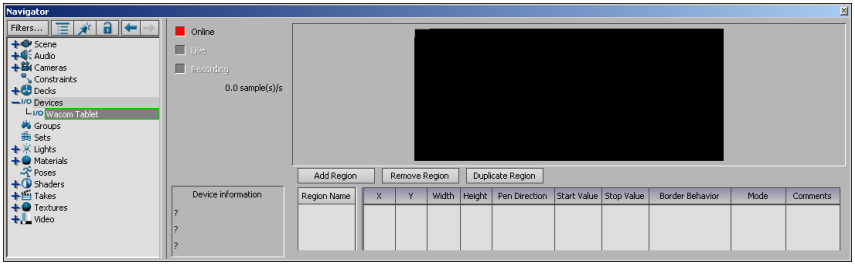
Type

Displays the action to perform to activate the corresponding trigger. There are five types of actions:

Action	Description
Off	No triggering action is defined.
Activate	Control is activated once (for example, when a joystick button is pressed and released).
Deactivate	Control is disabled once (for example, when a joystick button is released and pressed).
Activate Repeat	Control is activated and remains activated (for example, when a joystick button is pressed and held down).
Deactivate Repeat	Control is disabled and remains disabled (for example, when a joystick button is released and remains released).

Wacom Tablet

Use the Wacom Tablet device to connect Wacom tablets and Wintab compatible tablets (Windows version only) to MotionBuilder. Adding the Wacom Tablet device displays the Device Settings and a representation of the tablet, referred to as the Virtual Tablet, in the Navigator window.



Device Settings for the Wacom Tablet device

Use this representation to divide the tablet into different regions for specific uses. For example, you can set a region to adjust the intensity of lights when dragging the pen left and right. Values are taken from the region and applied to an object connected through a Relations constraint.

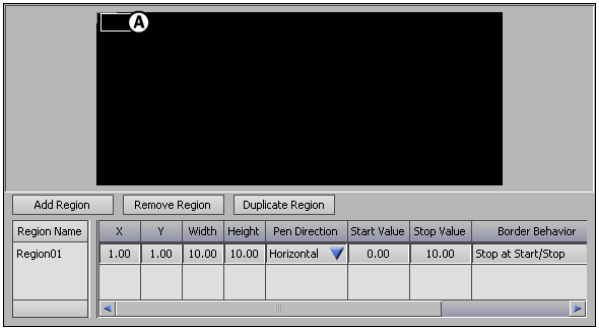
Each region is shown as a white outline and the region's properties display in the Regions table. When the pen is dragged or pressed in a region, its outline displays in red. The location of the pen is shown using gray crosshairs. When the pen makes contact with the tablet, the crosshairs are drawn in red.

See Wacom Tablet Devices in Relations on page 1248 for more information.

Adding a Region for a Wacom tablet

To add a region for a Wacom tablet:

1. In the Wacom Settings, click Add Region.
2. Select the added region in the Regions table, then set up the selected region using the fields in the Regions table.



Wacom Tablet settings *A.* **Added region**

When you add a region, it is automatically named, numbered, and drawn in blue. Its name cannot be changed.

Duplicating a region for a Wacom tablet

To duplicate a region for a Wacom tablet:

1. Select the Region to be duplicated from the Regions table in the Wacom Settings.

2 Click Duplicate Region to add a copy of the selected region to the table. Change the location of the duplicated region unless you want to assign separate behavior to the same region.

For example, do this when you want to have the same space send values for both horizontal and vertical pan movement. Set up the region using the fields in the Regions table.

Removing a region from a Wacom Tablet

To remove a region from a Wacom tablet:

➤ Select the region to be removed from the Regions table in the Wacom Settings, then click Remove Region.

The selected region is removed from the table, and remaining regions are automatically renumbered. If you remove a region that is used in a relation, it is automatically disconnected when removed.

Wacom Device Settings

The Device Settings for Wacom tablets consist of the Regions table, which lets you set the following properties for each region you create for your Wacom tablet.

Property	Function
X, Y	Use the X and Y fields to define the top-left corner of the region. The top-left corner of the tablet is 0,0.
Width	Width of the region, measured starting from the X-coordinate and continuing right. Measured as a percentage of the entire tablet.
Height	Height of the region, measured starting from the Y-coordinate and continuing down. Measured as a percentage of the entire tablet.
Pen Direction	The direction in which the pen must be dragged for the region to register a value. For example, if set to horizontal, a value is registered only when the pen is dragged

Property	Function
	horizontally. Pen Direction can be horizontal or vertical. If you want a region to send both horizontal and vertical values, define two regions for the same space but with different Pen Directions.
Start Value	The minimum value for the region. When dragging or pressing in the region, the value sent does not go below the Start value unless Border Behavior is set to "Continue past Start/Stop".
Stop Value	The maximum value for the region. When dragging or pressing in the region, the value sent does not go above the Stop value, unless Border Behavior is set to "Continue past Start/Stop".
Border Behavior	The behavior of the sent value when the pen contacts the edge of the region. There are two settings.
Continue past Start/Stop	Value is registered for the region even after the pen drags out of the region. The borders of the region are not observed. Start and End values are not used as limiting values.
Stop at Start/Stop	When the pen contacts the border of the region, the value is set to either the Start Value or Stop Value.
Mode	Use Mode to select how the region reacts to pen presses and pen dragging. There are two modes: Relative and Absolute. See Relative and Absolute regions on page 1248.
Comment	Use the Comment field to add your own comments or descriptions.

Relative and Absolute regions

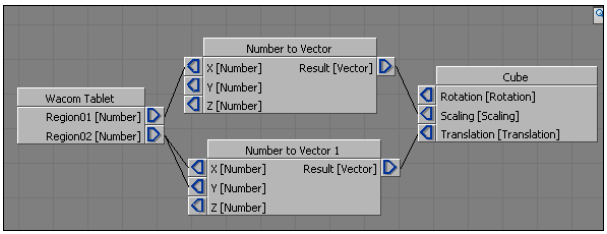
Use the Mode setting in the Wacom Device Settings to select how the region reacts to pen presses and pen dragging.

Region	Definition
Relative	The region is assigned values from the Start Value to the Stop Value. When you press the pen in the region, the current value is replaced with the value associated with where you pressed. When you lift the pen and press again, the value is replaced.
Absolute	The region is not assigned values. The Start value and Stop value act as minimum and maximum values. When you press the pen in the region, the value of where the pen is pressed is added to the current value for the region.

Wacom Tablet Devices in Relations

The Wacom Tablet device can be used in a Relations constraint to drive the position, scale, or rotation of an object. It can also be used to control animation such as blinking eyes, eyebrow movement, or other facial expressions.

For example, the following figure shows the Wacom Tablet device used to scale and rotate a cube. Region 1 controls the X rotation and Region 2 controls both the X and Y scale. Separate Number to Vector converters change the Region 1 and Region 2 values into vectors.



Wacom Tablet device in a Relations constraint

To use the Wacom Tablet device in a relation, drag it from the Asset browser to the Relations settings pane. It is automatically added as a Sender because it cannot receive data.

Each connector in the Wacom Tablet device corresponds with a defined region. You can add and remove regions after the Wacom Tablet device is added to the Relations settings.

Part 10: Animating Characters

When you have brought a character model into MotionBuilder and set it up for animation, there are three different types of motion sources you can use to animate the character: A Control rig, an Actor connected to motion data, or another character.

For more information on characters and setting up a character for animation, see Character setup on page 1269.

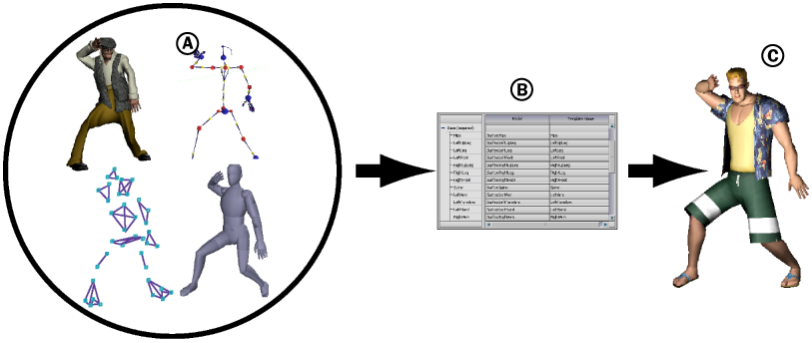
The overall workflow for animating characters in MotionBuilder can be summarized as follows:

1. Create a character model in your 3D package of choice and save it using the *.fbx* file format. (To do this, you need to have the appropriate FBX plug-in installed.)
2. Load your character model in MotionBuilder.
3. Complete the Character mapping process and characterize the character model. See Character mapping on page 1272 and Characterizing on page 1275.
4. Select the type of source you want to drive the character model. The motion source can be a Control rig, another character, or motion data attached to an Actor asset. See Selecting a motion source on page 1253.
5. Edit the animation by creating a Control rig and plotting the animation from the motion source to the Control rig. See Creating a Control rig on page 1437 and Plotting animation to a Control rig on page 1890.

   You can also use the Control rig alone to create poses and set keyframes to animate it.
6. Refine your animation data with editing and filtering. See Refining Animation on page 911.
7. Plot animation from the Control rig to your model's skeleton to prepare it for export. See Plotting animation to a character's skeleton on page 1890.
8. Save the animated character model as an *.fbx* file.

Motion sources

Motion sources are the various types of data that you can use to drive the motion of a character model. They are the data that tells a model how to move. Without a motion source, your character could only stand around in a neutral rest pose. Character models are linked to motion sources through the Character asset.



Motion source data flow *A.* **Motion sources** *B.* **Character asset** *C.* **Animated character model**

There are three main motion sources available in MotionBuilder, including:

- Actors linked to motion capture data
- Control rigs
- Retargeting from another character

To link each of these motion sources to your character model, you must first create a map of your character model using a Character asset, then select the motion source as the Input Type for your character.

The Input Type menu in the Character Settings pane lets you choose from the following sources of motion data for animating your character.

- Selecting a motion source on page 1253
- Actor assets on page 1353
- Character Settings pane on page 1519

- Actor settings on page 1359
- Creating a Control rig on page 1437
- Plotting animation to a Control rig on page 1890
- Retargeting animation character-to-character on page 1257
- Character mapping on page 1272
- Connecting an Actor to a character on page 1356

Selecting a motion source

Once you have a characterized character, you can choose the type of motion source you want to drive the character.

To select a motion source:

1. In the Scene browser, double-click a characterized character to select it as the current character and open the Character Settings.
2. Do one of the following:
   - In the Character Settings, open the Input Type menu.
   - In the Character Controls, select Edit > Input.
3. Select one of the following motion sources from the Input Types menu:
   - Actor Input: Only available when there is an Actor in the scene. Links the character to an Actor, which is connected to motion capture data.
   - Character Input: Only available when there is another animated character in the scene. Links the current character to the character specified in the Input Source field.
   - Control Rig Input: Creates a Control rig for the character, if there is no Control rig, and lets you animate the character by manipulating the rig, creating poses, and setting keyframes.
   - Control Rig Output: If there is animation on your character's skeleton, transfers animation from the skeleton to the Control rig for editing.
   - Stance Input: Resets a selected character to its stance pose.

Whichever type of motion source you choose is connected to your character. You can adjust the way your character reacts to this motion source using the Reach properties. See Reach and Pull area on page 1575 for more information.

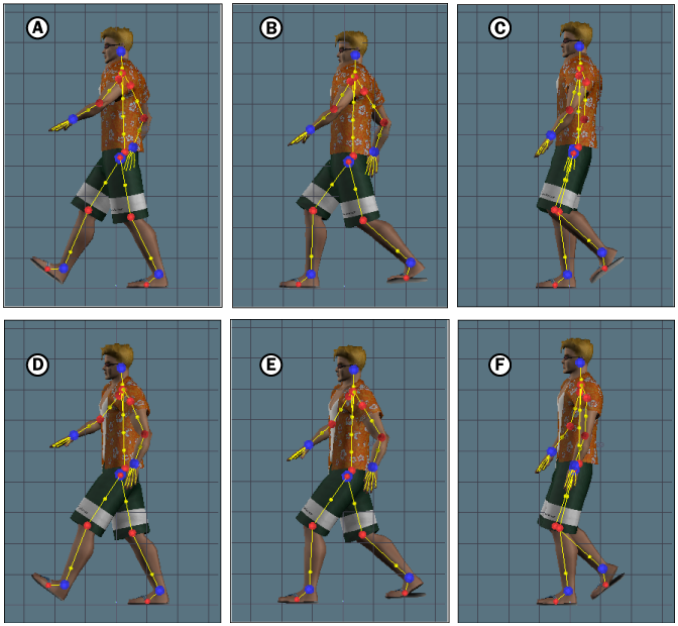
- Animating Characters on page 1251
- Retargeting animation character-to-character on page 1257
- Plotting character animation on page 1888
- Character keyframing workflow on page 1254
- Control rigs on page 1431
- Customizing the Control rig hierarchy on page 1481
- Pinning on page 1459

Character keyframing workflow

The basic process for animating characters involves changing the position and orientation of a character at different points in time, then marking those points with keyframes.

To animate a character, you choose where in time to change the position and orientation of your character, then set a keyframe on the character's position at that time. MotionBuilder then interpolates the movement between your keyframes, creating animation.

For example, in the following illustration, six keyframes were set on different positions of a character in a walk cycle. Playing the animation gives the impression of a continuous walking motion because of the interpolation.

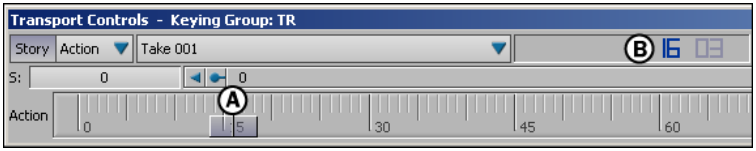


Poses in a keyframe animation cycle *A.* **Frame 0** *B.* **Frame 5** *C.* **Frame 10** *D.* **Frame 15** *E.* **Frame 20** *F.* **Frame 25**

Changing the current time

Changing the current time involves choosing the frame on which to perform a key transformation. Setting the current time can be done in a number of places that display the current timecode and a timeline. You can change the current time in various places, such as the Transport Controls window, the FCurves window, and the Dopesheet window.

The following illustration, shows the current time at frame 16 in the Current time field and at the location of the Timeline indicator.



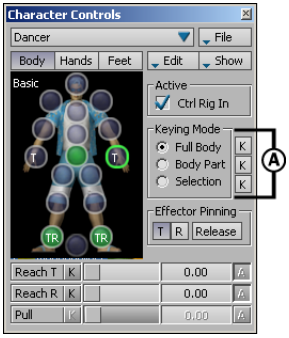
Transport Controls *A.* **Timeline indicator** *B.* **Timecode field**

Setting a keyframe

To mark the transformations, or changes you make to the character over time, you set a keyframe. There are various ways you can set keyframes, including pressing K, or using other keyboard shortcuts. The Key Controls window on page 843 contains the main keyframing options, but you can also set keyframes in the Character Controls window.

The Keyframe (K) buttons that display next to each Keying Mode in the Character Controls let you choose whether you want to key the character's entire body, or only selected body parts. The parts of the character that are available for transformation are also determined by the mode you select.

You can also click the Keyframe (K) buttons in the Character Controls to set keys without switching Keying modes. For example if you are in Full Body mode, you can click the Body Part K button to set a key on only the selected body part.



Character Controls *A.* **The Keying Mode area lets you select what you want to key.**

When Show Key Hint is active in the Transport Controls, keyframes set in Body Part Keying mode display with a green tip, keyframes set in Full Body mode display with a red tip, and when a Character Extension is keyed, the keyframe displays with a yellow tip. See Keyframing a Control rig on page 1257 for more information.

Transport Controls *A.* **Body Part keyframe** *B.* **Character Extension keyframe** *C.* **Full Body keyframe**

When you set more than one keyframe of the character's position over time, you have created character animation. When you play this animation, MotionBuilder interpolates the position of the character between the keyframes you have set, giving the impression of smooth continuous motion.

For general information on keyframing, see Setting keyframes on page 819 for more information. For more information about the basic animation process, see Basic Keyframe Animation on page 741.

- Animating Characters on page 1251
- Showing and hiding visual keyframes on page 836

Keyframing a Control rig

To set keyframes on a Control rig:

1. Position the character.
2. Choose a timecode.
3. Select the keying mode.
4. Set a keyframe.

For more information, see Character keyframing workflow on page 1254, Refining character animation on page 1263, and Plotting Animation on page 1887.

Retargeting animation character-to-character

Retargeting is the process of taking animation developed for one character and using it to drive another character without plotting (or baking) the animation onto either character's skeleton. You can retarget both keyframe animation and motion data.

Animation can be retargeted from one characterized character to another in the same scene, or you can save takes of animation to be retargeted onto any character.

Using generic biped or quadruped skeletons lets you reuse animation on different characters.

The main options that let you quickly retarget animation between characters are found in the Character Controls on page 1553.

NOTE Depending on the number of spine bones defined in the source character and the target character, the way animation is mapped from spine to spine can differ. See Defining a spine on page 1284 for more information.

Retargeting keyframe animation

When you retarget keyframe animation, the Reach properties are also retargeted to the target character. This means you can take the precise keyframe animation you have developed for one character and reuse it on another character.

When you select Retarget in the Character Controls Edit menu, keyframes are copied directly from one Control rig to the other, without plotting. The Character dialog box that appears lets you select how you want the retargeting to be done.

The quality of your animation is preserved and adjustments for any difference in size between the characters are made automatically.

In order to retarget keyframe animation properly, you must have an equivalent setup on both characters. The best way to achieve this is to create identical Control rigs for both the 'source' character (the character you want to retarget from) and the 'target' character (the character you want to retarget to).

- Bipeds and quadrupeds on page 1290
- Retargeting animation between characters in the same scene on page 1259
- Character Controls on page 1553

Retargeting a control rig

The purpose of retargeting on page 2016 a control rig is to take the animation of a characterized character and use it to drive another characterized character without having to plot (or bake) onto either character's control rig. You can retarget both keyframe animation and motion data.

For information on the main options available to quickly retarget animation, see the Character Controls on page 1553 and the Character Controls on page 1553 Retarget on page 1563.

See also:

- Retargeting animation character-to-character on page 1257

Retargeting animation between characters in the same scene

To retarget keyframe animation from one character to another in the same scene:

1. Load two character models into the scene, one 'source' character with a Control rig and keyframe animation, and one 'target' character with no Control rig attached.

2. Save a copy of the source character's Control rig, then apply it to the target character. See Saving a Control rig on page 252.

   This creates the identical setup on both characters necessary for retargeting keyframe animation.

3. Double-click the target character in the Scene browser to open the Character Settings.

4. Select Character Input as the Input Type, and select the source character as the Input Source.

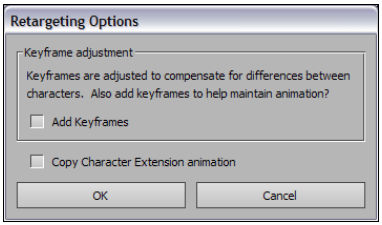
5. Activate the Active option.

   The target character is now set up to be driven by the keyframe animation of the source character. You can use the various character properties such as Retargeting, Pull, Floor Contact and so on to modify the way the animation is retargeted.

6. Select Retarget from the Edit menu in the Character Controls.

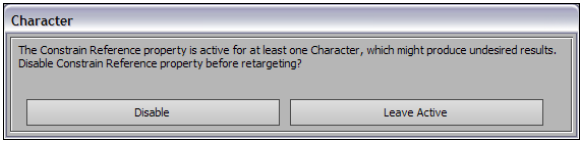
7. In the Retargeting Options dialog box that appears, activate or disable any options you choose.

   For example, activate the Add Keyframes option if you are concerned with retargeting your original animation as precisely as possible. See Retarget in Load Technique area on page 1582 for more detailed information.



Retargeting Options dialog box

If the Constrain References property for one of the characters is active, a Character dialog box appears asking if you want to disable the Constrain References property. Click Disable if you want to turn off the active Constrain References property. See Constrain References on page 1533 for more information on this property.



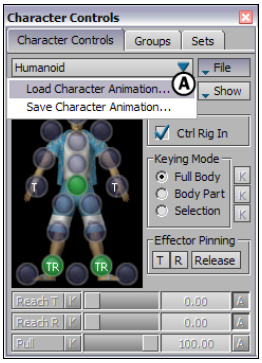
Character dialog box asking if you want to disable the Constrain References property.

The keyframe animation from the source character is copied to the target character, and MotionBuilder makes the necessary adjustments for any differences in the size and shape of the two characters. The exact dynamic of your original keyframe animation is preserved on the target character.

Retargeting saved animation onto a character

After you have saved motion data or keyframe animation using the File > Save Character Animation option in the Character Controls, you can retarget that animation onto any character.

1. In the Character Controls, select a character in the Current Character menu.
2. Still in the Character Controls, select File > Load Character Animation.



Character Controls *A.*
Select the Load Character Animation option

The Open File dialog box appears.

3 Browse and select the *.fbx* file containing the animation you want to load.

NOTE For best results, use *.fbx* files saved using the Save Character Animation option. See Saving character animation on page 257.

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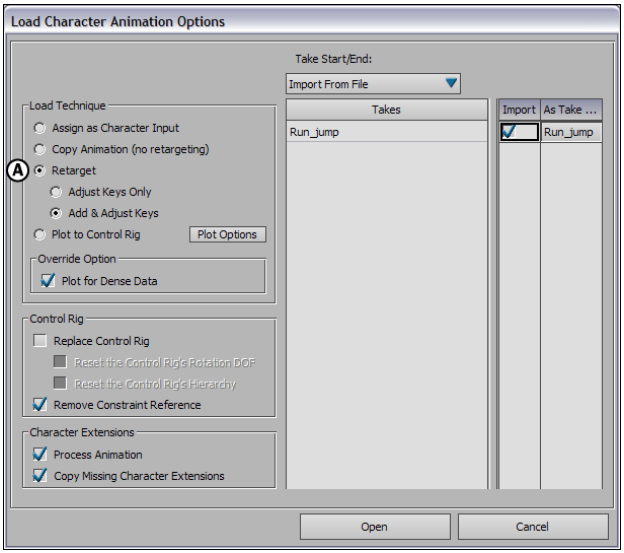
4 Click Open.

5 The Load Character Animation Options dialog box appears.



Load Character Animation Options dialog box *A.* **Retarget option**

6 In the Load Technique area, select the Retarget option.

7 In the Key adjustment dialog box that appears, select either the Adjust Keys Only option or the Add & Adjust Keys option.

If you want to keep the same number of keyframes as in the source file, select the Adjust Keys Only option. This option works best when all keyframes are on the Base Layer. It adjusts all keyframe values to fit the current character.

If you want to help preserve the original animation when using multiple layers, select the Add & Adjust Keys option. This option adds keyframes as well as adjusts all keyframe values to fit the current character.

8 Make sure the take you want to retarget is selected in the Take list.

9 Click Open.

The animation from the file you selected is retargeted onto the current character in the scene.

- Saving a Control rig on page 252
- Attaching a Control rig to a character on page 1439

- Load Character Animation Options dialog box on page 1581

Character motion capture workflow

In order to connect recorded motion data to a character, you need to use an Actor asset. Once this process is complete, the character can move according to the motion data defined in the Actor's Marker set.

When you are satisfied with your mapping, you can drive the character independently of the recorded data by transferring (plotting) the data to your character's skeleton. You can then export your plotted character and open it in other 3D software.

The following procedure summarize the process of connecting a character to motion capture data:

1. Add an Actor asset to the scene. See Creating an Actor on page 1354.
2. Merge your motion data file into the scene.
3. Create a Marker set. See Creating a Marker set on page 1377.
4. Connect the Actor to your character. See Connecting an Actor to a character on page 1356.
5. Adjust the connection between the Actor and character. See Adjusting a character connected to an Actor on page 1357.
6. Optional: Plot the motion data to the character. See Plotting animation to a character's skeleton on page 1890.

- Motion sources on page 1252
- Selecting a motion source on page 1253

Refining character animation

Once your character is animated, you can refine its movement by editing and filtering the animation data.

For precise control over keyframes, you can modify the function curves in the FCurves window.

To speed up or slow down the entire animation, you can manipulate your entire animation by adding and manipulating points on a Timewarp curve. See TimeWarp curves on page 965.

In the Character Settings pane, there are various filtering options available. For example, the Floor Contact option makes sure that your character's feet do not go through the floor.

Loading character animation

After you have saved character animation using the Save Character Animation option in the Character Controls, you can load that animation onto any character.

To load character animation:

1. In the Character Controls, select a character in the Current Character menu.
2. Still in the Character Controls, select File > Load Character animation.
3. In the File Open dialog box, navigate to select an *.fbx* file (or multiple *.fbx* files) containing motion data or keyframe animation saved with the Save Character Animation option, then click Open.
4. In the Load Character Animation dialog box that appears, select any options you need. See Load Character Animation Options dialog box on page 1581 for detailed information.

   If you selected more than one *.fbx* file to load at the same time, the files are loaded in alphabetical order.

- Saving character animation on page 257
- Troubleshoot loading character animation on page 1264

Troubleshoot loading character animation

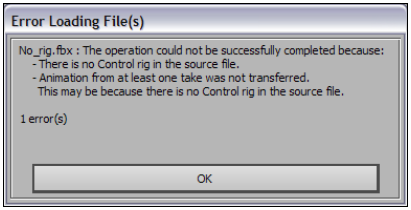
As you load character animation using the File > Load Character Animation option in the Character Controls, a dialog box may appear to warn you that the operation was not completed successfully.

Depending on the options you selected in the Load Character Animation Options dialog box and the contents of the source file you selected, you may

encounter one or more of the following messages in the Error Loading File(s) dialog box.

No Control rig in the source file

If the Replace Control Rig option is active, but there is no Control rig in the source file, this error message displays.



Error Loading Files dialog box: There is no Control rig in the source file.

To correct this problem, disable the Replace Control Rig option, or make sure there is a Control rig in the source file you select, then try again.

No character in the source file

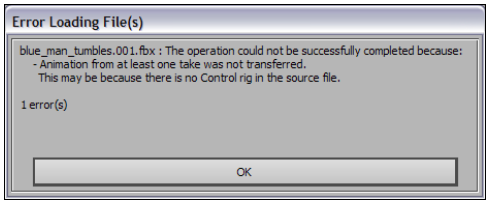
If there is no character in the source file you have selected, this message displays.

To correct this problem, make sure there is a character in the source file you select, then try again.

Animation was not transferred

This message can display for one or more of the following reasons:

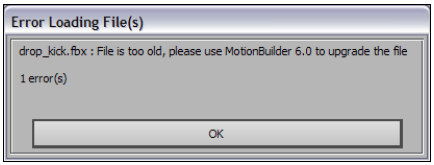
- The plot operation failed, because there is not character in the source file.
- There was no character in the source file.
- There was no Control rig in the source file.
- There was no character in the current scene.
- There was no Control rig in the current scene.
- The Control rig in the source file was not connected to the Control rig in the current scene. Either there is no character in the source file, or there is another problem.



Error Loading Files dialog box: Animation was not transferred.

File is too old

If the file you have selected was created in MB version 6.0 or earlier, it is not compatible with the Load Character Animation feature.



Error Loading dialog box: File is too old

- Character motion capture workflow on page 1263
- Character Controls on page 1553

Creating realistic human movement

MotionBuilder provides you with many tools that make it easy to create realistic movement for a character.

For the sake of simplicity, this topic discusses how the MotionBuilder character engine works with biped or human skeletons. There are special conditions and exceptions when animating quadrupeds that are beyond the scope of this section.

Before you can successfully animate a character within MotionBuilder, it is important to understand how skeletons move and how MotionBuilder can help you recreate believable motion.

Studying the human skeleton

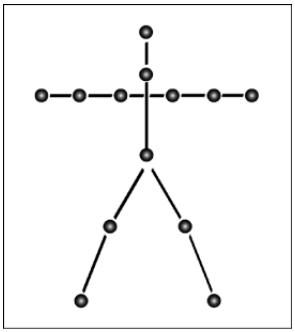
In order to create believable human movement, you must first look at the human skeleton and how it operates.

A human skeleton is basically composed of a series of joints. The joints are connected by bones which are moved by muscles and tendons.

In order to create realistic movement in animation, 3D skeletons mimic the movement of human skeletons using a series of joints, rather than actually replicating the complex system of muscles, tendons, and bones.

A simple 3D skeleton is composed of the main joints, such as the shoulder, elbow, wrist, knee, and so on. Since muscles and tendons move the joints that move a real skeleton, we can achieve an accurate recreation on a model by manipulating the joints directly, without replicating muscles and tendons.

Each point is placed in 3D space and connected together to resemble the joints of a human skeleton. For example, the following illustration shows a very simplistic skeleton created with dots representing the joints, and lines representing the bones. What is drawn between the joints is not important at this stage.



A simple skeleton

We now have a series of dots representing joints that are connected with lines (representing bones). The next section discusses the relationships and rules needed to make this series of points act like a human skeleton.

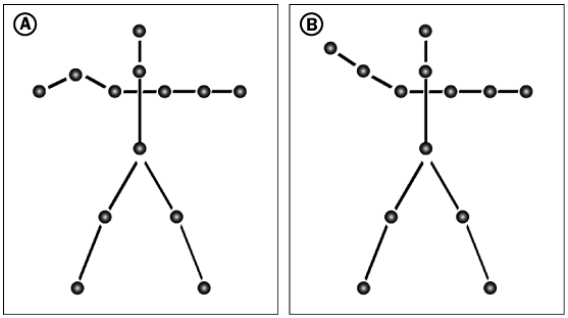
Basic rules of creating human movement

When you characterize a character in MotionBuilder, the character engine automatically defines a group of settings that govern human movement, so you won't need to create your own. Still, it is important to have a good idea of what's involved in creating realistic human movement.

Making a series of points act like a human skeleton involves setting up rules to determine the ways in which the points can interact with each other. For proper interaction, it is necessary to create relationships to govern how each point influences the other. Otherwise, when the series of joints moves, it does not behave like a human skeleton.

Refer again to which uses dots to represent joints. With no relationships established, each joint moves independently.

For example, if you move the dot representing an elbow, only the elbow moves and the wrist and hand do not move. On a human skeleton, if you move your elbow, the wrist and hand move as well.



A. **If no relationships are established to define the movement of the right arm on the simple skeleton, it moves in an unnatural fashion.** *B.* **A rule is created to make the wrist and hand move when the elbow moves, resulting in natural movement.**

To create natural movement, you need a rule that says "when the right elbow moves, the right wrist and hand must also move".

You also need a rule to govern the rotation of joints. Through studying human movement, it is obvious that when, for example, the right elbow moves, the wrist and hand also move, and the right shoulder rotates. So you create a rule that says "when the right elbow moves, the right shoulder rotates."

After studying all of the movements of a human skeleton, you can discover hundreds of rules governing translation and rotation. Fortunately, MotionBuilder already has most of these rules figured out for you.

- Interpolation on page 913
- Dynamic Editor on page 929
- Floor contact on page 1323

Part 1: Character setup

This section includes all of the topics involved when bringing a character model into MotionBuilder and preparing it to be animated.

Before you can animate a character, you have to map out its structure and characterize it. The essential tool in the MotionBuilder character setup process is the Character asset, which helps you map out your character, characterize it, then link the character model to a motion source.

Following are the topics included in this chapter.

- Setting up a character on page 1269
- Character assets on page 1271
- Models on page 1289
- Skeletons on page 1309
- Floor contact on page 1323
- Character Extensions on page 1341

Setting up a character

This topic provides a general overview of the steps required when bringing a character model into MotionBuilder and preparing it for animation.

To set up a character:

1. Create a character model in external software and save it as an *.fbx* file. (To do this, you need to have the appropriate FBX plug-in installed.)

   It is recommended that you use the bone-naming conventions recognized by MotionBuilder as you build your model and name its bones. See Bone naming conventions on page 1317.

2. Load the *.fbx* file containing your character model in MotionBuilder. See Opening an .fbx file on page 195.
3. Add a Character asset to the scene. See Adding a Character asset on page 1271.

   The Character asset provides you with a template you can use to map out your character for MotionBuilder.
4. Link your character to the Character asset by completing a character map. See Character mapping on page 1272.
5. Characterize the character. See Characterizing on page 1275.

   If you have named your character's bones according to MotionBuilder's naming conventions (as discussed in step 1), you can complete steps 4 and 5 automatically. See Automatically mapping and characterizing a character on page 1278.

Your character is now set up and ready to be animated in MotionBuilder.

Related Topics

- Character assets on page 1271
- Control rigs on page 1431
- About the Mapping List on page 1273
- Character mapping on page 1272
- Characterizing a character model on page 1277
- Skins window on page 1302

Character assets

75

The MotionBuilder Character asset helps you create a complete map of your character model's structure and link it to a motion source for animation. The topics in this section include information on working with the Character asset to bring your character models into MotionBuilder and animate them.

NOTE MotionBuilder also includes a Character asset designed specifically for 3ds Max Bipeds. See Characterizing a 3ds Max biped on page 1276.

Before you can animate a model, you use the Mapping List in the Character asset to introduce the different bones of your model's skeleton to MotionBuilder. This process is called Character mapping.

In the Asset browser, the Templates > Characters folder contains the Character asset. You can add a Character asset to the scene to begin creating a map of your character model, or you can use it to automatically map and characterize your character. See Characterizing on page 1275 for more information.

When you add a Character asset to the scene the Character Settings you need display in the Navigator window.

- Models on page 1289
- Bone naming conventions on page 1317
- Animating Characters on page 1251

Adding a Character asset

To add a Character asset to the scene:

- From the Templates > Characters folder in the Asset browser, drag a Character asset into the Viewer window or Scene browser.

NOTE If you drag the Character asset over a model with a skeleton that follows MotionBuilder naming conventions, you can automatically define and characterize your character.

To add a Character asset for 3ds Max Biped to the scene:

- From the Templates > Characters folder in the Asset browser, drag the 3ds Max Biped Template asset over an imported 3ds Max Biped skeleton and choose Characterize.
  The 3ds Max Biped Template asset automatically defines and characterizes your character.

  NOTE The 3ds Max Biped Template supports up to 10 neck bones whereas Bipeds created in 3ds Max support up to 25 neck bones.

  For information on how you can create your own specialized Biped template, see Customizing the 3ds Max Biped template on page 1286.

- Character assets on page 1271
- Character settings on page 1505
- Bone naming conventions on page 1317
- Automatically mapping and characterizing a character on page 1278

Viewing Character settings

To display the Character settings, double-click a Character asset in the Scene browser. The Character settings for the selected Character asset display in the Navigator window.

- Character settings on page 1505

Character mapping

When you bring a character model into MotionBuilder, you must define that character's structure by completing the Mapping List. This process is referred to as Character mapping.

Essentially, Character mapping tells MotionBuilder that on this character's skeleton, these are the arms, these are the legs, this is the head, and so on. Once you have completed the Mapping List, you can link your character model to a motion source to animate it.

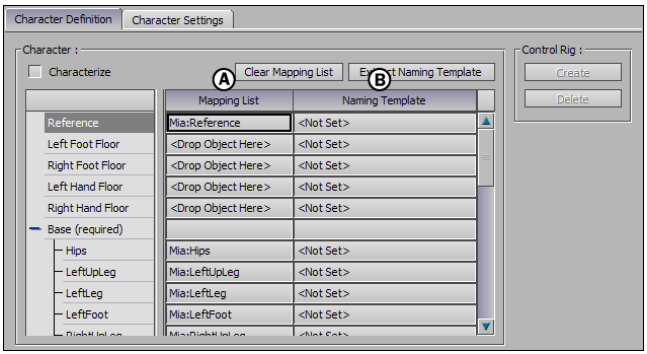
There are two ways to map out a character model and prepare it for animation: automatic and manual. Both methods use a Character asset to help you complete the Mapping List.

Whether you can automatically map your character depends on the naming of its bones. If you have named the bones using the naming conventions found in the Mapping List, you can automatically complete the mapping. If you have a character with bones that are named differently, you must manually map out the bones.

If you plan to use several characters with bones that do not follow the MotionBuilder naming conventions, you can create a naming template of your own bone names. See Creating a bone-naming template on page 1319.

About the Mapping List

The Mapping List in the Character Definition pane includes required and optional slots that let you define the skeleton of your model. The Character asset uses the objects defined in this list to link your character model to a motion source.



A. **Mapping List** *B.* **Naming Template column**

Essentially, the Mapping List contains all of the data that MotionBuilder needs to understand the structure of your character and how it can move. It contains the list of bone names that MotionBuilder understands.

For any skeleton that you introduce, MotionBuilder requires that you map a minimum of fifteen objects to the Base group of slots.

After you have completed the character mapping, you can characterize your character model to ready it for animation.

See Mapping List on page 1506 for a detailed description of all the slots in the Mapping List.

- Character assets on page 1271
- Character settings on page 1505
- Characterizing a character model on page 1277
- Manually mapping and characterizing a character on page 1278
- Automatically mapping and characterizing a character on page 1278
- Bone naming conventions on page 1317

Spine mapping behavior

Depending on the number of spine bones defined in a motion source and its target character, the way animation is mapped from spine to spine can differ.

When you retarget animation from one character to another, and the target and source characters have the same number of spine bones, the animation is mapped directly from spine bone to spine bone. The source spine animation is reproduced exactly on the target spine.

If the source character has fewer spine bones than the target character, the source spine animation is solved evenly over all the target spine bones. The reproduced animation is not exactly the same, but is adjusted so the spine still moves naturally based on the source character.

This same behavior is available when targeting animation from an Actor to a character. Actor assets have two spine bones, while characters may have many. When you use an Actor as the motion source for a character, the spine animation is mapped directly if the character also has two spine bones. If the character has more than two spine bones, the animation is solved evenly over all the spine bones.

- Defining a spine on page 1284

Defining toe behavior

If you want a character's big toes to have thumb-like movement, map the toe bones to the “LeftFootThumb” and “RightFootThumb” slots of the Mapping List. You might want this behavior if, for example, you have a quadruped with opposable thumbs on their feet, you should use the thumb. You can also use the thumb for dew claws.

If you want the character's big toes to have normal toe movement, map the toe bones to the “LeftFootExtraFinger” and “RightFootExtraFinger” slots in the Mapping List.

NOTE If your character model has bones named using naming conventions from previous versions of MotionBuilder, the toe bones are named “LeftFootThumb,” “RightFootThumb” and so on. When you map and characterize this model, the toes use thumb-like behavior unless you rename them or manually map them to the “LeftFootExtraFinger” or “RightFootExtraFinger” slots.

Characterizing

The action of activating the Character map you have defined is called characterizing. When you characterize a model, it is no longer just mesh and a skeleton, MotionBuilder recognizes it as a character that can be animated.

Once you have a characterized character, you can select what type of motion source you want to control it, such as a Control rig, Actor, or other character.

NOTE You cannot edit the Mapping List for a characterized character. If you need to edit the Mapping List, for example to add an object to define the floor, you must temporarily disable the characterization.

There are two ways to characterize a character: manually and automatically. The way you set up and characterize a character depends on how you named the bones of your character model’s skeleton.

- Bone naming conventions on page 1317
- Character mapping on page 1272
- Manually mapping and characterizing a character on page 1278
- Automatically mapping and characterizing a character on page 1278

Characterizing a 3ds Max biped

MotionBuilder has a character template specifically for use with 3ds Max Bipeds. The 3ds Max Biped Template is identical to the MotionBuilder standard Character constraint, but it uses the 3ds Max Biped naming convention instead.

The 3ds Max Biped Template recognizes bones of biped objects created in 3ds Max and it recognizes namespaces.

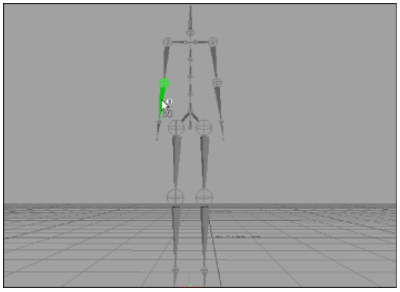
For example, if you drop the 3ds Max Biped Template on a skeleton, the character is re characterized using a 3ds Max Biped-specific naming template.

You can customize the 3ds Max Biped template. See Customizing the 3ds Max Biped template on page 1286.

NOTE The 3ds Max Biped template works on multiple Bipeds so long as every time you re-merge the file, you import it into another namespace.

To characterize a 3ds Max biped:

1. Choose File > FBX Plug-in Import.
2. On the Open File dialog box, locate the 3ds Max Biped and click Open. Leave the default settings unchanged in the FBX Importer, and click Open.
3. From the Asset browser, click the 3ds Max Biped Template asset and drag it onto the 3ds Max Biped.



Drag the 3ds Max Template onto the Biped in the Viewer window.

4. Click Characterize.

   Your 3ds Max Biped is fully rigged.

NOTE The MotionBuilder 3ds Max Biped Template supports up to 10 neck bones, whereas the 3ds Max Bipeds support up to 25 neck bones.

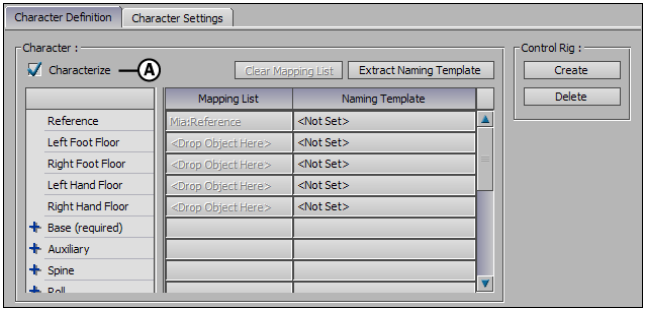
Characterizing a character model

After you have finished the character mapping process, linking your character model to a MotionBuilder Character asset, you can characterize the model to activate it in MotionBuilder and make it ready for animation.

To characterize a character model:

1. Complete the character mapping process, manually or automatically. See Character mapping on page 1272.

2. In the Character Definition pane of the Character Settings, activate the Characterize option.



Character Definition pane *A.* **Characterize option**

3. A dialog box appears to remind you that your model must be in a stance pose facing the positive Z-axis. Choose between two types of postures for your character (Biped or Quadruped).

   Once it is characterized, your character is ready to be attached to a motion source.

If you want to characterize a 3ds Max Biped, see Characterizing a 3ds Max biped on page 1276.

- Character mapping on page 1272
- Troubleshoot characterizing a character on page 1281

Automatically mapping and characterizing a character

If you have a model with bones that are named according to the same naming conventions as the Mapping List, you can automatically map out the character model for MotionBuilder and characterize it. If your model uses different bone naming conventions, you must manually map out the character.

To automatically map and characterize a character:

1. Load a character model.
2. Drop a Character asset from the Asset browser (Templates > Characters folder) onto your model in the Viewer window. If you have a 3ds Max Biped, drop the 3ds Max Biped Template onto your model.
3. Select Characterize in the menu that appears.
4. A dialog box appears to remind you that your model must be in a stance pose facing the positive Z-axis. Choose between two types of postures for your character (Biped or Quadruped) to continue.

   The Character mapping is automatically completed in the Mapping List, and the character is characterized and ready for animation.

After characterizing your character, you cannot make any changes to the Mapping List. To make changes, you must disable the Characterize option to remove characterization.

- Characterizing a character model on page 1277
- Troubleshoot characterizing a character on page 1281
- Manually mapping and characterizing a character on page 1278
- About the Mapping List on page 1273

Manually mapping and characterizing a character

When a model's bones are named differently from the names recognized by MotionBuilder, you need to map out each bone manually before the model can be characterized.

To manually map and characterize a character:

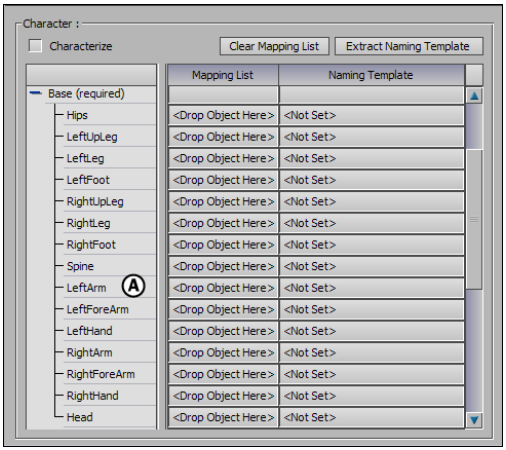
1. Load a character model into the scene.

2 From the Templates > Characters folder of the Asset browser, drag a Character asset into the scene.

A Character asset is added in the Scene browser and the Character Settings open in the Navigator window.

3 Activate the Lock option in the Scene browser to keep the Character Settings open for the duration of this procedure.

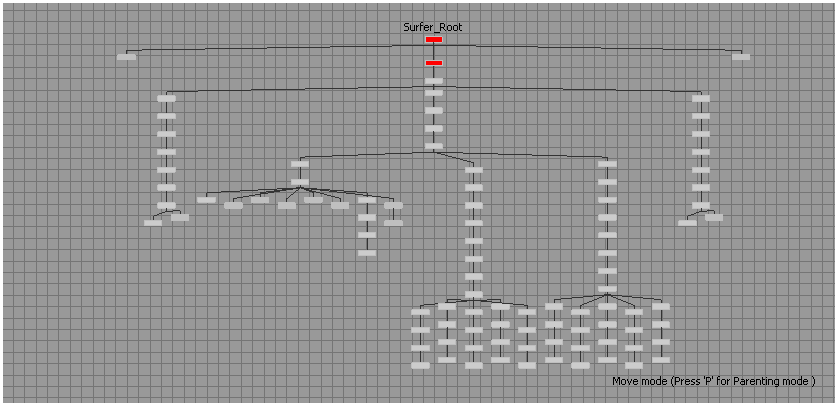
4 Switch to the Character Definition pane and view the Mapping List. Expand the Base (required) group of slots.



Character Definition pane *A.* **Base (required) objects**

The words <Drop Object Here> currently display for each required slot in the Mapping List because the model's bones have not yet been mapped.

5 In the Viewer window, switch to the Schematic view (Ctrl-W), then press A to frame the hierarchy. Each of the bones in your character's hierarchy are represented by rectangular nodes.



Character hierarchy in the Schematic view

You may find it easier to select bones using these nodes in the Schematic view.

6 Select a bone, then *Alt*-drag it into the Mapping List of the Mapping List. Drop each of the character's bones into the corresponding slot of the Mapping List.

   For example, if you select your character model's left thigh bone, you would *Alt*-drag it into the LeftUpLeg field in the Mapping List.

   Repeat this step until you have dragged all of the required bones into the Mapping List. The Character mapping is now complete.

7 Activate the Characterize option at the top of the Mapping List.

8 A dialog box appears to remind you that your model must be in a stance pose facing the positive Z-axis. Choose between two types of postures for your character (Biped or Quadruped) to continue.

After characterizing your character, you cannot make any changes to the Mapping List. To make changes, you must disable the Characterize option to remove characterization.

- About the Mapping List on page 1273
- Character mapping on page 1272
- Stance on page 1292
- Characterizing a character model on page 1277

- Bone naming conventions on page 1317
- Character Definition pane on page 1506
- Troubleshoot characterizing a character on page 1281

Troubleshoot characterizing a character

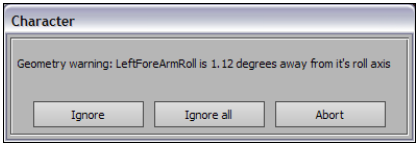
This topic discusses common error messages that can occur when you attempt to characterize a character model.

NOTE You can only characterize a model that has a completed Character map. See Character mapping on page 1272.

Depending on your model and the objects defined in the Mapping List, you may encounter errors when you attempt to characterize a character. You can ignore some of these errors, while other errors prevent your model from becoming characterized.

Roll Axis error

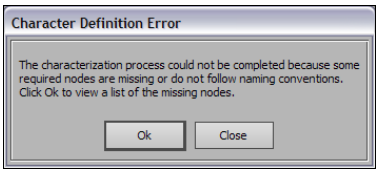
For example, the following figure shows a warning that occurs when the roll axis of a certain bone on your skeleton is not where it should be for accurate roll. If you do not think the difference in roll axis location affects your animation, choose one of the Ignore options.



Roll axis warning

Missing required nodes error

If you did not define objects in all of the slots required to successfully characterize your model, the following error dialog appears and the characterize operation is not completed.

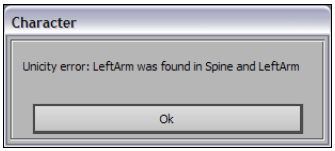


Character Definition error dialog box

You must define objects in all the slots of the Base group of the Mapping List before you can characterize the character. Click Ok in the Character Definition Error dialog box to view a list of required objects.

Unicity error

If you have used the same bone in more than one slot of the Mapping List, a dialog box similar to the following image appears.



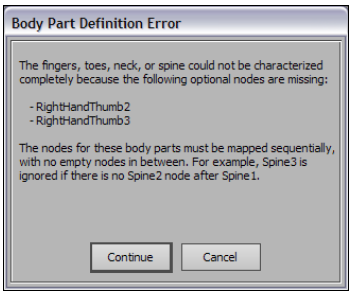
Character unicity error dialog box

Each bone can only be mapped to a single slot in the Mapping List, and the dialog box indicates which bone is currently duplicated. In the previous figure, the dialog box indicates that the “LeftArm” bone is mapped in both the LeftArm slot and the Spine slot. The “LeftArm” bone can only appear in one of those slots.

To avoid this problem, make sure that each bone is mapped to only one slot in the Mapping List, then characterize your character model.

Body Part Definition error

This warning message appears if you have left empty slots between the objects mapped for any body part composed of a single continuous hierarchy, such as the fingers, toes, neck, or spine. As the dialog box explains, the objects defining these body parts must be mapped sequentially with no empty slots in between.



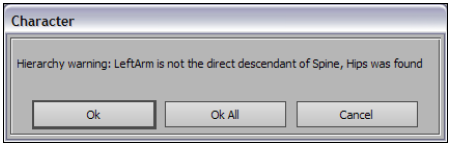
Body Part Definition error

For example, if a character's spine is made up of three objects, those objects must be mapped to the Spine1, Spine2, and Spine3 slots. If the objects are mapped to Spine1, Spine3, and Spine4, the empty slot at Spine2 causes the objects in Spine3 and Spine4 to be ignored.

Because these slots are optional, you do not have to correct the problem to characterize your character. However, the affected body part may not react as expected when manipulated. Click Continue if you want to characterize your character anyway, or click Cancel to stop the operation and change the mapping.

Hierarchy warning

The Hierarchy warning dialog box appears when MotionBuilder recognizes the naming conventions on your character's bone objects, but the bone objects are not in the expected hierarchical order. For example if a LeftArm bone is detected but it is not a child of the Spine object, not below the Spine... Click Ok to ignore the first warning message, or click Ok All to ignore all warning messages concerning the character hierarchy. Click Cancel to stop the characterization process and adjust the mapping or hierarchy.



Hierarchy warning dialog box

- Characterizing a character model on page 1277
- Character mapping on page 1272

Defining a spine

As part of the Character mapping process, you have the option of defining a spine with up to nine additional objects (besides the required Spine object mapped in the Base group). If you define additional spine objects, rotation data is accurately split between all of them.

For best results, when creating your model's skeleton, space the joint or bone of each vertebrae a similar distance apart.

To specify a spine:

1. Double-click a character in the Scene browser to open the Character Settings.
2. Switch to the Character Definition pane, and expand the Auxiliary group of slots.
3. Drop the first bone for the spine into the Spine cell (also displays in the Base group).
4. Drop the second bone into the Spine1 cell.
5. Continue dropping your model's spine bones into the Character map's Spine cells in sequential order. For example, the bone for Spine must parent Spine1. The bone of Spine1 must parent Spine2, and so on.

- Character Definition pane on page 1506
- About the Mapping List on page 1273
- Resetting character properties on page 1284
- Troubleshoot characterizing a character on page 1281

Resetting character properties

To reset properties, click Reset All Properties and then select the appropriate option in the dialog box that appears.

Resetting properties does not affect your animated properties; only non-animated properties are restored to the default settings. All character properties remain unchanged.

To reset all solving and definition properties:

➤ Click Reset All Properties, then click Reset All.

All Character solving and definition properties are set back to their default values.

To reset only character solving properties:

➤ Click Reset All Properties, then click Reset Solving.

All solving properties, including Pull, Resist, Reach, and Stiffness are reset to the default.

To reset only character definition properties:

➤ Click Reset All Properties, then click Reset Definition.

All character definition properties such as Hand Contact Positions and Feet Contact Positions are reset to the default. The Character Type is also reset to Biped.

- Character settings on page 1505
- Character Definition pane on page 1506

Character properties

The Character properties display in the Properties window when a Character asset is selected in the Scene browser. These properties also displayed in the Character Settings. See Character settings on page 1505 for more information.

Character assets are composed of all of the data that defines a character model and links it to a motion source. These Character properties give you ways to adjust the solving, retargeting, floor contacts, pull, stiffness, and many other properties associated with that asset. When you modify a Character property in the Properties window, it is also updated in the Properties area of the Character Settings.

Customizing the 3ds Max Biped template

You can edit the 3ds Max Biped template and save your customized templates. Once you save the customized Biped template, it appears in the Asset browser Characters folder.

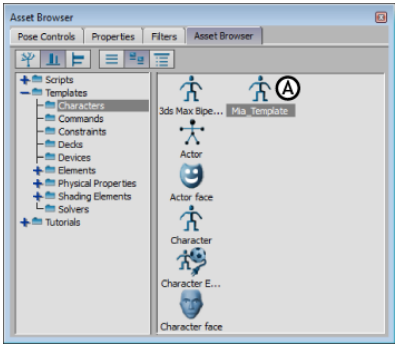
To customize the 3ds Max Biped template:

1. Navigate to the Program Files > Autodesk > MotionBuilder <version> > bin > config > *CharacterTemplate* folder.
2. Create a copy of the *3ds Max Biped Template.py* file.

   TIP It is good practice to make copies of MotionBuilder software files you wish to edit. Doing so ensures the original files remain intact.

3. Open the *Copy of 3ds Max Biped Template.py* file.
4. In the Windows dialog, choose the select the program from a list option and click OK.
5. In the Open With dialog, choose a Text editor program and disable "Always use the selected program to open this kind of file" and then click OK.
6. Make your changes to the file.
   - Make sure that the python script does not create a character as it creates conflicts.
   - If you have a scene with more than one character, characterize the last character added to the scene: (FBSystem().Scene.Characters[len(FBSystem().Scene.Characters) - 1]. This is necessary because the character was created at the moment you applied the template. This way it is exposed to Undo functionality.
7. Save the file through File > Save As . In the Save As dialog select "All Files" from the Save as type drop down menu and give your file name a *.py* extension.
8. In the Character Template folder delete the *Copy of 3ds Max Biped Template.py* file.

   The new template appears in the Asset browser Character asset folder after you restart MotionBuilder.



Characters folder *A.* **Custom template**

Modifying the 3ds Max Biped Template for custom skeletons

You can modify the current 3ds Max Biped Template.py script to accommodate a custom skeleton.

To modify the 3ds Max Biped Template.py script for custom skeletons

1. Navigate to the Program Files > Autodesk > MotionBuilder <version> > bin > config > Character Template folder.
2. Create a copy of the *3ds Max Biped Template.py* file.

   TIP It is good practice to make copies of MotionBuilder software files you wish to edit. Doing so ensures the original files remain intact.

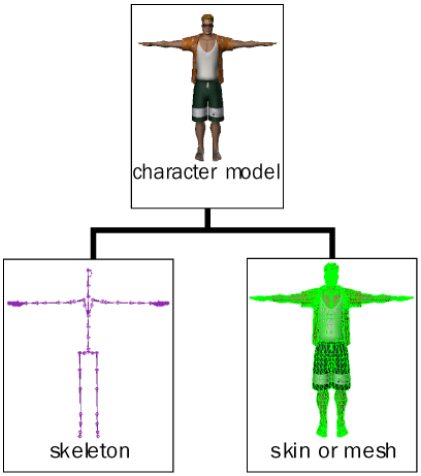
3. Open the *Copy of 3ds Max Biped Template.py* file.
4. At the start of the script, there are three variables that you must modify:
   - bipedrootname # for custom skeleton: set bipedrootname # to the name as the root node.
   - bipedPrefixNamingScheme = False # : this must be set to False for custom skeletons that do not use the normal biped naming conventions.
   - bipedMap # : populate this python dictionary with the custom mapping for your skeleton.

NOTE A limitation exists if you merge the same bipeds multiple times into a scene. The MotionBuilder naming scheme conflicts with the *3ds Max Biped Template.py* script. To modify the script, all bones must be correctly named without any suffix numbering. The workaround is to activate Apply Namespace from the FBX Plug-in Merge Options dialog when you merge the same bipeds into a scene. Using the Apply Namespace option prepends a namespace to the bipeds, guaranteeing their uniqueness while their "short name" is correct. See the Namespace area on page 247 in the FBX Plug-in Merge Options dialog box on page 243.

Models

76

A 3D model can be any object in a scene, created using geometry to resemble an object we find in real life. Models can represent objects as simple as cubes, objects such as furniture, or they can be more complex objects such as characters .



Components of a character model

A character model is a 3D model that resembles biped, quadruped, or any other type of figure, and is composed of a skeleton covered by a geometric skin or mesh.

What a character looks like, its outer appearance and shape, is determined when the model is built. The geometric skin gives the model its outer appearance, and the underlying skeleton structure moves the geometric skin. The ways a character can move are not determined until you introduce it into MotionBuilder.

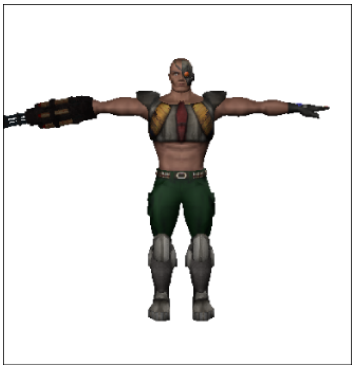
Before importing a character model into MotionBuilder, you should ensure that your model's skeleton follows certain naming conventions, that you have created the appropriate shapes or clusters, and that your model is created in a T-stance on page 2023. See Bone naming conventions on page 1317 and Skins window on page 1302.

In MotionBuilder, a complete character model can be connected to motion data using the Character asset in order to create motion.

- Bipeds and quadrupeds on page 1290
- Skin on page 1295
- Skins window on page 1302
- Bone naming conventions on page 1317
- Skins window on page 1302

Bipeds and quadrupeds

Biped character models are humanoid models that walk on two legs and make contact with the floor using only their feet .



Biped character model

A stance for a biped model resembles a "T" pose in which the arms are parallel to the floor, the feet are flat on the floor, and the spine is straight. The model should face towards positive Z-axis. This is referred to as a T-stance. See Stance on page 1292 for more information.

If your biped model uses fingers and toes, make sure each hand is open and flat with the fingers and thumb straight. For feet, the ankle should be bent to ensure proper floor contact and the toes should be straight and pointed toward the positive Z-axis.

Quadruped character models are four-legged and make contact with the floor using all four limbs (both hands and both feet). When you create and

characterize a four-legged character, select Quadruped if your model is a four-legged animal such as a dog, cat, horse, and so on.

A stance for a quadruped model has the front and back limbs and all fingers and toes fully-extended towards the floor. The model should face towards the positive Z-axis. See Stance on page 1292 for more information.

After you characterize your quadruped, you may need to rotate and adjust the hands and feet for proper floor contact.

Quadruped feet are not automatically adjusted like the feet on a biped (T-stance). This is to allow for all possible foot types, such as paws, feet, hooves, claws, and so on.

- Models on page 1289
- Characterizing on page 1275

Guidelines for creating a character model

Character models are 3D objects that can resemble bipeds, quadrupeds, or any other type of figure. They are composed of a skeleton covered by a geometric skin or mesh. The geometric skin is what gives a model its outer appearance.

In many production pipelines, characters are modeled in other software such as Maya. This means that the geometric skin that shapes the model, as well as the bones and joints of the model's skeleton are laid out, and the whole model is exported to MotionBuilder.

To take advantage of the character and facial animation features in MotionBuilder, keep the following guidelines in mind when creating character models:

- Name your skeleton using MotionBuilder recognized naming conventions. See Bone naming conventions on page 1317.
- Create your model in a T-stance to aid the characterization process. See Stance on page 1292.
- After creating your model's geometry, your character model should be properly skinned. See Skin on page 1295.
- If you intend to take advantage of MotionBuilder's facial animation and voice recognition capabilities, you should also create specific shapes or clusters for your model's head. For a complete list of recommended shapes

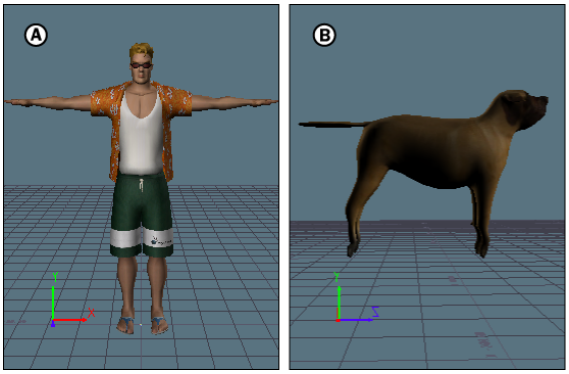
and more information on facial animation, see Animating Faces on page 1587.

- Models on page 1289
- Skeletons on page 1309
- Stance on page 1292

Stance

Before you characterize a model, it must be in a T-stance or rest pose, and it must be facing the positive Z-axis.

For biped models, the rest pose is a T-stance with all fingers and thumbs out straight. For quadrupeds, it is a stance where the model's four limbs and all toes point towards the floor.



Stances *A.* **Biped T-stance** *B.* **Quadruped stance**

This stance is important because when you characterize a model, MotionBuilder takes the model's current pose as the starting pose. All future movement is based on this starting pose.

Creating a T-stance

The Tstance (or rest pose) is often used as the default position for a character. For example, Ragdoll solves recommend that characters are in the T-stance for pose matching.

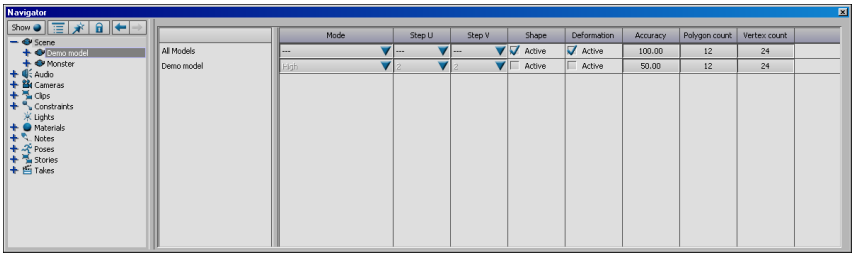
To put your character in the T-stance:

1 Load a character into the scene.

2 In the Character controls, click Edit > Stance.
The character assumes a T-stance position.

Models settings

The Models settings list all the models and model components in your current scene. They let you adjust the level of detail used by a model and activate its shapes or morph targets.



Models settings

The Models settings let you do the following:

- Change a model's name (Models column)
- Adjust the level of detail (Mode column)
- Activate shape animation (Shape column)

Models are created in other 3D software packages, exported, and loaded into MotionBuilder. Some models, such as cubes and planes, are added from the Elements folder in the Asset browser and are referred to as *assets*.

All models appears in the Scene browser under the Scene heading. The Models settings display in the Navigator window when you select a model in your scene. The Models settings consist of the Models Chart.

Models Chart

The Models Chart lets you modify the properties and details of a model.

The first column in the Models settings lists all of the selected models. Double-click a model name in this column to rename it. Select the All Models entry to change all models.

Use the Mode, Step U, Step V, Shape, Deformation, Accuracy, Polygon Count, and Vertex Count columns to alter models in your scene.

Column	Description
Mode	Use the Mode column to set a model's level of detail using a pre-defined mode. You can choose from five different modes: Raw, Low, Low (no normals), High, and High (no normals).
Step U and Step V	Use the Step U and Step V columns to reduce the number of tessellation steps used by the selected model. These columns only work with NURBS and patch-based models and have no effect on polygon-based models. The Step U column affects horizontal NURBS patches. The Step V column affects the vertical NURBS and patches. Ultimately, the manner in which the Step U and Step V settings affect your NURBS and patches depends on how your model was created.
Shape	Deactivate the Shape option if your model contains shapes or morph targets and you want to use these different shapes within MotionBuilder. For example, if you are using the Voice device and you have created different shapes for each phoneme, activate Shape to use these shapes.
Deformation	Deactivate the Deformation option if your model uses deformations and you want these deformations within MotionBuilder.
Accuracy	Use the Accuracy option to set the accuracy of skin deformations. 100% is full accuracy and 1% is a rough estimation of the envelope deformation. Lower accuracy in-

Column	Description
	creases the deformation evaluation speed, which increases the speed of MotionBuilder.
Polygon Count	The Polygon Count column displays the number of polygons used to draw the model. You cannot change or reduce the number of polygons. You can, however, speed up the refresh rate by changing the level of detail used by the selected model. See Mode.
Vertex Count	The Vertex Count column displays the number of vertices used to draw the model. You cannot change the number of vertices.

Model properties

When you select a character model in your scene, many common properties display. If you select a model that includes shapes, such as a face model, the Shapes properties are listed.

Negative Shape Values

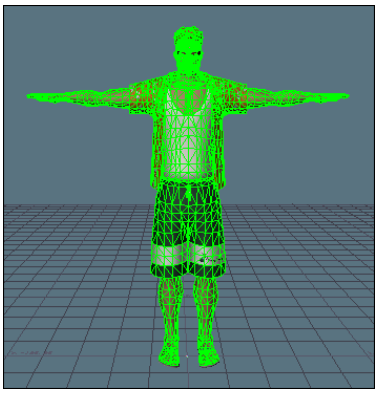
Activate Negative Shape Values if you want to allow a model's shapes to be scaled to negative values.

Shapes

See Animating Faces on page 1587.

Skin

For all character models, the skeleton provides their underlying structure. The outer appearance of each model is created by a geometric skin (or mesh) on which textures, colors, facial and body features are applied to form the character's body. It is the skin that gives a model its distinct appearance.



The geometric skin gives the model its outer appearance. Model is shown in a T-stance.

Your character model should be properly skinned before being used within MotionBuilder. A properly skinned model has its mesh reacting with its skeleton when the arms, legs, head, and other body parts move.

Some modeling software refers to this process as skinning while others refer to it as weighting.

Weighting

Weighting defines to what extent the skin or mesh that envelopes a character follows the movements of its limbs. The skin consists of vertices that control its shape.

The weight applied to vertices determines how the skin or mesh deforms from its original shape as the bones translate or rotate. The goal is to set the weight of each vertex so that the skin or mesh it controls adjusts realistically as the character moves.

For example, in the following figure, A shows the mesh of the character's shoulder deforms unnaturally as the shoulder is rotated on the Z-axis. B, in the following figure shows the same character with improved weighting on the shoulder vertices. The shoulder assumes a much more natural position as the shoulder is rotated on the Z-axis.

Mesh deformation *A.* **The shoulder mesh deforms at an unnatural angle.** *B.* **The shoulder mesh deforms naturally.**

Weight values are measured using a percentage. The higher the percentage, the closer the vertices follow the movements of the bone. For example, with a value set at 100%, the vertex follows the bone exactly. With a value set at 50%, the vertex moves only half as much as the bone.

For deformations to be realistic, you have to associate some vertices with more than one bone. In such a case, any change in the weight percentage relative to one bone adjusts the weighting of the other bones. For example, vertices along the shoulder of a character are influenced by movements of the arms, chest, or spine. To obtain realistic deformations, some shoulder vertices are weighted using arm bones and chest bones, while other vertices are weighted using only arm bones.

The weighting process takes a lot of practice before you can achieve the best balance between vertices. To make it easier to distinguish the influence of different bones on vertices, MotionBuilder indicates weight values using spectral color-coding. Different hues and color blends indicate which bones have the most and least influence.

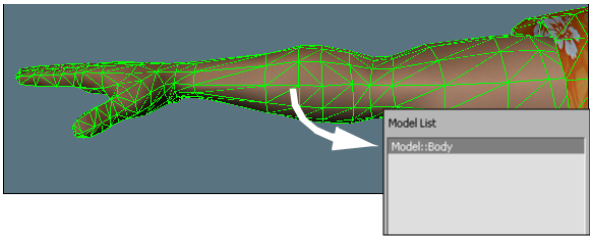
TIP You can minor weighting problems using the Skinning window, but this window is not meant as a full skinning tool. See Skins window on page 1302.

- Selecting vertices for immediate weighting on page 1301
- Preselecting vertices for future weighting on page 1301
- Skins window on page 1302

Adjusting the weighting of vertices

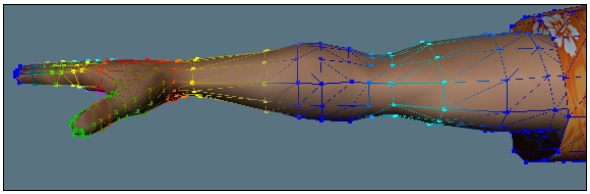
To adjust the weighting of vertices:

1. In the Skins window, select Smooth Colors in the Weighting Options pane.
2. Add the model you want to adjust to the Skins window by selecting and Alt-dragging it from the Viewer window into the Model List .



Alt-drag the model into the Model List.

The name of the model is added to the Model List, and all the bones associated with the model are listed in the Bones list. In the Viewer window, the vertices of the model display in different colors .

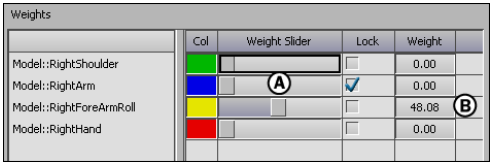


Colored vertices indicate the amount of weighting applied to specific bones.

TIP You can also Alt-drag models out of the Skins window to remove them from the list.

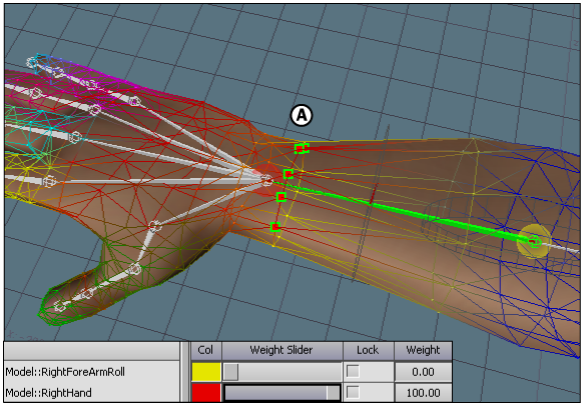
---

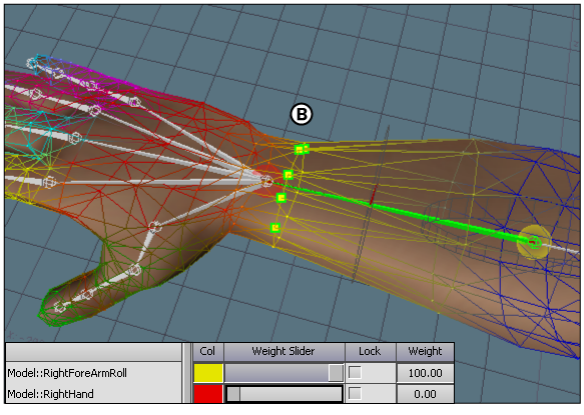
3. Select the bones in the Bones list, select the vertices on which you want to adjust the weight, then use the weight sliders or fields to change the vertices' weight .



A. **Weight slider** *B.* **Weight field**

For example, A and B show how weighted vertices are modified relative to the right elbow roll, to be weighted relative to the right wrist. The color of the vertices changes from pink to blue to reflect that the vertices are weighted with respect to the right wrist, which displays in blue.





A. **Before adjustment** *B.* **After adjustment**

■ Skin on page 1295

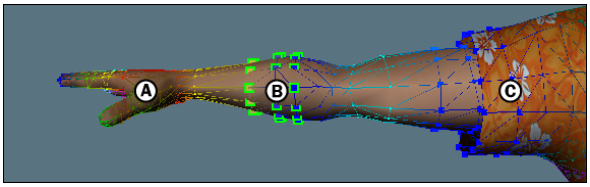
Selecting and preselecting vertices

You can use the following two methods to select vertices:

- Selecting vertices for immediate weighting on page 1301
- Preselecting vertices for future weighting on page 1301

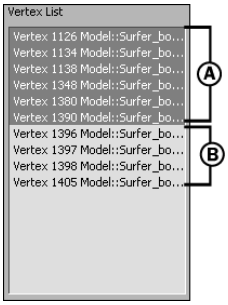
You can also select or deselect vertices directly in the Vertex list of the Skins window.

How vertices display in the Viewer window indicates their status . Vertices selected for weighting display with a green outline. Preselected vertices are bigger than deselected vertices.



A. **Deselected vertices** *B.* **Selected vertices** *C.* **Preselected vertices**

In the Vertex list, vertices available for immediate weighting are highlighted in gray, while preselected vertices display with no highlighting. Deselected vertices do not display .



A. **Selected vertices** *B.* **Preselected vertices**

- Skin on page 1295
- Skins window on page 1302

Selecting vertices for immediate weighting

Immediate selection is a method of selecting vertices to make them available for weighting in one operation.

To select a vertex:

Click the vertex.

To select a group of vertices:

Click-drag across a group of vertices in the Viewer window.

To deselect a vertex:

Middle-click the vertex.

To deselect a group of vertices:

Middle-click and drag to create a deselection area.

To deselect all vertices:

Double-click an empty location in the Viewer window.

To reverse the selection of a vertex:

Right-click the vertex.

To reverse the selection of a group of vertices:

Right-click and drag over a group of vertices to create a selected area.

For more information, see Skin on page 1295, Adjusting the weighting of vertices on page 1298, and Selecting and preselecting vertices on page 1300.

Preselecting vertices for future weighting

Preselection adds the names of vertices to the Vertex list in the Skins window, without making them available for weighting. You may select the vertices for weighting later. This is useful when you want to select the vertices to be weighted directly from the Vertex list.

To preselect a vertex:

X-click the vertex.

To preselect a group of vertices:

X-click and drag in the Viewer window.

To deselect a preselected vertex:

X-middle-click the vertex.

To deselect a group of preselected vertices:

X-middle-click and drag to create a deselection area.

To deselect all preselected vertices:

X-double-click an empty location in the Viewer window.

To reverse the preselection of a vertex:

X-right-click the vertex.

To reverse the preselection of a group of vertices:

X-right-click and drag to create an area.

For more information, see Selecting and preselecting vertices on page 1300, and Skins window on page 1302.

Skins window

The Skins window lets you adjust the weight of vertices relative to one or several bones of a character. This means you can use the Skins window to modify or correct poor weighting of a character.

Skins window *A.* **Model List** *B.* **Bones list** *C.* **Vertex list** *D.* **Weights list** *E.* **Weighting Options pane**

While you can set all weighting for a character within MotionBuilder, to obtain the best results, use a character that has weighting already applied by MotionBuilder-compatible 3D software.

To open the Skins window, select Window > Skins in the menu bar.

The Skins window consists of the following main areas:

- Model List on page 1303
- Bones List on page 1303
- Vertex List on page 1303
- Weights List on page 1303
- Weighting Options Pane on page 1304

Model List

The Model List contains the names of selected models in the Viewer window. You can select the models in this list for weighting.

Add and remove models in the Model List by Alt-dragging them to and from the Viewer window.

TIP It is easiest to select a model's skin when in Models Only mode in the Viewer window.

Bones List

The Bones list contains the name of the selected model's bones.

The bones are automatically included in the Bones list when you select a model name in the Model List. If you select several names, the Bones list displays the name of the bones of all the selected models.

Only the bones that influence the models in the Model List display in the Bones list.

Vertex List

The Vertex list contains the names the vertices for a selected bone. You can choose these vertices for weighting.

Weights List

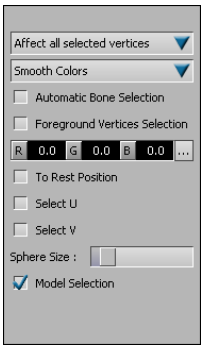
The Weights list lets you adjust the percentage of weight to apply to each selected vertex, with respect to its associated bone or bones.

You can use the following options in the Weights list:

Option	Description
Col (Color)	Defines the color of the vertices associated with the bone. MotionBuilder uses various colors to identify each set of vertices. See Changing Bone Colors on page 1308.
Weight Slider	Determines the weight value of the selected vertex with respect to the associated bone. The weight value automatically updates in the corresponding Weight field. Sliders are only operational when at least one vertex is selected in the Vertex list.
Lock	Locks the weight value of the corresponding bone. Consequently, the weights of other selected bones adjust using the remaining percentage of unlocked weight values. For example, if a weight is locked at 20%, the other weights can only be edited for 80% of the total weight of the selected bones.
Weight	Determines the weight value of the selected vertex with respect to the associated bone. The weight value automatically updates in the corresponding weight slider. This field is operational only when one or more vertices are selected in the Vertex list.

Weighting Options Pane

The Weighting Options pane lets you change the colors for displaying the weight of vertices, change the appearance of the model, select bones automatically, and so on.



Weighting Options pane

Affect Field

The following options in the Affect field let you determine which vertices are affected by the modification of weight values:

Option	Description
Affect all selected vertices	Applies weighting changes to all the vertices selected in the Vertex list.
Affect first selected vertex	Applies weighting changes only to the first vertex selected in the Vertex list.

Color Options Field

The following options in the Color Options field let you determine the color of selected bones and vertices:

Option	Description
Smooth Colors	Displays vertices with a blend of color from all the bones that influence them. The stronger the color of the bone in the blend, the greater the weight applied on the vertex for that bone. For example, if a red bone and a yellow bone influence a group's vertices, these vertices display in orange. If the orange vertices color shifts closer to red, this indicates that the red

Option	Description
	bone is applying the greater weight to the vertices.
Most Influential Bone	Draws vertices using the color of the bone for which they are most weighted.
Least Influential Bone	Draws vertices using the color of the bone for which they are least weighted. This option detects and corrects useless weights, thus optimizing the character's performance.

Automatic Bone Selection

When activated, Automatic Bone Selection chooses the bones that influence selected non-zero weight vertices. This is an easy method of finding influential bones. When you select vertices with Automatic Bone Selection disabled, the selected bones do not show. NOTE: To use Automatic Bone Selection, at least one selected vertex must have a non-zero weight.

Foreground Vertices Selection

When active, Foreground Vertices Selection lets you choose only the vertices located in the foreground of a scene. When disabled, Foreground Vertices Selection lets you choose both foreground and background vertices.

Color Values

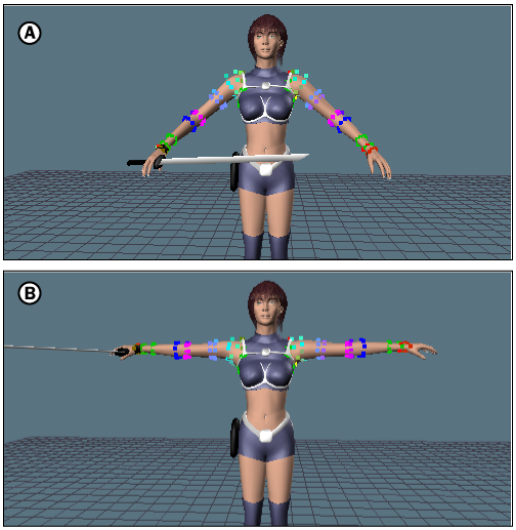
Changes the color of bones using RGB values. These color values determine the color that displays in the Color column of the Weights list. See Changing Bone Colors on page 1308.

To Rest Position

When active, To Rest Position displays the selected models in the Model List using the position they were originally created in. This position is referred to as the rest position. Before adding bones to your model's rest position, you must activate To Rest Position.

For example, in the follwoing image, A and B show the position of a character's arms when To Rest Position is active and disabled. If you activate the rest positions of models that do not depend on each other, or if you use the same bone in several different models because they use different resting positions,

your results may be unpredictable. This option uses the same name order as names in the Model List.



Rest Position *A.* **To Rest Position disabled** *B.* **To Rest Position activated**

Select U

When active, Select U selects all the vertices in the Vertex list that belong to the same U coordinate for a given series of control points of a NURBS surface.

Select V

When active, Select V selects all the vertices of the Vertex list that belong to the same V coordinate for a given series of control points of a NURBS surface.

Sphere Size

Adjusting the Sphere Size slider changes the size of joints. This is useful if you are using a model that uses nodes or joints to represent a skeleton instead of bones. Sphere Size only changes the visual representation of your skeleton.

Model Selection

When active, Model Selection lets you choose the surrounding models when selecting a bone. When disabled, Model Selection lets you choose bones without selecting their surrounding models.

For additional information on weighting vertices, see Skin on page 1295.

Changing Bone Colors

While adjusting weights, many bones that are close to each other may use the same or similar colors. To clearly distinguish a bone. you may want to change its color. The colors assigned to bones are random, but you can change their color. To change the color of a bone, click the color box in the Weights list corresponding to the bone you want to change. Use the color fields to select a new color for the bone. As you change the color, the color and gradients of its weighted vertices update. This makes it easier to choose the best color for the selected bone.

Skeletons

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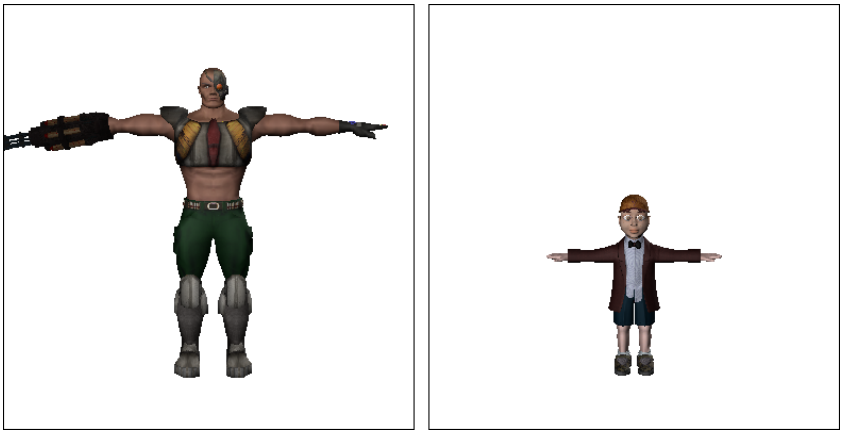
All 3D character models have one thing in common: a rigid skeleton as their underlying structure. The skeleton is covered by a skin (or mesh) on which textures, colors, facial, and body features are applied to distinguish the model's appearance.

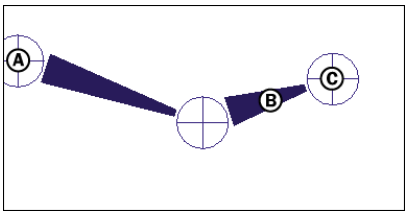
Although the characters in the following figure may look quite different, their underlying skeletons are similar.



Two models that look different can have very similar skeletons.

Just like real skeletons, 3D skeletons contain a hierarchy of bones. In a real skeleton, these bones are connected by joints. Skeletal hierarchies allow the figure to rotate around each individual joint.

A skeletal hierarchy chain starts with top-level joints, and finishes with end effectors. For example, the following figure shows a common hierarchy for an arm in MotionBuilder.



Arm hierarchy *A.* **Joint** *B.* **Bone** *C.* **End effector**

When you animate a character in 3D software you are always animating the skeleton, regardless of the character's outer appearance.

Animation data for a character is always stored on the model's skeleton. When you import an animated model into MotionBuilder and you want to edit the animation, you must first plot the animation to a Control rig. To export animation, you plot the animation back to the skeleton.

The main topics in this section include:

- Skeleton types on page 1311
- Skeleton node and Skeleton root assets on page 1312
- Creating a skeleton on page 1312
- Adding bones to a skeleton on page 1313
- Attaching more than one bone to the same joint on a skeleton on page 1314
- Inserting a limb between two joints on page 1314
- Changing the size of a skeleton on page 1315
- Bone naming conventions on page 1317
- Creating a bone-naming template on page 1319
- Applying a bone naming template on page 1320
- Skeleton Node Settings on page 1321

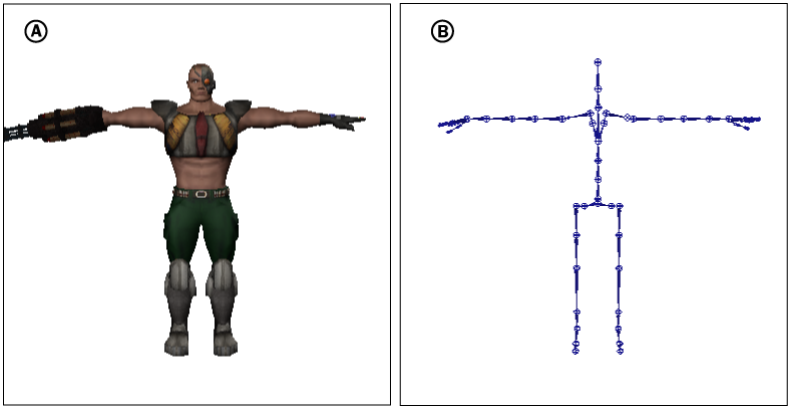
See also:

- Plotting character animation on page 1888

Skeleton types

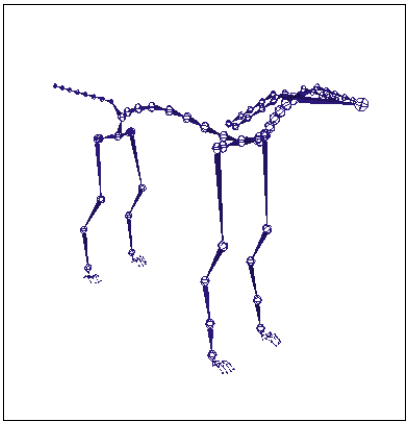
In MotionBuilder you can use two types of skeletons: bipeds or quadrupeds.

A bided skeleton has two limbs that touch the ground. For example, a human biped model displays in the following figure, A. In B, the skeleton of the same model displays with its mesh hidden.



A. **Biped model** *B.* **Skeleton only**

A quadruped skeleton has four limbs that touch the ground.



Quadruped skeleton

- Skeletons on page 1309
- Creating a skeleton on page 1312

Skeleton node and Skeleton root assets

Found in the Elements folder of the Asset browser, the Skeleton node and Skeleton root assets let you build skeletons that can be exported and used in other 3D software.

Skeleton node assets represent the bones of a skeleton, and must be joined to a Skeleton root to create a skeleton hierarchy. The Skeleton root must be joined to at least one Skeleton node.

When creating a chain of bones, MotionBuilder automatically finds a vector at the middle joint and sets its rotational limits. For best results, always build your skeleton with bent joints.

MotionBuilder can give more precise limits for bent joints than for straight joints. After creating your skeleton, you can view and adjust its limits (see Degrees of Freedom (DOF) on page 727).

- Skeletons on page 1309
- Creating a skeleton on page 1312
- Adding bones to a skeleton on page 1313
- Skeleton Node Settings on page 1321

Creating a skeleton

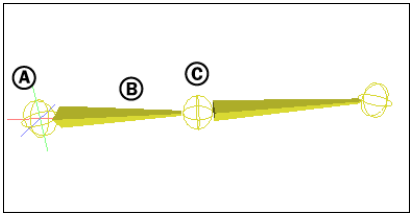
The following steps show how you can create a skeleton.

To create a skeleton:

1. From the Elements folder in the Asset browser, drag a Skeleton root into the Viewer window. The root is automatically selected, and a marker resembling a null indicates where your skeleton begins.
2. Double-click the Skeleton node asset in the Asset browser.

   The cursor changes into a small cross-hair, indicating that wherever you click in the Viewer window, you create a Skeleton node.
3. Click in the Viewer window to place the first node, then click to place another node that joins to the preceding one.

   Each time you click, another node (or bone) is added to the skeleton in a chain to create a limb. Each successive bone is parented to the preceding bone.



A. **Skeleton root** *B.* **Skeleton limb** *C.* **Skeleton node**

4 When you are finished inserting Skeleton nodes, press Enter or right-click in the Viewer window. This returns the cursor to normal.

As you create your skeleton, you may want to add more than one limb to the same joint (for example, when creating a hand with fingers). For more information, see Attaching more than one bone to the same joint on a skeleton on page 1314.

- Skeletons on page 1309
- Skeleton node and Skeleton root assets on page 1312
- Adding bones to a skeleton on page 1313

Adding bones to a skeleton

After creating your skeleton, you may notice one or two missing joints. For example, after creating the upper body of a human skeleton, you might want to add collar bones between the skeleton root and shoulder.

To add bones to a skeleton:

1 From the Asset browser, drag a Skeleton node into the Scene.

2 Switch to Schematic view in the Viewer window (Ctrl-W) and press F to frame the skeleton hierarchy and the Skeleton node.

3 Press P to activate Parenting mode, then drag from the new Skeleton node to an existing node. The existing node you drag to becomes the parent of the new Skeleton node.

For example, if you are adding a collar bone between the skeleton root and the shoulder bone, you would drag the new Skeleton node to the skeleton root, making the root the parent of the new node.

4 Drag any child bones of the original node to re-parent them as children of the added node.

For example, you would drag the Shoulder bone (including its children) to be a child of the new collar bone in the above example.

- Skeletons on page 1309
- Skeleton node and Skeleton root assets on page 1312

Attaching more than one bone to the same joint on a skeleton

Sometimes you might want to attach more than one bone to a joints on your skeleton.

To attach more than one bone to the same joint:

1 Select the joint to which you want to add another bone.

2 In the Elements folder of the Asset browser, double-click the Skeleton node asset.

The cursor changes to a small cross-hair, indicating that wherever you click in the Viewer window, you create a Skeleton node.

3 Click in the Viewer window where you want to add the bone to the selected joint.

The bone is attached to the selected joint.

4 Hit Enter when you are finished adding joints.

- Skeletons on page 1309
- Skeleton node and Skeleton root assets on page 1312

Inserting a limb between two joints

You can insert a limb between two existing bones, which can be useful, for example when you need to add another bone in a skeleton's spine for added flexibility.

1 Switch to Parenting mode in the Schematic view.

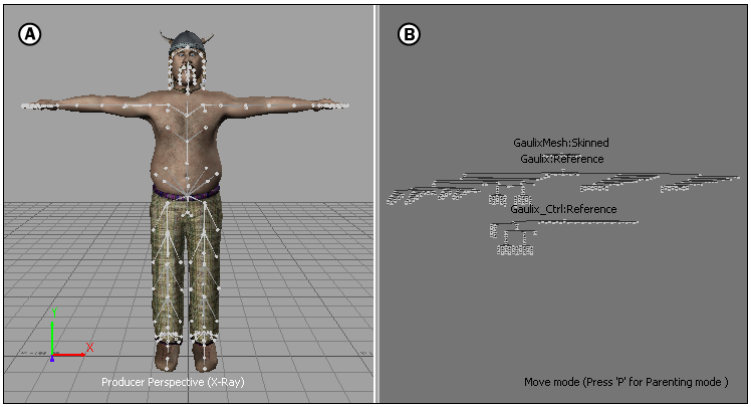
2 Select the joint where you want to attach a new limb, then drag from the selected joint to the new one.

As you create your skeleton, a parent-child hierarchy develops based on the last selected element.

Changing the size of a skeleton

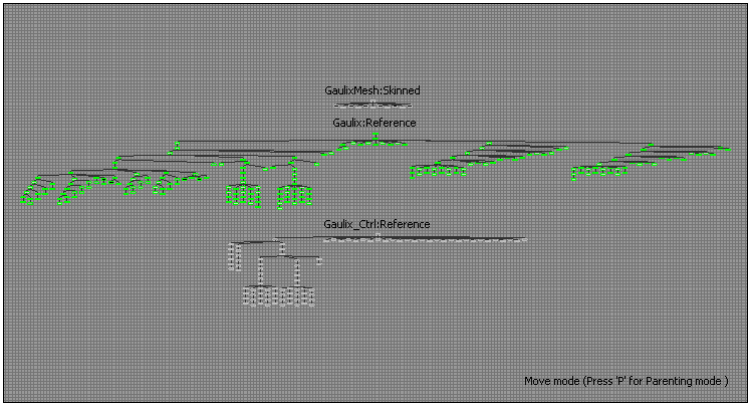
To change the size of a skeleton

1 Choose a display mode so that you can see your skeleton clearly, such as the X-Ray display mode.



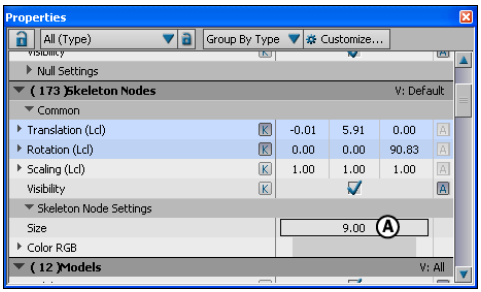
Viewer window *A.* **The camera view in one pane.** *B.* **The Schematic view in the other pane.**

2 Switch to the Schematic view and select all of the nodes representing your character's bones.



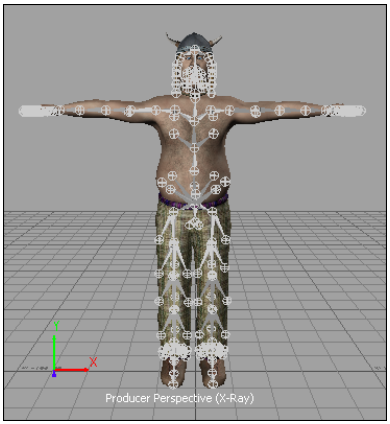
The character's bones are selected in the Schematic view.

3 In the Properties window, expand the Skeleton Node Settings and adjust the Size property.



Properties window *A.* **Skeleton Node Settings, Size property**

Switch back to the camera view and observe the change in size on your character's bones.



The character's bones appear larger in the Viewer window.

- Skeletons on page 1309
- Creating a skeleton on page 1312
- Adding bones to a skeleton on page 1313
- Attaching more than one bone to the same joint on a skeleton on page 1314

Bone naming conventions

To better integrate your models with MotionBuilder, create skeletons with bones that follow MotionBuilder's recognized naming conventions. These bone naming conventions can be found in the Mapping List.

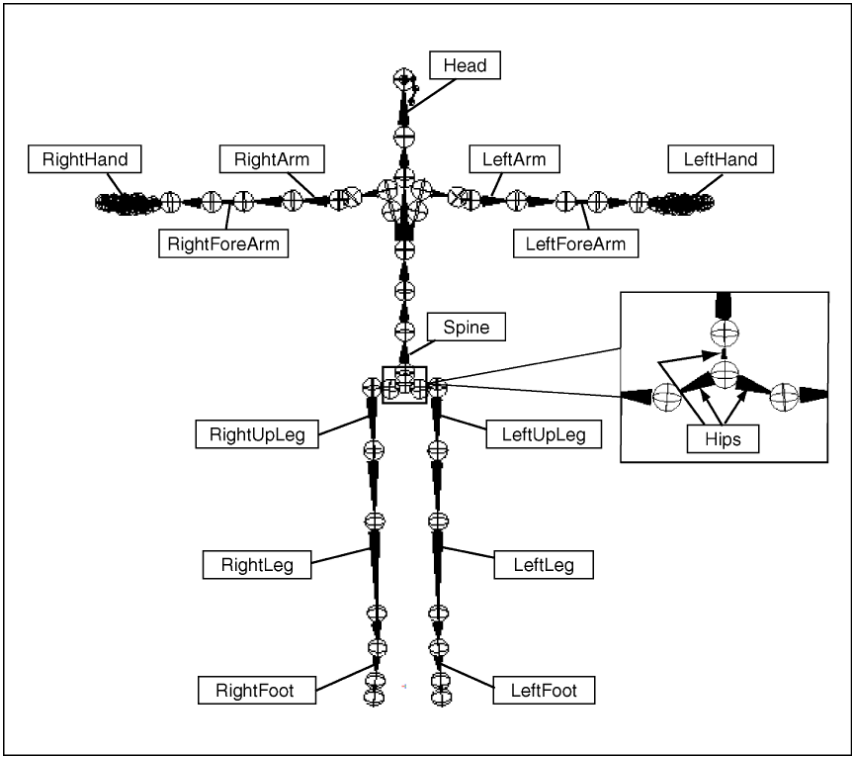
If you follow the MotionBuilder naming conventions when you create a skeleton, even if you create the model using different software, you can automatically map out and characterize your character models.

If you use other bone naming conventions, MotionBuilder cannot automatically recognize your model's structure, and you must manually map out and characterize your character models.

For example, if you have a model with an upper left leg bone named "LeftUpLeg", that bone can be automatically mapped in the Mapping List, because MotionBuilder recognizes the name.

On the other hand, if you have a model with the upper left leg bone named "LeftThigh", you need to manually map the LeftThigh bone to the LeftUpLeg slot in the Mapping List.

The Mapping List requires that you indicate a minimum of fifteen required bones, as illustrated in the following diagram.



Basic skeleton with Base bones labelled

NOTE You do not have to rename the bone objects on your existing skeletons. Instead, you can create a template of your own naming conventions to use for all of your characters. However when creating new skeletons, you may find it is easier to follow MotionBuilder naming conventions so that the mapping process can be done automatically.

- Characterizing a character model on page 1277
- Defining a spine on page 1284
- Automatically mapping and characterizing a character on page 1278

Creating a bone-naming template

If you have your own bone-naming conventions that you use when creating character models, you can create a template of those naming conventions for MotionBuilder. This template lets you automatically map out other characters for MotionBuilder.

Naming templates are saved as *.fbx* files containing the naming conventions used on a skeleton.

To create a bone-naming template:

1. Load a character that uses your naming conventions, and manually map out its bones for MotionBuilder. See Manually mapping and characterizing a character on page 1278.
2. In the Character Definition pane of the Character Settings, notice that the words <Not Set> display in the Template Name column.

   This indicates that there is no template of the naming conventions for the current character's skeleton.
3. Click Extract Naming Template.
4. Click Ok in the dialog box that appears asking if you want to update the naming template using this model's naming conventions.

   The names from the set of bones you Alt-dragged into the Mapping List when you manually characterized your character are automatically entered in the Template Name column.
5. Select the character in the Scene browser and select File > Save Selection from the menu bar to save this template.
6. In the Save File dialog box that appears, navigate to the directory of your choice, type a name for this *.fbx* file, and click Save.

   The Save Selection Options dialog box opens.
7. Disable the Take 001 check box and click Save.

   The template of the naming conventions on this character's skeleton is now saved.

- Character mapping on page 1272
- Applying a bone naming template on page 1320
- Bone naming conventions on page 1317

- Characterizing a character model on page 1277

Applying a bone naming template

After you have created a template of the bone-naming conventions you use on your character models, you can apply that template to other models with the same naming to automatically map them out for MotionBuilder.

To apply a bone-naming template:

1. Load a new character model whose skeleton uses the same bone-naming conventions as your template.
2. Drag the *.fbx* file containing your naming template into the scene, and select FBX Merge > Options from the contextual menu.
3. Click Merge in the Merge Options dialog box that appears to add the template to the scene.

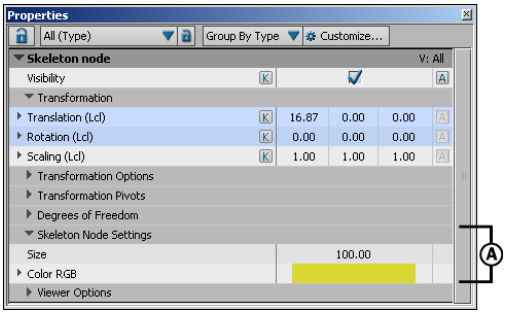
   By default, the naming template is listed in the Characters folder named for the character you used to create it. If you find it confusing to work with the template named after the character, rename it.
4. Double-click the template in the Scene browser and view the Character Definition pane. The template names you created are listed in the Template Name column. Lock the Navigator window to keep the Character Settings open.
5. In the Viewer window, switch to the Schematic view (Ctrl-W) and Ctrl-click to select all of the nodes that you want to automatically map. At a minimum, you must select the fifteen required nodes in the character's skeleton.
6. Alt-drag the selected nodes into the Mapping List of the Mapping List.

   All of the slots are automatically filled based on the naming conventions in your naming template, and the character is ready to be characterized.

- Creating a bone-naming template on page 1319
- Characterizing a character model on page 1277
- Character mapping on page 1272
- Character settings on page 1505

Skeleton Node Settings

When a Skeleton node is selected in the Viewer window, the Skeleton Node Settings are listed in the Properties window.



All Skeleton node properties *A.* **Skeleton Node Settings**

The Skeleton Node settings contain the Size and Color RGB properties, which let you adjust the size and color of the nodes that make up the skeleton.

If you adjust the color of skeleton nodes in the camera view, the changes also appear on the node in the Schematic view. Changing the color of nodes on the skeleton can make it easier to locate them while using the Schematic view.

- Skeletons on page 1309
- Creating a skeleton on page 1312

Floor contact

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There are two components involved in creating a character that respects the boundaries of a defined floor. First, there are floor contact markers and finger and toe tips that define what parts of a character's hands, feet, fingers, and toes interact with a floor. Second, there is an object assigned to the character that represents the level and orientation of the floor.

Once you have activated and defined the floor contact for the character's hands and feet, you can customize the actual floor those markers come in contact with. If you do not define a floor, the character's hands and feet treat the plane at 0 on the Y-axis as the floor.

- Defining the floor for characters on page 1323
- Defining foot floor contact for a character on page 1327
- Defining hand floor contact for a character on page 1331
- Defining toe floor contact for a character on page 1336
- Defining finger floor contact for a character on page 1338

Defining the floor for characters

To define the floor for characters:

1. Double-click an uncharacterized character in the Scene browser to open the Character Settings, then activate the Lock option to keep the settings open throughout this procedure.

   Your character must be uncharacterized so that you can edit the Mapping List.

2 Do one of the following:

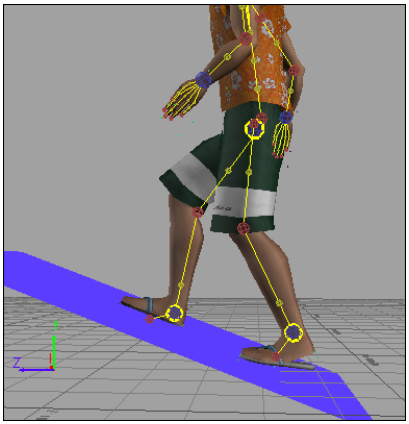
- If you want each hand and foot that contacts the floor to have its own floor defined, drag an object (such as a marker) into the scene for each hand and foot.
- If you want to define only one floor surface for all hands and feet, drag only one object into the scene.

NOTE The type of object that you choose is not important. You can use a plane, marker, null, or another object.

3 Assign the object(s) to represent the floor for the feet and hands by Alt-dragging them into the Left Foot Floor, Right Foot Floor, Left Hand Floor, or Right Hand Floor nodes of the Mapping List.

4 Translate and rotate the floor object(s) to represent the type of terrain you want to your character's feet and hands to respect.

For example, if you want the character to walk on a sloped floor as shown in the following figure, rotate the floor object to represent the angle you want the character to walk on.



5 Characterize the character.

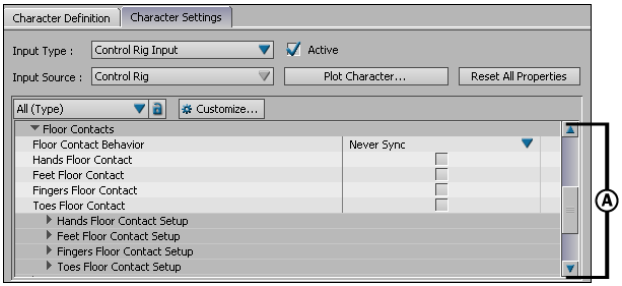
6 Define and activate the floor contact markers for the character's feet and hands in the Character Settings, if you have not already done so.

As you move and animate your character, the feet and hands now respect the level and orientation of the object you defined as the floor.

- Floor contact on page 1323
- Defining foot floor contact for a character on page 1327
- Defining hand floor contact for a character on page 1331
- Character settings on page 1505
- Characterizing a character model on page 1277

Floor Contact properties

The settings in the Floor Contacts group let you define how you want a character's feet, hands, fingers, and toes to react when they come in contact with the floor of your scene.



Character Settings pane *A.* **Floor Contacts group of properties**

Floor Contact Behavior

Lets you select which method of solving the Control rig uses when a character's feet or hands come in contact with the floor.

Floor Contact Behavior lets you choose when the IK and FK Control rigs are synchronized, which affects how hands and feet react to manipulation after floor contact. Floor Contact Behavior includes the following three options:

Option	Function
Never Sync	Similar to the Automatic toe and finger base features, but lets you manipulate a character's fingers and toes as they are lifted after floor contact. The FK and IK Control rigs are not synchronized.

Option	Function
Always Sync	Always synchronizes the FK and IK Control rigs and retains the foot or hand position after floor contact, not allowing toe or finger manipulation.
Sync on Key	Similar to the Never Sync option, Sync on Key makes the foot or hand retain its position after floor contact if you set a keyframe while it is on the floor. The FK and IK control rigs are synchronized only when a keyframe is set.

Hands Floor Contact

Activate Hands Floor Contact to prevent your model's hands from going through the floor. The options within the Hands Floor Contact Setup folder let you adjust how hands make contact with the floor. See Feet Floor Contact Setup properties on page 1328.

Feet Floor Contact

Activate Feet Floor Contact to prevent your model's feet from going through the floor. The options within the Feet Floor Contact Setup folder let you adjust how feet make contact with the floor. See Toes Floor Contact Setup properties on page 1336.

Fingers Floor Contact

Activate Fingers Floor Contact to prevent your model's fingers from going through the floor. The settings within the Fingers Floor Contact Setup folder let you adjust every aspect of how fingers make contact with the floor. See Fingers Floor Contact Setup properties on page 1339.

Toes Floor Contact

Activate Toes Floor Contact to prevent your model's toes from going through the floor. The options within the Toes Floor Contact Setup folder let you adjust every aspect of how toes make contact with the floor. See Toes Floor Contact Setup properties on page 1336.

Defining foot floor contact for a character

To define foot floor contact for a character:

1. Select a character in the Scene browser.
2. In the Character Controls, activate the Floor Contact option in the Show menu to make the foot floor contact markers on your character visible.

   NOTE You must be in X-Ray display mode in the Viewer window to see the floor contact markers.

   Green and blue floor contact markers display around your character's hands and feet.
3. Expand the Floor Contacts heading in the properties area of the Character settings pane and activate the Feet Floor Contact option.
4. Expand the Feet Floor Contacts Setup heading and select the Feet Contact Type that you want to use.
5. Use the other Feet Floor Contact Setup properties to make any adjustments to the floor contact that you need.
6. In the Viewer window, translate the floor contact markers to position them around your character's feet.

   If you are working with a humanoid model, the foot markers should display just under the toe, the ball of the foot, and the heel.

   Moving one foot marker adjusts the other markers accordingly. For example, when you adjust the green markers on the character's left foot, the blue markers on the right foot are adjusted as well.

The character's feet are now ready to interact naturally with the defined floor. If you have not defined a floor for the feet, the plane at 0 on the Y-axis is used as the floor.

- Defining the floor for characters on page 1323
- Show menu on page 1566
- Feet Floor Contact Setup properties on page 1328

Resetting Floor Contacts

You can reset or retain any changes made to the Floor Contacts settings during re-characterization.

To reset a characterized character's Floor Contacts:

1 In the Character Definition pane, disable the Characterize option. The Reset Floor Contacts window appears.

Reset Floor Contacts window

NOTE The Reset Floor Contacts window does not appear when you characterize a new character.

2 Select Yes to restore the character's floor contact settings.

3 Activate the "Do not ask me again" function, if you never want floor contacts to be reset when you re-characterize.

Feet Floor Contact Setup properties

In the Floor Contact group of character properties, the Feet Floor Contact Setup properties let you adjust how feet make contact with the floor.

The Feet Floor Contact options are similar to the options in the Hands Floor Contact group.

Automatic Toe Base

Corrects the feet but does not let you manipulate each toe base. This option is disabled by default when you create a character so that you can manually manipulate and animate each toe base.

When Automatic Toe Base is active, you cannot animate each toe base, but you can still keyframe the result positions provided by the floor contact.

To take full advantage of the solving from each foot's toe base, it is recommended that when you create your model's skeleton that the toe base should be the parent of each toe. For the big toe, you should use the extra toe.

Feet Floor Pivot menu

Use the Feet Floor Pivot to select the pivot of the foot when it makes contact with the floor. The following table describes the three Feet Floor Pivot options.

Option	Behavior
Auto	The default option that averages the priority between the ankle and toes. When the foot makes contact with the floor, the ankle is translated backwards and the toes are pushed forwards.
Ankle	Gives the ankle priority and uses it as the pivot point. When the toes make contact with the floor, they are translated forward to keep the ankle's trajectory towards the floor constant.
Toes	Gives the toes priority and uses them as the pivot point. When the toes make contact with the floor, the ankle is translated backwards to keep the toes firmly planted on the floor.

Feet Contact Type

The Feet Contact type lets you define the number and orientation of markers used to define the floor contact for your character's feet. The four types of feet contact are described in the following table.

Option	Behavior
Normal	Six markers define each foot's floor contact. The middle markers should define the ball of the foot, or where the toes begin.
Ankle	Four points define each foot's floor contact. The foot markers display around each foot.
ToeBase	Four points define each foot's floor contact. The foot floor contact markers display around each foot's toes.
Hoof	Four points define each foot's floor contact, but the points are oriented at a 90 degree angle, letting you define the floor contact for animal types with hooves, such as horses. These contact markers allow for 180 degrees of movement.

Feet Contact Stiffness

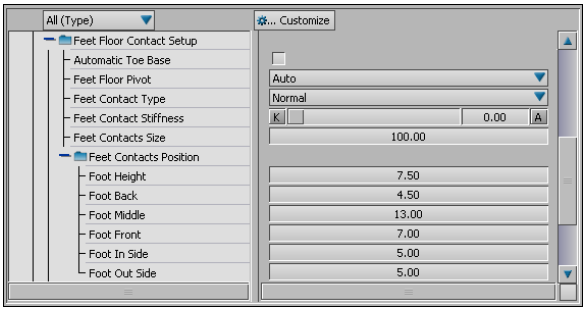
Use the Feet Contact Stiffness setting to define how stiff the foot becomes as soon as any part of the foot contacts the floor.

Feet Contacts Size

Lets you change the size of the contact markers that outline each foot. The center of the contact markers is the point used for floor contact. Increasing the Feet Contacts Size only makes the floor contact markers more visible, it does not affect the way the feet contact the floor. To view the contact markers for both hands and feet, select Show > Floor Contact from the Character Controls window.

Feet Contacts Position

Each setting in the Feet Contacts Position folder lets you define the contact region for the feet numerically. You can also change the region by selecting the foot floor contacts in the Viewer window and translating them.



Feet Contacts position properties

Each Feet Contacts Position setting defines a different aspect of the foot contact area. These settings are described in the following table.

Setting	Description
Foot Height	Defines the bottom of the model's foot. Adjust this setting until all markers are at the bottom of a model's foot.
Foot Back	Defines the back edge of the model's foot. Adjust this setting until the back markers are behind the heel.
Foot Middle	Defines the middle, or ball of the foot. Adjust this setting until the middle markers are where the foot bends.

Setting	Description
Foot Front	Defines the front part of the model's feet. Adjust this setting until the markers are in front of the foot.
Foot In Side	Defines the interior of the foot. Adjust this setting until the markers are at the interior of the foot.
Foot Out Side	Defines the exterior of the foot. Adjust this setting until the markers are at the exterior of the foot.

Defining hand floor contact for a character

To define hand floor contact for a character:

1. Select a character in the Scene browser.
2. In the Character Controls, activate the Floor Contact option in the Show menu to make the hand floor contact markers on your character visible.

   NOTE You must be in X-Ray display mode in the Viewer window to see the floor contact markers.

   Green and blue floor contact markers display around your character's hands and feet.
3. Expand the Floor Contacts heading in the properties area of the Character settings pane and activate the Hands Floor Contact option.
4. Expand the Hands Floor Contacts Setup heading and select the Hands Contact Type that you want to use.
5. Use the other Hands Floor Contact Setup properties to make any adjustments to the floor contact that you require.
6. In the Viewer window, translate the floor contact markers to position them around your character's hands.

   If you are working with a humanoid model, the hand markers should display just under the wrist, the base of the palm, and the base of the fingers (not including the thumb).

   Moving one hand marker adjusts the other markers accordingly. For example, when you adjust the green markers on the character's left hand, the blue markers on the right hand are adjusted as well.

Your character's hands are now ready to interact naturally with the defined floor. If you have not defined a floor for the hands, the plane at 0 on the Y-axis is used as the floor.

- Defining the floor for characters on page 1323
- Defining finger floor contact for a character on page 1338
- Show menu on page 1566
- Feet Floor Contact Setup properties on page 1328

Hands Floor Contact Setup properties

In the Floor Contacts group of character properties, the Hands Floor Contact Setup folder let you adjust how hands make contact with the floor.

Automatic Finger Base

Corrects the hands but does not let you manipulate the hand's finger base. This option is disabled by default when you create a character so that you can manually manipulate and animate each finger base.

When Automatic Finger Base is active, you cannot animate the finger base, but you can still keyframe the result positions provided by the floor contact.

To take full advantage of the solving from each hand's finger base, it is recommended that when you create your model's skeleton that the finger base should be the parent of each finger. The thumb should be parented by the wrist.

Hands Floor Pivot menu

Use the Hands Floor Pivot menu to define which part of the hand should be treated as a pivot when the hands make contact with the floor. There are three options for the Hands Floor Pivot, described in the following table.

Option	Behavior
Auto	The default option that averages the priority between the wrist and fingers. When the hand makes contact with the floor, the wrist is translated backwards and the fingers are pushed forwards.
Wrist	Gives the wrist priority and defines it as a pivot point for the hand's floor contact. When the fingers make contact with the floor, they

Option	Behavior
	are translated forward to keep the wrist's trajectory towards the floor constant.
Fingers	Gives the fingers priority and uses them as the pivot point. When the fingers make contact with the floor, the wrist is translated backwards to keep the fingers firmly planted on the floor.

Hands Contact Type

The Hands Contact type lets you define the number and orientation of markers used to define the floor contact for your character's hands. The following table illustrates the types of hand contact available.

Option	Behavior
Normal	Six markers define each hand's floor contact. The middle markers should define where the fingers begin.
Wrist	Four points define each hand's floor contact. The hand markers display around each palm.
FingerBase	Four points define each hand's floor contact. The hand floor contact markers display around each hand's fingers.
Hoof	Four points define each hand's floor contact, but the points are oriented at a 90 degree angle, letting you define the floor contact for animal types with hooves, such as horses. These contact markers allow for 180 degrees of movement.

Hands Contact Stiffness

Use Hands Contact Stiffness to define how stiff and sudden the hand becomes as soon as any part of the hand contacts the floor.

For example, using MotionBuilder default settings but only adjusting the Hands Contact Stiffness to 100%, as soon as the fingers of the hand come into contact with the floor, the hand stops translating. At 50%, the hand translates gradually after coming into contact with the floor.

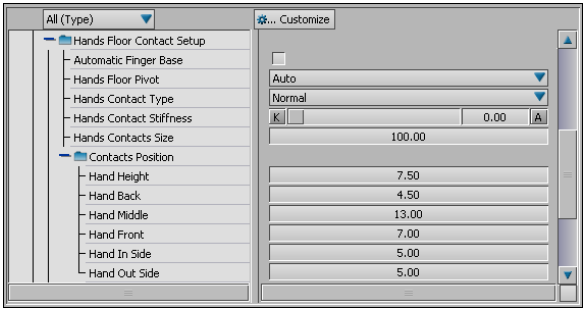
Hands Contacts Size

Lets you change the size of the contact markers that outline the hands. The center of the contact markers is the point used for floor contact. Increasing

the Hands Contacts Size only makes the floor contact markers more visible, it does not affect the way the hands contact the floor. To view the contact markers for both hands and feet, select Show > Floor Contact from the Character Controls window.

Hands Contacts Position

Each setting in the Hands Contacts Position folder lets you define the contact region for the hands numerically. You can also change the region by selecting the hand floor contacts in the Viewer window and translating them.



Hands Contacts Position folder and settings

Each Hand Contacts Position setting defines a different aspect of the hand contact area. These settings are described in the following table.

Setting	Description
Hand Height	Defines the bottom of the model's hand. Change this setting until all markers are at the bottom of a model's hand.
Hand Back	Defines the back edge of the model's hand. Change this setting until the back markers are behind the hand.
Hand Middle	Defines the middle of the hand, where the fingers bend. Adjust this setting until the middle markers are where the fingers bend.
Hand Front	Defines the front part of the model's hand. Change this setting until the markers are in front of the hand.
Hand In Side	Defines the interior of the hand. Adjust this setting until the markers are at the interior of the hand.

Setting	Description
Hand Out Side	Defines the exterior of the hand. Change this setting until the markers are at the exterior of the hand.

NOTE When you adjust the size of the hand, view your scene using the Right camera view for all measurements, except for Hand In Side and Hand Out Side. For these last measurements, view the scene using the Front camera view. To see through your model, switch to X-Ray viewing mode.

Finger and toe tips

Fingers and toes use the outer mesh of each toe and finger tip marker to define the area that makes contact with the floor.

When you characterize your character, finger tip markers are automatically placed at the end of the fingers and toes, specified by the last joint or bone in each finger and toe. To ensure finger tips work properly, you must specify an end joint or bone as the last node in each finger or toe.

- Viewing finger and toe tips on page 1335
- Fingers Floor Contact Setup properties on page 1339
- Toes Floor Contact Setup properties on page 1336

Viewing finger and toe tips

To view the finger and toe tips on your character:

1. Select Show > Finger Tips from the Character Controls window.
2. To view the finger and toe tips markers, hide the IK and FK markers on your character's Control rig. Do this using Show > IK and Show > FK in the Character Controls.

- Finger and toe tips on page 1335
- Fingers Floor Contact Setup properties on page 1339
- Toes Floor Contact Setup properties on page 1336

Defining toe floor contact for a character

To define toe floor contact for a character:

1. Select a character in the Scene browser.
2. In the Character Controls, activate the Finger Tips option in the Show menu to make the toe tip markers on the character visible.

   In order to see the toe tips markers, you may also have to temporarily hide the FK and IK markers on your character by disabling them in the Show menu.
3. In the properties area of the Character Settings pane, expand the Floor Contacts heading and activate the Toes Floor Contact option.
4. Expand the Toes Floor Contact Setup heading and select the Toes Floor Contact Mode that you want to use. These options let you decide how you want the toes to react when they come in contact with the floor.
5. Adjust any other Toes Floor Contact Setup properties that you require.

If you have no floor defined for the feet, the toes react to the plane at 0 on the Y-axis as the floor.

- Finger and toe tips on page 1335
- Viewing finger and toe tips on page 1335
- Defining foot floor contact for a character on page 1327
- Character Controls on page 1553
- Toes Floor Contact Setup properties on page 1336

Toes Floor Contact Setup properties

The options within the Toes Floor Contact Setup folder let you adjust how toes make contact with the floor.

Toes Floor Contact Mode

Lets you choose the behavior of the toes as they contact the floor. The three different behaviors are outlined in the following table.

Option	Behavior
Sticky	Each toe sticks to the floor exactly where contact is made.
Spread	Spreads the toes as they make contact with the floor, attempting to keep the position of the toes intact. Rotation is applied to the root of each toe.
Sticky & Spread	Averages the toe behavior between both Sticky and Spread.

Toes Contact Roll Stiffness

Corrects unnatural toe rotation when toe floor markers contact the floor. At 100%, Toes Contact Roll Stiffness attempts to prevent the toes from rotating in impossible directions.

Toe Tips Sizes

The Toe Tip Sizes group lets you adjust the size of each of the floor markers used to outline the toe tips for the left and right feet.

To view the toe tips on your model, select Show > Finger Tips from the Character Controls window. See Finger and toe tips on page 1335.

Finger tips for right hand

Unlike hand and foot contacts, the outer mesh of each toe tip marker defines the area that makes contact with the floor.

When you characterize your character, toe tips are automatically placed at the end of the model's toes, specified by the last joint or bone. To ensure toe tips work properly, you must specify an end joint or bone as the last node in each toe.

- Floor contact on page 1323
- Viewing finger and toe tips on page 1335
- Defining toe floor contact for a character on page 1336

Defining finger floor contact for a character

To define finger floor contact for a character:

1. Select a character in the Scene browser.
2. In the Character Controls, activate the Finger Tips option in the Show menu to make the finger tip markers on the character visible.

   In order to see the finger tips markers, you may also have to temporarily hide the FK and IK markers on your character by disabling them in the Show menu.
3. In the properties area of the Character Settings pane, expand the Floor Contacts heading and activate the Fingers Floor Contact option.
4. Expand the Fingers Floor Contact Setup heading and select the Fingers Floor Contact Mode that you want to use. These options let you decide how you want the fingers to react when they come in contact with the floor.
5. Adjust any other Fingers Floor Contact Setup properties that you require.

If you have no floor defined for the hands, the fingers react to the plane at 0 on the Y-axis as the floor.

- Finger and toe tips on page 1335
- Viewing finger and toe tips on page 1335
- Defining hand floor contact for a character on page 1331
- Defining the floor for characters on page 1323

- Fingers Floor Contact Setup properties on page 1339
- Character Controls on page 1553

Fingers Floor Contact Setup properties

In the Character Settings pane, the options within the Floor Contacts > Fingers Floor Contact Setup folder let you adjust how fingers make contact with the floor.

Fingers Floor Contact Mode

Lets you choose the behavior of the fingers as they contact the floor. There are three behaviors you can choose from, described in the following table.

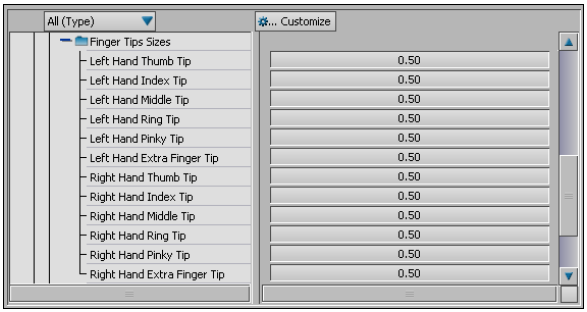
Option	Behavior
Sticky	Each finger sticks to the floor exactly where contact is made.
Spread	Spreads the fingers as they make contact with the floor, attempting to keep the position of the fingers intact. Rotation is applied to the root of each finger.
Sticky & Spread	Averages the finger behavior between Sticky and Spread.

Fingers Contact Roll Stiffness

Corrects unnatural finger rotation when finger floor markers contact the floor. At 100%, Fingers Contact Roll Stiffness attempts to prevent the fingers from rotating in unnatural directions.

Finger Tips Sizes

Adjust the size of each of the floor markers used to outline the finger tips for both the left and right hands.



Finger Tips Sizes group of properties

- Finger and toe tips on page 1335
- Viewing finger and toe tips on page 1335
- Defining finger floor contact for a character on page 1338

Character Extensions

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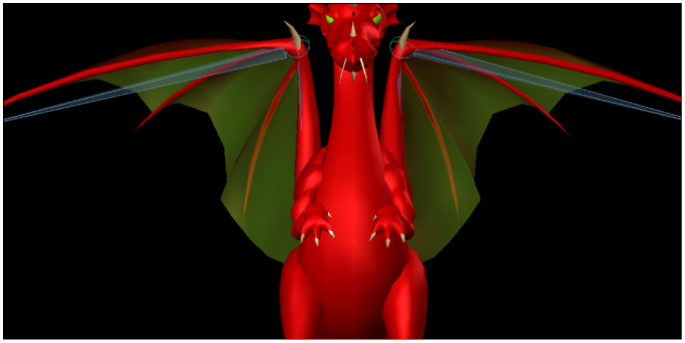
Character Extensions can be created to associate any type of object with your character, whether it is an extra limb, a weapon your character carries, a camera, or a spot light that follows your character around. Any type of object or property that you want to control and key along with your character can be added as a Character Extension.

Character Extensions are particularly useful with character models that have atypical features (such as the character with wings and a tail in the following figure) because they let you easily include the added features with your character's Full Body keying group.



A dragon character with wing and tail Character Extensions.

Using Character Extensions in poses

When you create a pose with a character that has Character Extensions, the Character Extensions are included in the pose. You can also paste poses based on objects in the Character Extension.

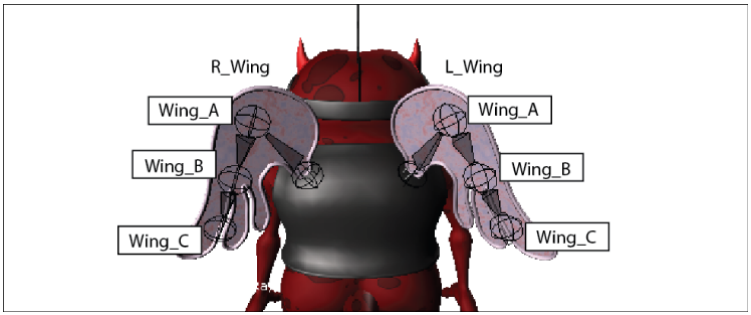
If you plan to create poses involving Character Extensions, make sure to define a Reference Object in the Character Extension properties *before* you begin to create poses. See Character Extension properties on page 1348 for more information on the Reference Object.

With the proper setup, you can also mirror-paste poses on Character Extensions just as you can on a character's regular body parts. For example, if your character has symmetrical left and right wings, you can mirror poses from the left wing onto the right wing, and so on.

Mirroring Character Extensions

Just like the right arm is the mirror of the left arm in a character's structure, you can set up right and left mirror pairs for Character Extensions. You can also mirror poses on a single Character Extension, such as a tail, the same way you can mirror poses on a character's spine.

The Mirror Partner property for Character Extensions lets you create left and right mirror pairs. For example, to set up a pair of symmetrical wings for your character, and to be able to mirror poses between them, you would select the right wing Character Extension as the Mirror Partner of the left wing Character Extension.



A character with two wings set up for symmetrical mirroring.

When you select the Extension Label for one Character Extension in the Mirror Partner menu, MotionBuilder determines whether the set up of the selected Extension matches the current Extension exactly. In order for two Extensions to function as a perfect mirror pair, both Extensions must be composed of objects with identical Label names and property references. If the setup for the Extension you choose in the Mirror Partner menu is not an exact match for the current Extension, a dialog box appears that reports the unmatched objects and properties.

TIP If you want the two Character Extensions that you have paired to be asymmetrical, you do not need to correct the mismatched objects and properties.

When you paste poses between two mirrored Character Extensions, only translation, rotation, and scaling values are calculated for mirroring. If you have added custom property sliders to two Character Extensions and you want to mirror that data, the custom properties on each Extension must have the same names, and the slider values will be copied directly.

See also Mirror Partner on page 1350 for more information.

Keying Character Extensions

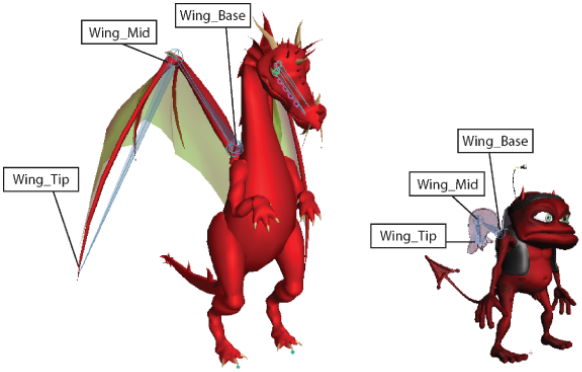
Once you have created Character Extensions, you can use the Properties window to define exactly what is keyed when you set keyframes on the Character Extension. By default, the translation and rotation properties for objects in the Character Extension are keyframed.

Activate the Add To Full Body option in the Properties window if you want the Character Extension to be keyed whenever you set a Full Body keyframe on your character.

If your Character Extension is composed of markers, cameras, lights, limbs, Skeleton roots, Skeleton nodes, or nulls, the same visual feedback elements that you can activate for Control rigs are also available for your Character Extension. For example, the HighLight Active Body Part and Outline Currently Keyed visual feedback elements also work with your Character Extension if it is composed of these types of objects. See Visual feedback on Control rigs on page 1463 for more information on the types of visual feedback available.

Copying animation between two Character Extensions

If you have two characters with equivalent Character Extensions, you can copy keyframe animation from Extension to Extension. To create an equivalent set up on the source and target Character Extensions, both Extensions need to have the same Extension Label, and the corresponding objects within the Extensions need to have the same Labels.



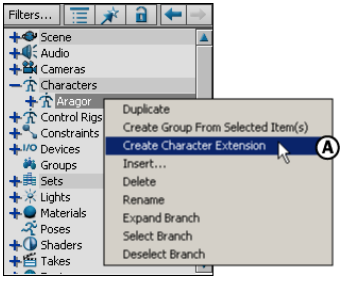
Two Character Extensions set up for copying animation.

See Copying Character Extension animation on page 1346 for more information.

Creating a Character Extension

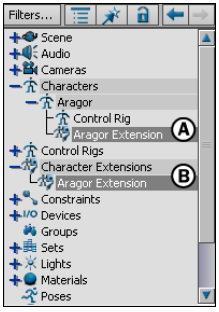
To create a Character Extension:

1 In the Scene browser, right-click a characterized character and select Create Character Extension.



Scene browser *A.* Create Character Extension option

A Character Extensions heading is added to the Scene browser. By default, the Character Extension object added is named "*<char_name>* Extension," where *<char_name>* is the name of your character.



Scene browser *A.* A Character Extension is added to the character. *B.* A Character Extensions heading is added to the Scene browser.

2 *Alt*-drag any type of object(s) you want to associate with your character onto your character's Extension.

For example, you can add a light, a sphere, a constraint, or any other object. If your character model has additional limbs or a tail, you might add a series of Skeleton nodes.

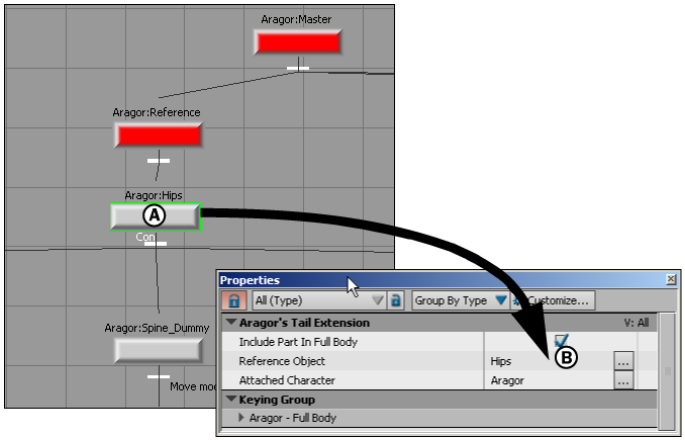
3 Select Add to <*char_name*> Extension from the popup menu that appears.

This object is now part of the Character Extension and is considered as if it is a "body part" on the current character.

4 Create a Reference Object for this Character Extension by doing the following:

- Select the closest part of the body that affects the movement of your Character Extension. Normally, this is the direct parent of the Extension, but it can be any object associated with the Extension. For example, if you are adding a tail, you might select the Hips bone, because you want the tail to be attached at the hips.

- *Alt*-drag the selected body part into the Character Extension's Reference Object field in the Properties window.



A. **Select the bone you want to associate with the Character Extension.**
B. **Drag it into the Reference Object property.**

This creates a Reference for your Character Extension, which is used to calculate all future positioning of the Extension, for example if the Character Extension is included in a pose.

5 In the Properties window, view the list of properties to be keyed when you set a keyframe on this Character Extension. Add or remove the properties you want to have keyed by right-clicking and selecting Remove

Property from Extension or Add Property to Extension. These properties are also included in any poses you create for this character.

You can also use the Add To Full Body option to define whether you want the Character Extension to be keyed when you set keys in Full Body Keying mode.

Copying Character Extension animation

Once you have set up your Character Extensions correctly, there are two ways to copy animation between them. If you have two characters with Extensions in the same scene, you can copy the Extension animation as you retarget animation from character to character. Or, if you have saved Character Extension animation using the Save Character Animation option in the Character Controls, you can copy the animation onto characters in other scenes or reload them onto the same character using the Load Character Animation option.

See Copying animation between two Character Extensions on page 1343 for information on setting up Extensions for copying animation.

To copy Character Extension animation between two characters in a scene:

1. Make sure that the target character has a Control rig attached.
2. Select Character Input as the Input Type for the target character, and select the source character as the Input Source if it is not automatically selected.
3. In the Character Controls Edit menu, select Retarget.
4. In the Retargeting Options dialog box that appears, activate the Copy Character Extension Animation option and click Ok.

   The animation is copied from the source Character Extension to the target Character Extension.
5. To see the result, in the Character Controls Edit menu, select the Control rig as the Input Source for the target character.

NOTE Although Character Extension animation can be included during retargeting, the Extension animation itself is not retargeted. The local Character Extension animation is copied directly, so if the axes of objects in both Extensions are not set up in a similar way, unexpected results may occur.

To copy saved Character Extension animation:

1. Make sure that the target character has a Control rig attached, unless you plan to activate the Replace Control Rig option in the Load Character Animation Options.
2. From the Character Controls File menu, select Load Character Animation.
3. Navigate to select an *.fbx* file containing Character Extension animation that was saved using the Save Character Animation option, then click Open.
4. In the Load Character Animation Options dialog box that appears, activate the Process Animation option in the Character Extensions area and click Open.

   NOTE Always disable the Copy Missing Character Extensions option if you only want to copy animation between two Extensions.

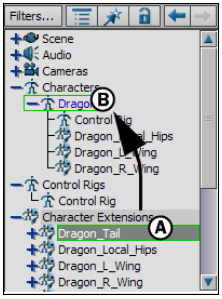
   The animation is copied from the source Character Extension in the *.fbx* file to the target Character Extension in your scene.

■ Character Extensions on page 1341

Attaching a Character Extension to a character

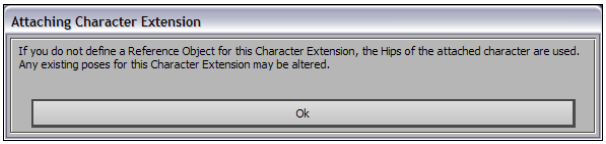
To attach a Character Extension to a character:

1. In the Scene browser, select the Character Extension you want to attach.
2. Drag the selected Character Extension onto a character.
3. In the contextual menu that appears, select Attach *<Extension_name>* To *<Character>* where *<Extension_name>* is the name of the Character Extension, and *<Character>* is the name of the character.



A. **Drag the Character Extension** *B.* **Onto a character.**

4 Click OK in the Attaching Character Extension dialog box that appears.



Attaching Character Extension dialog box

This dialog box appears to remind you to define a Reference object for your Character Extension. It's very important to define a Reference object as you attach the Character Extension because all poses and transformation for the Extension will be based on this object.

Detaching a Character Extension from a character

1 In the Scene browser, select the Character Extension you want to detach.

2 Right-click and select Detach <> From <>.

A dialog box appears warning you that you need to update the Reference object for this Character Extension.

Character Extension properties

This section describes the properties found in the Properties window when you have a Character Extension selected.

Add To Full Body

When activated, objects and properties in the Character Extension are keyed along with the rest of the character's body if Full Body keying mode is selected.

Reference Object

Lets you define the part of your character's body where the Character Extension is attached. Character Extensions are transformed relative to the Reference Object, and all poses are calculated relative to the Reference Object. Each time you attach an Extension to a character, you should define a Reference object.

If you do not define a Reference Object, and the Character Extension has no parent, the attached character's hips act as the default Reference Object. To assign a Reference Object, select and *Alt*-drag a part of your character's body into this field.

NOTE If you plan to mirror poses between Character Extensions, you must define a Reference object for each Extension. You can use the same Reference object for more than one Extension. For example if you have two wings, you might use the same Spine object as the Reference object for both.

When selecting a Reference object, it is best to use the closest object that affects the movement of the Extension. Normally, this object is the direct parent of the Character Extension.

When you define a Reference Object, a dialog box appears to let you know that the stance pose for this Character Extension will be updated with the new Reference. Any poses you created for the Character Extension before defining the Reference Object may be altered, so it's a good idea to define the Reference Object before you do any work with the Extension.

Attached Character

Lists the character to which the Character Extension is attached. This property is updated automatically when you attach the Character Extension to a character.

Extension Label

Lets you define "undercover" non-unique names for each Character Extension that enable you to copy animation between Extensions.

To avoid naming conflicts, no two Character Extensions can have the same name in MotionBuilder. For example, if you have two characters with tails in a scene, each tail must have its own unique Character Extension name.

However, you can give two Character Extensions the same *Extension Label*. Giving two Character Extensions the same Extension Label indicates to MotionBuilder that these Extensions are compatible, and animation can be copied between them.

In the scene with two characters with tails, both tail Extensions cannot have the same *name* "Tail", but they can have the same *Extension Label* "Tail".

See Copying Character Extension animation on page 1346 for more information.

Mirror Partner

Lets you define another Character Extension as the mirror of the current Character Extension. From this menu, you can choose from a list of the Extension Label names representing all Character Extensions in the scene.

For example, if your character has a pair of wings, you might use the Extension Labels "L_Wing" and "R_Wing". To indicate that these are a mirror pair, you select the "L_Wing" Extension Label in the Mirror Partner menu for the right wing Extension.

See Mirroring Character Extensions on page 1342 for more information on setting up your Character Extensions to be mirrored.

Plot Method

Lets you define how you want the Character Extension to be handled when you plot the associated character's animation. You can choose from the following options:

Option	Function
Never	Character Extension animation is not plotted when you plot the attached character's animation.
With Skeleton	Character Extension animation is plotted when you plot to the attached character's skeleton.
With Control Rig	Character Extension animation is plotted when you plot to the attached character's Control rig.
Both	Character Extension animation is plotted when you plot to the attached character's Control rig, or if you plot to the skeleton.

Update Stance Pose

Click to update the stance pose of the selected Character Extension. The stance pose is like a snapshot of all the properties associated with the Character Extension, including its position, and it is used in calculations whenever you create poses, mirror poses, and copy animation.

The first stance pose of the Character Extension is determined by the objects and properties as they are added to the Extension. If you create the Extension with the objects and properties in a suitable state, you do not need to update the stance pose.

However, if you want to set up two Character Extensions as a symmetrical pair of body parts, both Extensions need to have mirror versions of the same stance pose. You can change the stance pose by positioning the Character Extension and changing its values, then clicking Update Stance Pose.

Go to Stance Pose

Click to put the Character Extension in its stance pose.

Properties for Character Extension objects

When you drop an object into a Character Extension, the object's Translation and Rotation values are added as reference properties in the Character Extension properties. A Label property is also added for any object added to an Extension, which lets you create a second non-unique name for the object.

The Labels that you define for each object in an Extension have a similar function to the body part names in the character Mapping List - they both let you describe a structure. The difference is, you can change the Label names for objects that make up your Character Extension.

For example, on a character with Character Extensions for two wings, you might want to mirror poses from the right wing to the left. To do this, you can create a symmetrical set up where the two Character Extensions are each made up of three objects. All of the wing objects must have a unique name in the scene, but you can indicate to MotionBuilder which objects correspond wing-to-wing by giving each pair the same Label, such as "WingA," "WingB," and "WingC." Using the same Label for two objects indicates to MotionBuilder that the objects are compatible, so you can retarget animation between them, and mirror poses on them.

Plotting Character Extensions

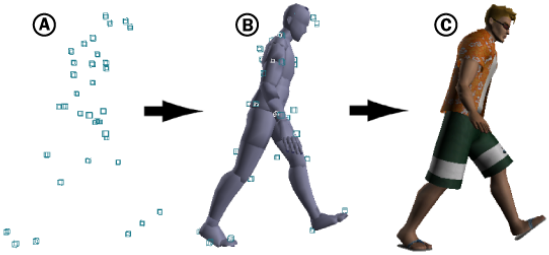
When you're ready to plot your character animation, turn on the "Plot character Extensions" option in the 2nd dialog box. Also, use the Plot Method property to specify that you want Character Extensions to be plotted when you are plotting to the skeleton, Control rig, neither, or both.

Plotting Character Extensions works around a limitation where the Mapping list only offers you five slots for prop objects. (Anything in the Mapping list gets plotted along with your character.) Because you can add any number of prop objects to a Character Extension, you can now plot animation for any number of objects associated with your character.

Part 2: Actor assets

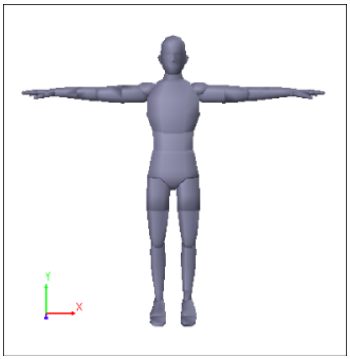
An Actor is an asset used to preview motion data, and to connect motion data to a character model. It is one of three types of motion source that can be used to drive a character.

During a motion capture session, a live performer wears a set of sensors that detect and record their movements as motion data. This motion data can be attached to an Actor using a Marker set. The Actor is then linked to a Character asset so it can drive the movement of the character model.



Motion capture data driving character animation *A.* **Optical data markers** *B.* **Actor with Marker set** *C.* **Animated character model**

Actors are visually represented in MotionBuilder by a gray humanoid model with detachable body segments. This generic model lets you preview how the motion data will drive your character. You can even use the same Actor to drive more than one character in a scene.



Actor asset

- Marker sets on page 1377
- Character assets on page 1271
- Actor settings on page 1359
- Creating an Actor on page 1354
- Connecting an Actor to a character on page 1356
- Creating motion using a glove device on page 1358

Creating an Actor

To create an Actor:

➤ Drag an Actor asset from the Characters folder of the Asset browser into the scene.

The Actor displays as a humanoid model in the Viewer window.

Once you load an Actor, you can use a Marker set to map objects containing motion (markers or sensors) to the selected Actor. Mapped motion data in a Marker set eventually drives the Actor.

- Marker sets on page 1377
- Creating a Marker set on page 1377

Renaming an Actor

To rename an Actor:

1. Select the Actor you want to rename in the Scene browser.
2. Right-click and select Rename from the contextual menu.
3. Type a new name in the field.

■ Actor assets on page 1353

Changing the look of an Actor

You can define the appearance of Actors using the Actor Settings group of properties in the Properties window. These settings let you change the body, skeleton and pivot color of the Actor in the Viewer window, as well as change the size of pivot and market sets.

Changing the look of Actors is useful when you want to distinguish between multiple Actors in a scene.

■ Actor properties on page 1366

Manipulating Actors

You can manipulate an Actor's detachable body segments in two ways. You can use inverse kinematics to transform the Actor, or you can manually adjust the Actor to reach a Marker set.

To manipulate an Actor's hierarchy with Inverse Kinematics:

1. Activate the IK Manip option in the Actor Controls.
2. Select a cell in the Actor representation, then transform the Actor.

To manipulate the Actor to reach a Marker set:

1. Make sure that IK Manip is disabled in the Actor Controls.
2. Select a joint by clicking the corresponding cell in the Actor representation.

The corresponding body part is selected in the Viewer window with the name of the selected body part appearing at the lower right corner.

3 Translate, rotate, and scale the selected body part.

To scale and translate an Actor's limbs together:

1 In the Actor Controls, activate the Symmetry Edit option.

2 Select one of the Actor's limbs and activate a transformation mode.

3 Change the transformation values.

For example, to scale both arms simultaneously, select Symmetry Edit, choose an arm, then change the scaling values.

- Actor assets on page 1353
- Actor Controls window on page 1368

Connecting an Actor to a character

After you have connected motion data to an Actor asset using a Marker set, you can connect the Actor to a character. This lets you drive the character using the motion data, or plot the motion data directly onto the character's skeleton.

To connect an Actor to a character:

1 Load an Actor that has motion data mapped in a Marker set.

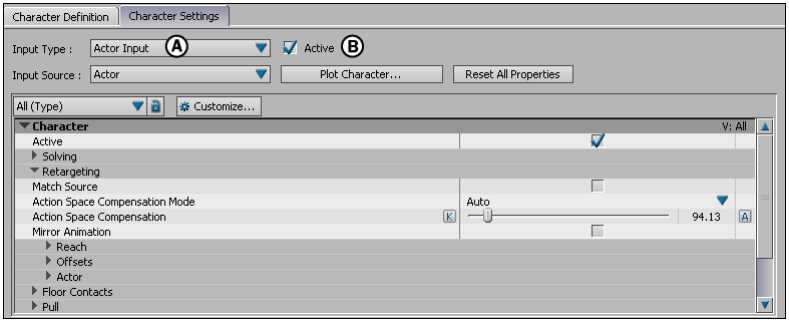
2 Merge a characterized character into the scene.

3 Expand the Characters folder of the Scene browser and double-click your character's name.

The Character Settings display in the Navigator window.

4 From the Input Type menu in the Character Settings pane, select Actor Input, then select the Actor by name from the Input Source menu (if it is not automatically selected).

5 Click the Active option (if it is not already activated) to snap the character onto the Actor source.



Character Settings pane *A.* **Actor Input is selected as the Input Type.** *B.* **The Active option is activated.**

The Actor and character will now move together using the same motion. You can select and play a take using the Transport Controls window.

In some cases, the movement may not be perfectly aligned between the Actor and the character. You can fine-tune the movement by adjusting certain Character settings, such as Match Source and Reach values.

- Creating a Marker set on page 1377
- Characterizing on page 1275
- Adjusting a character connected to an Actor on page 1357
- Retargeting - Actor properties on page 1546
- Character Settings pane on page 1519

Adjusting a character connected to an Actor

After you have connected an Actor to a character, you may notice the animation directed onto your character results in some awkward movement. For example, the character's shoulders may appear too low and close to the body in certain frames, or the neck may have some unnatural movements. This can occur when certain markers are poorly captured, or when the Actor configuration does not provide good capture data.

You can use the Motion Reduction settings in the Character Settings pane to adjust and fine-tune the way the character's chest, shoulders, neck, and head react to the Actor source.

To adjust a character connected to an Actor:

1. Switch to Models Only display mode in the Viewer window (*Ctrl+ A*).
2. In the Character Controls window, disable the Actor (All) option in the Show menu.

   This hides the Actor in the Viewer window so you can see your character clearly. Even though the Actor is hidden, it still drives the motion of the character.
3. In the Scene browser, expand the Characters heading and double-click the character to open the Character Settings.
4. In the Character Settings pane, expand the Retargeting > Actor > Motion Reduction settings.
5. Experiment with the various Motion Reduction settings until your character moves more smoothly.

   For example, if the shoulders appear too low and tight to the body, set the Shoulder Reduction slider to 80 to achieve a more natural result.

- Character motion capture workflow on page 1263
- Connecting an Actor to a character on page 1356

Activating all markers on an Actor

In the Marker table in the Actor Settings, click the Oriented title at the top of the column to activate all markers for a selected Actor.

- Actor assets on page 1353
- Actor settings on page 1359
- Connecting an Actor to a character on page 1356

Creating motion using a glove device

If you do not have finger marker data, you can connect glove devices to an Actor to create realistic hand and finger movements. You can set gloves as live devices or as devices containing recorded data.

After you have connected the glove device to an Actor, you can select the Actor as the motion source driving your character model.

To connect a glove device to an Actor automatically:

1. Select the left or right-hand cell in the Actor representation.
2. Drop the root of the glove device into the Glove reference in the Model column.

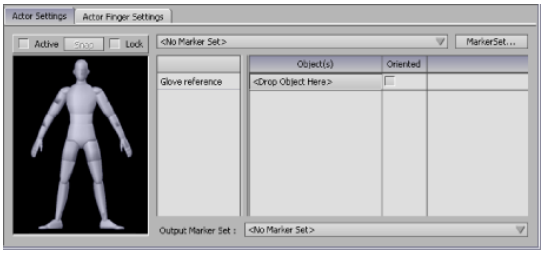
- Connecting an Actor to a character on page 1356
- TBD - Actor Finger-Solver Settings

Actor settings

To display the Actor settings in the Navigator window, select an Actor from the Actors folder in the Scene browser.

Actor representation

The Actor representation visually represents the Actor in the Actor settings. The Actor representation is used to add markers or sensors containing motion data to a Marker set and view selected markers in the Marker table (see Marker Table on page 1361).



Actor Settings *A.* **Actor representation**

When you first create an Actor, the cells in the Actor representation are empty. These cells indicate the number of markers that affect each part of the Actor body. You can assign up to five markers per cell.

To add markers to a Marker set, *Alt*-drag one or more selected markers or sensors into one of the cells corresponding to the Actor body part. You can drag from the Scene browser or from the Viewer window.

Dragging connects the marker or sensor to the other markers in the cell, and influences the corresponding part of the Actor body. If the cell already contains markers and sensors, the new markers and sensors are added to the existing list.

Active

The Active option above the Actor representation lets you activate the mapping and fit the Actor onto the Marker set. Enable Active to activate mapping.

Snap

The Snap button calculates rotational offsets and slight positioning differences between the Marker set and the markers or sensors used by the Marker set. Snap is best suited for Marker sets that have oriented markers, commonly found in magnetic capture data.

You can also use Snap to compensate for optical capture sessions that use the same Marker set, but were captured during different sessions. Although the Marker set is identical, the sensors might have been in slightly different locations on the performer's body compared to the previous capture session. Snap works best when these differences are subtle.

NOTE If you change the position of an Actor finger and click Snap, the finger pops back to place which appears more like selecting Active instead of Snap. See Actor Finger Settings and Properties on page 1363.

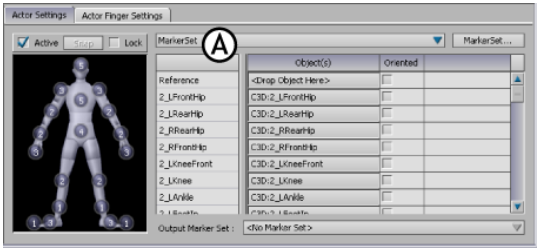
Lock

The Lock option locks the current position and rotation of the selected Actor and its Marker set. You must have an active Marker set to use Lock.

Current Marker Set

The Current Marker Set field lets you select the Marker set used by the Actor. You work with the current Marker set when you edit, rename, import, export, and map data to your Actor.

If there are no Marker sets, <No Marker Set> appears in the Current Marker Set field and no cells display in the Actor representation.



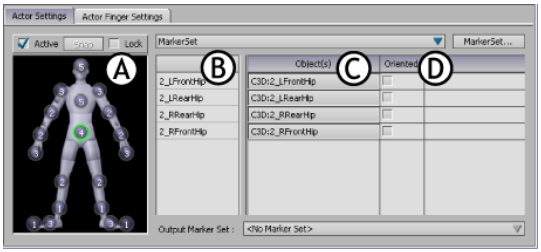
Actor Settings *A.* **Current Marker set field**

The Marker Set button to the right of the Current Marker set field opens the Marker Set menu that lets you create, rename, import, export, and delete Marker sets.

Marker Table

The Marker table lists the markers that drive the Actor joints. If your selected Actor does not have a Marker set, the Marker table is empty.

The Marker table consists of the Marker, Model, and Oriented columns.



Actor Settings *A.* **Hips cell is selected in the Actor representation.** *B.* **Marker column** *B.* **Model column** *C.* **Oriented column**

To view only the objects that influence a part of the Actor in the Marker table, click the corresponding cell in the Actor representation. A green outline circles the selected cell in the Actor representation. The list of markers that influence that part of the Actor appears in the Marker table as well.

Selecting a marker in the Marker column selects that marker in the Viewer window and deselects all other markers.

NOTE Be careful when you select markers in the Marker table. If there is a sensor or bone selected in your scene, it remains selected when you select a new marker from the Marker table.

To view all the markers in the Marker table, click the background of the Actor representation to deselect any selected cells. To scroll through the Marker table, Shift-click and drag up or down, or use the scroll bars.

To remove a marker or sensor from the Marker table, select the marker in the Marker column, and press Delete. This removes the marker, which means that it is no longer used by the Marker set. The actual physical sensor or marker is still in the scene.

Column	Function
Marker	The Marker column lists the defined markers that indicate the placement of the sensors, markers, or bones that drive the Actor in your scene. You can rename the fields in the Marker table by double-clicking the field, changing the name, and pressing Enter.
Model	The Model column specifies the sensors, markers, or bones that drive the white markers. Make sure you *Alt*-drag the root of your object into the Reference field in the Model column. This is the only field that is not modified in the Actor representation cells.
Oriented	The Oriented column activates rotation and translation data for the corresponding marker. If a marker contains both rotation and translation data, activate the Oriented option for that marker. When Oriented is disabled, only translation data is active. Click the Oriented title at the top of the column to activate all markers for your selected Actor.

Output Marker Set

The Output Marker Set field outputs the result from one Actor to another Marker set. You can use this technique to transfer motion data that was captured with many different Marker sets to a single format.

Actor Settings *A.* **Output Marker Set field**

For example, you can transfer data from the Marker set of an Actor using magnetic motion data to an Actor using optical data. You can then export the optical data using one of the export file formats.

You can also reverse the direction of Character mapping and have a Character output to a Marker set. Since the Marker set is based on either magnetic sensors or optical markers, you are actually outputting back to these sensors or markers.

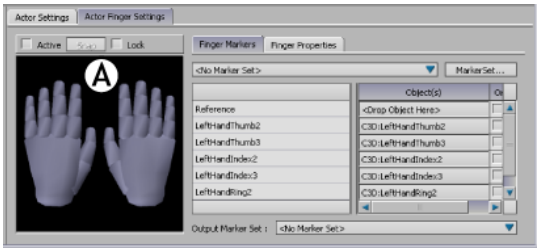
Essentially, this method of mapping lets you reverse the flow of Character mapping and transfer data from a plotted Character to magnetic sensors or optical markers. This is important if you want to export the finished character as a data file (for example, Vicon *.c3d*). You can also save cleaned data as a different set of optical or magnetic sensors.

■ Actor assets on page 1353

Actor Finger Settings and Properties

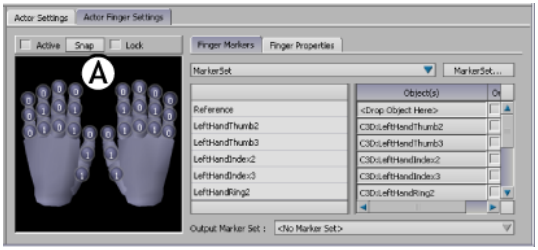
To display the Actor Finger Settings in the Navigator window, select an Actor from the Actors folder in the Scene browser, and then select the Actor Finger Settings pane.

The Finger representation is used to add markers or sensors containing motion data to a Marker set. You also use this representation to view selected markers in the Marker table (see Marker Table on page 1361).



Actor Finger Settings *A.* **Finger representation**

When you first import a marker set, the Actor Finger representation cells are empty. These cells indicate the number of markers that affect each part of the fingers. As with markers on the body, you can assign up to five markers per cell.



Actor Finger Settings *A.* **Finger markers**

To add Finger markers to a marker set:

1 Choose the marker set to which you want to add marker data:
   - From the marker set contextual menu, select the marker set you want
   - Click Marker Set and either create or import the marker set

2 Select a marker from the Viewer window, and *Alt*-drag it into the corresponding finger cell.

NOTE Dragging assigns the marker to the cell. If a cell already has a marker in it, the new marker is added to the list of markers for that cell.

These options work the same way they do for the actor's body:

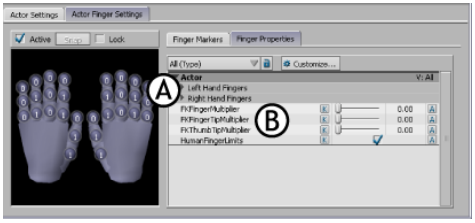
- Active on page 1360
- Snap on page 1360
- Lock on page 1360
- Current Marker Set on page 1360
- Marker Table on page 1361
- Output Marker Set on page 1362

NOTE If you change the position of an Actor finger and click Snap, the finger pops back to place which appears more like selecting Active instead of Snap. See Snap on page 1360.

Finger properties

The properties you can change for finger data pertain to:

- Control—you can create relationships between fingers on the same hand to control movement. You can nominate which data (from other fingers) controls the animatable rotation of a finger, specified as a percentage of the total rotation value.
- Finger-solving—you can change multiplier values using the sliders to increase or decrease FK interpolation for the rotation of all fingers on both hands. These values work with the Actor-solving to extrapolate forward kinematics (FK).
- Human Finger Limits—this option imposes limits, for both hands, to control unnatural rotation. If this option is not activated, the plane of rotation is still considered along with an internal set of limits for the off-axis rotation.



Actor Finger properties *A.* **Finger controllers** *B.* **FK multipliers**

To modify finger data control:

1. Select the Finger Properties tab
2. Click the arrow beside either the left or right hand fingers menus
3. Choose the finger you want to control

   NOTE Each controller is identified by <hand><target finger><controller finger> labels. For example, LeftHandIndexMiddle means you're using data from the middle finger of the left hand to influence the rotation of the index finger of the left hand.

4. Position the slider to the value amount that you want to apply control to the finger, for example a value of 100 controls the finger completely.

NOTE The default values are that each finger drives itself 100% with no influence from other fingers.

5 Enable animation on this finger by clicking "A", and then add a keyframe by clicking "K". For more information, see Keyframe (K) and Animate (A) buttons on page 822.

To modify finger FK Multiplier values for interpolation:

1 Select the Finger Properties tab

2 Choose the multiplier whose interpolation you want to modify:

- FK Finger and Thumb Tip works specifically on the last phalange
- FK Finger Multiplier works on the movement of the second phalange and does not affect the thumbs

3 Position the slider to the value amount that you want to apply FK interpolation for the finger (for example a value of 1 gives total FK interpolative movement)

Actor properties

The Actor properties display when you select an Actor in the Scene browser, or when you have an Actor selected in the Actor Controls window and select Edit Properties from the Edit menu.

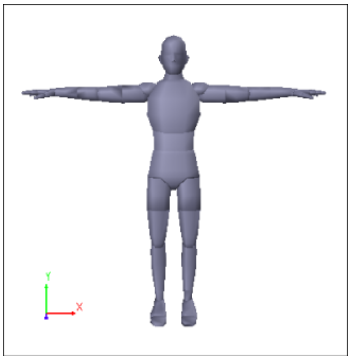
The Active, Snap, Lock, and MarkerSet properties are all defined using the Actor Settings. See Actor settings on page 1359 for more information on these settings. The other Actor properties include the Actor Settings and Body Part Pivots groups of properties.

Actor Settings

The Actor Settings group of properties let you change the way the Marker set, Actor body, skeleton, and pivot points display in the Viewer window.

Body Color

The Body Color properties let you modify the RGB color values that define the color of the Actor in the Viewer window. By default, the Actor displays in grey.



Default Actor color

Skeleton Color

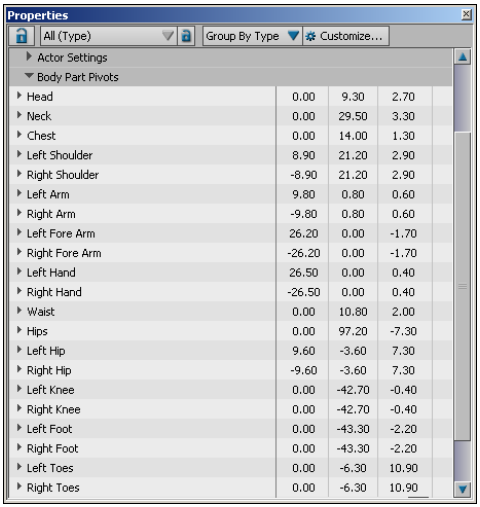
The Skeleton Color properties let you modify the RGB color values that define the color of the Actor skeleton in the Viewer window. By default, the Actor displays in grey. You can hide the Actor's skeleton using the Show menu in the Actor Controls.

Pivot Color

The Pivot Color properties let you modify the RGB color values that define the color of the Actor pivots in the Viewer window. By default, the Actor pivots display in orange. You can hide the Actor's pivot points using the Show menu in the Actor Controls. To work with the Actor's pivots, use the Body Part Pivots properties.

Body Part Pivots

The Body Part Pivots properties define the position for each pivot point associated with the Actor.



Body Part Pivots properties

- Actor assets on page 1353
- Changing the look of an Actor on page 1355

Actor Controls window

The Actor Controls window provides options for adjusting your Actor. You can scale, rotate, and translate an Actor's detachable segments to reach the markers specified by the Marker set, to add offsets, or to compensate for the lack of a T-stance on page 2023.

The Actor Controls window also lets you manipulate your Actor using Inverse Kinematics (IK). Using IK prevents unwanted dislocation of the Actor's parts while manipulating and adjusting the Actor.

To open the Actor Controls window, choose Window > Actor/Character Controls from the menu bar.

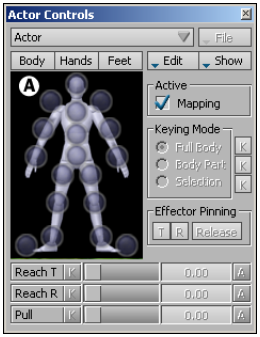
Current Actor

The Current Actor menu displays the name of the current Actor to which all options apply. When switching from an Actor to a character using this menu, the options in the Actor Controls window are replaced and become contextual to the current character.

Select an Actor in the Actor Controls window by making a selection from the Current Actor menu.

Actor Representation

The cells in the Actor representation visually represent the Actor's joints. Selecting a cell lets you manipulate that part of the Actor using Inverse Kinematics or as detachable body segments.



Actor Controls window *A.* **Actor representation**

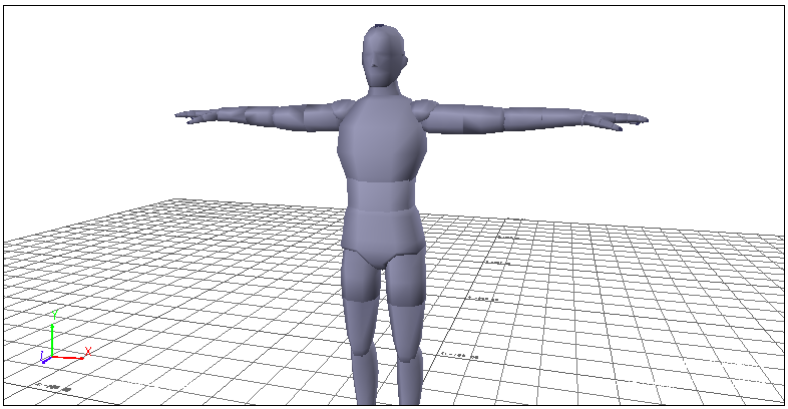
Cells in the Actor representation can have the following states:

State	Indicates
T	A cell containing the letter T indicates that its corresponding body part is pinned in translation.
R	A cell containing the letter R indicates that its corresponding body part is pinned in rotation.
T and R	A cell containing both T and R indicates that its corresponding body part is pinned in both translation and rotation.
Empty	An empty cell indicates that its corresponding body part has no translation or rotation pinning.
Circle	A green circle around the cell indicates the corresponding body part is selected.

Edit

The Edit menu in the Actor Controls includes the following options:

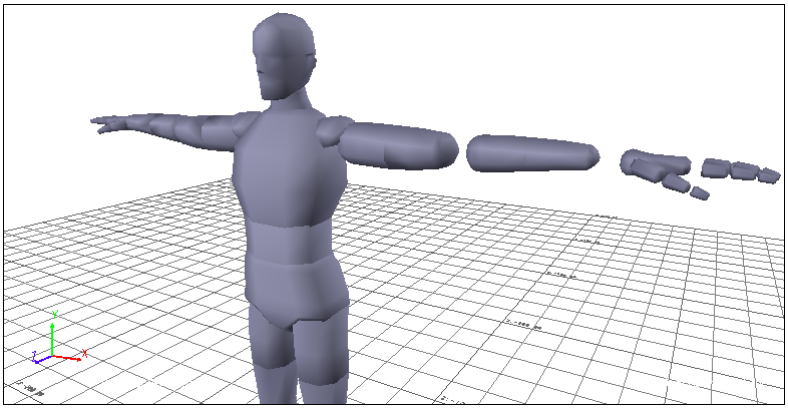
Option	Function
Lock	Activate Lock to lock the current position and rotation of the selected Actor and its Marker set. The Lock option in the Edit menu and in the Actor settings are identical.
IK Manip	Activate IK Manip to manipulate your Actor using Inverse Kinematics. Disable IK Manip to manipulate individual body segments on the Actor.
Symmetry Edit	Activate Symmetry Edit to simultaneously scale **and** translate an Actor's limbs. Disable Symmetry Edit to independently change the size or length of a limb.
Stance Pose	Activate Stance Pose to position the Actor in its default stance position. You can use this pose to reset and modify the Actor's position. Stance Pose only resets rotational offsets. These offsets remain if you translate or scale the model.



Actor Stance Pose

Option	Function
Collapse	Activate Collapse to rejoin any detached limb segments of an Actor without resetting the Actor's size or stance. This may be necessary in certain situations. For example, when adding position offsets to an Actor or when translating source markers further than their initial

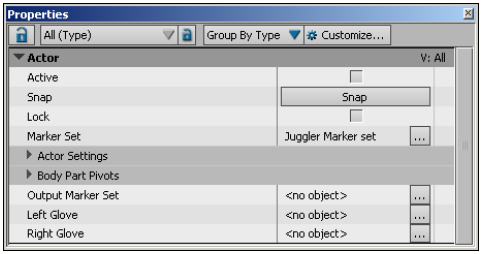
Option	Function
	definition, some limbs may detach to reach all the markers defined by its Marker set.
Reset Size	Select Reset Size to reset the scale of the selected Actor to its default size. If a scaling offset affects the position of a segment, Reset Size resets the scale of the Actor, but leaves the segment at its new location.



Reset Size resets the scale of the left arm but keeps the position of the left hand, detaching segments of the arm.

Option	Function
Find Size	Select Find Size when the Actor is in a T-stance on page 2023 to calculate and size each segment of the Actor based on the selected Marker set and source markers.
Reset Pivot Points	Select Reset Pivot Points to return all Actor pivot points to their original positions.
Reset All	Select Reset All to reset the Stance Pose, Collapse, and Reset Size options simultaneously. This option returns the Actor to its default stance position, reconnects any detached limb segments, and resets the scale of the Actor to the default size.
Edit Properties	Select Edit Properties to open the Properties window and display all the properties associated with the selected Actor. These properties let you change, activate, and disable various Actor

Option	Function
	properties. The Name, Active, Snap, Lock, and Marker Set properties also appear in the Actor Settings. For more information see Actor settings.



Actor properties display in the Properties window

Option	Function
Switch to Character	The Switch to Character option switches focus to the character that is constraining the current Actor. Selecting this option switches from the Actor Controls to the Character Controls, and all the options become contextual to the active character. This option is unavailable if there is no constraining character.

Show

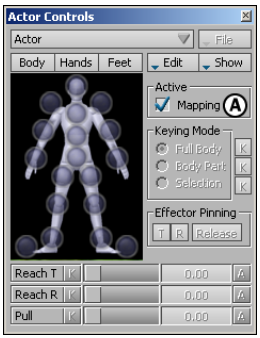
The Show menu in the Actor Controls window includes the following options:

Option	Function
Actor (All)	Shows or hides the entire Actor. By default, the Actor's body, bones, Marker set, source markers, and pivot points display. To hide the Actor, disable Actor (All).
Actor Body	Shows (default) or hides the body of the Actor. To hide the Actor's body, disable Actor Body.
Actor Skeleton	Actor Skeleton shows a set of connecting lines representing the bones of the Actor. To show only the bones, activate Actor Skeleton and disable Actor Body.

Option	Function
Marker Set	Hides or shows the markers that belong to the defined Marker set. The Marker set displays as white markers around the Actor's body. To hide the Marker set, disable this option.
Source Markers	Shows (default) or hides the markers containing motion data. To hide the source markers, disable this option. When the Marker set and the Source markers are both active, the markers belonging to the Marker set display inside the source markers by default.
Pivot Points	Hides or shows the pivot points for the Actor. To hide the pivot point markers, disable this option. By default, the pivot points display as orange crosses. To change the way pivot points display, use the Actor Settings properties in the Properties window. You can also adjust the position of the pivot points using the Body Part Pivots properties. See Edit Properties.

Active

The Mapping option in the Active area activates and snaps the Actor to its Marker set. This option is the same as the Active option in the Actor settings.

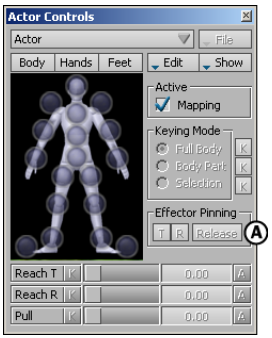


Actor Controls window *A.* **Active area**

When the Mapping option is active, you can manipulate the Actor in the Viewer window.

Effector Pinning

When manipulating an Actor in IK Manip mode, the options in the Effector Pinning area help control the Actor's body movement.



Actor Controls window *A.* **Effector Pinning area**

You can activate, disable, and temporarily release pinning on cells that represent the Actor's body parts. Pinning on certain body parts restricts the Actor's body movement, and determines how other body parts move relative to the pinned body part.

These options behave the same for Actors as they do for characters. The only difference is that for Actors, IK Manip mode is used only for positioning the Actor.

Option	Function
T and R	The T (Translation) and R (Rotation) options let you activate or disable pinning on body parts in translation or rotation. An Actor's hands are pinned in translation, and its feet are pinned in translation and rotation by default. This pinning constrains the Actor's body parts until they are unpinned. Activate pinning on one body part by selecting the cell in the Actor representation for the body part you want to pin, then activating T or R. Activate pinning on multiple body parts by *Ctrl*-clicking cells in the Actor representation, and then activating T or R. Remove pinning by selecting the cell in the Actor representation, and disabling T or R. You can also use the Release option and keyboard shortcuts to toggle pinning on selected cells.
Release	The Release option lets you temporarily remove the translation or rotation pinning related to a selected body part and those down the chain. This lets you manipulate your Actor without constraining the selected body part. Activate Release or press and hold the Q key to temporarily unpin effectors while manipulating your Actor. Disable the Release option to return the pinning to its previous state.

■ Actor assets on page 1353

- Manipulating Actors on page 1355

Marker sets

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In order to drive a character using motion data, you must first connect the data to an Actor, then select the Actor as the motion source for the character. The Marker set is the link between the magnetic or optical data recorded from a live performer and the Actor asset.

Creating a Marker set matches the motion data to the Actor's body parts, letting you preview how the motion data will make a character move. In the Viewer window, a defined Marker set displays as a group of white markers attached to an Actor.

Actors and the Actor settings are used to define the Marker set for a motion capture device or data.

- Actor assets on page 1353
- Creating a Marker set on page 1377
- Creating an Actor on page 1354
- Importing a Marker set on page 1383
- Exporting a Marker set on page 1385
- Renaming a Marker set on page 1384
- Deleting a Marker set on page 1384

Creating a Marker set

There are two ways to create a Marker set, depending on what type of motion capture data you are working with.

- Creating and defining a Marker set with optical data on page 1378
- Creating and defining a Marker set with magnetic data on page 1381
- Marker sets on page 1377

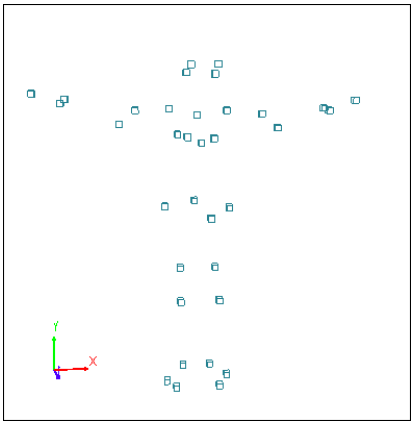
- Importing a Marker set on page 1383
- Renaming a Marker set on page 1384
- Exporting a Marker set on page 1385

Creating and defining a Marker set with optical data

A Marker set links optical motion data to the Actor asset, matching the motion data to the Actor's body parts. Linking the Actor to the optical data through a Marker set lets you preview the optical motion data on the Actor.

To create and define a Marker set with optical data:

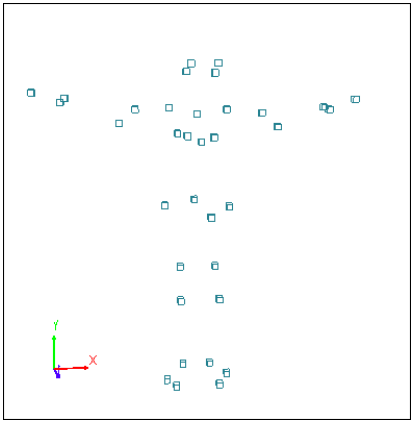
1 Load a file containing optical motion data.



Motion capture data loaded in the scene

Ideally, the markers load in a T-stance facing the positive Z-axis. When capturing motion data, you should always start or end your take with the performer in a T-stance facing the positive Z-axis.

2 From the Characters folder of the Asset browser, drag an Actor asset into the scene.



Actor added to the scene

The name “Actor” appears in the Actors folder of the Scene browser, the Actor Settings display in the Navigator window, and a gray model displays in the scene.

3 In the Viewer window, select the Actor’s hips and translate until the Actor appears inside the cloud of data markers.

4 Translate, scale, and rotate the Actor and its body parts until the data markers are appropriately aligned.

TIP Try to position the Actor’s body so that the markers are placed exactly as they were on the performer’s body.

5 In the Actor settings, click the MarkerSet button and select Create in the Marker Set menu.

6 In the Scene browser, click the Lock button to keep the Actor settings in the Navigator window.

7 *Alt*-drag each optical marker into the appropriate body part cell of the Actor representation. Each cell can have a maximum of five markers.

As you drag markers into the Actor representation in the Actor Settings, white markers representing the Marker set appear around the light blue optical sensors in the Viewer window. The cells in the Actor representation display the number of markers affecting each body part, and the names of the sensors appear in the Object(s) List.

NOTE Make sure to deselect each marker after you are finished dragging it, otherwise it is dragged into each successive cell. When using a Glove device, place hand markers into the wrist cells, and the Glove reference into the Glove reference fields in the hand cells. To see the Glove reference fields, click the hand cell in the Actor representation.

8. In the Actor settings, click Snap to calculate offsets and to activate the mapping in the Actor settings.
9. Click TR in the dialog box that appears asking how you want to recalculate the Marker set offsets. TR indicates that you want to recalculate them based on both translation and rotation

   The Actor is active, and the position of the sensors match the Actor's body parts. The Marker set links the sensors and the Actor, letting the Actor move using the optical motion data.

After you have created a Marker set for an Actor, you can select the Actor as a motion source for a characterized character.

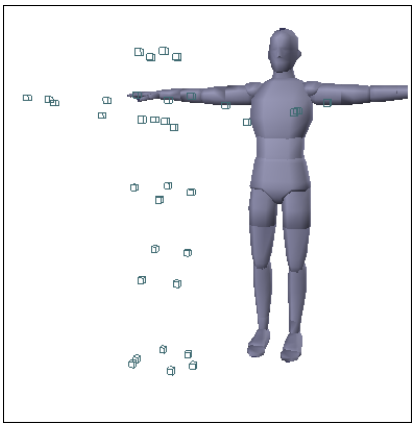
- Actor assets on page 1353
- Marker sets on page 1377
- Creating an Actor on page 1354
- Importing a Marker set on page 1383
- Exporting a Marker set on page 1385
- Connecting an Actor to a character on page 1356

Establishing a Zero Point

Before creating a Marker set, you must establish a zero point for your Actor, which is the stance where both translation and rotation are set to zero. By default, the Actor settings use the T-stance as the zero point. All subsequent movements are based on this zero point.

If your capture session does not begin with a T-stance, the Actor's limbs must be rotated to meet the starting location of the motion capture markers or sensors.

Before rotating the Actor, you should translate it to occupy the same space as the sensors. This makes it easier to match the markers.



Even if you started the capture session with your performer in a T-stance, you should reposition and scale the Actor to the sensors before you create the Marker set.

TIP When transforming the Actor to match its sensors, you do not have to be precise. You can add additional offsets to compensate for poor placement later in the mapping process.

After you activate the Actor's Marker set, you may also have to adjust the position, rotation, or scale of the Actor's arms, legs, torso, chest, or head.

You can adjust your Actor using the Actor Controls window (see Actor Controls window on page 1368).

- Marker sets on page 1377
- Actor Controls window on page 1368
- Creating and defining a Marker set with optical data on page 1378
- Creating and defining a Marker set with magnetic data on page 1381

Creating and defining a Marker set with magnetic data

To create and define a Marker set with magnetic data:

1. Load a file containing set of magnetic motion data.

   In the Viewer window, yellow markers containing magnetic motion data display as they were captured on the performer.

Ideally, the markers should be in a T-stance facing the positive Z-axis. When capturing motion data, you should always start or end your take with the performer in a T-stance facing the positive Z-axis.

2 Add an Actor asset to the scene.

The name "Actor" appears in the Actors folder of the Scene browser, the Actor Settings display in the Navigator window, and a gray model displays in the scene.

3 In the Viewer window, select the Actor's hips, and translate until the Actor appears inside the cloud of magnetic markers.

4 Translate, rotate, and scale the Actor's body parts to better align with the markers. Use the various camera perspectives and the Normal and X-Ray display modes as you adjust the Actor.

TIP Try to position the Actor's body so that the markers are placed exactly as they were on the performer's body.

5 In the Actor settings, click the MarkerSet button and select Create in the Marker Set menu.

By default, the first Marker set you create is named "Marker Set 1" in the Marker Set field. Additional Marker sets are numbered in sequential order.

6 In the Scene browser, click the Lock button to keep the Actor settings in the Navigator window.

7 *Alt*-drag each magnetic marker into the Actor representation in the Actor Settings, dropping them into the cell that represents the associated body part. Each cell can have a maximum of five markers.

As you drag markers into the Actor representation, white markers representing the Marker set appear around the yellow magnetic sensors in the Viewer window. The cells in the Actor representation display the number of markers affecting each body part, and the names of the sensors appear in the Object(s) List.

NOTE Make sure to deselect each marker after you are finished dragging it, otherwise it is dragged into each successive cell.

8 In the Marker table, click the Oriented header, then click Ok in the dialog box that appears to activate all the Oriented options in the Marker table.

9 In the Actor settings, click Snap to calculate translation and rotation offsets, and to activate the mapping in the Actor settings.

10 Click TR in the dialog box that appears to indicate that you want to recalculate the Marker set offsets for translation and rotation (TR).

The Actor is active, and the position of the sensors match the Actor's body parts. The Marker set links the sensors and the Actor, letting the Actor move using the magnetic motion data.

NOTE The mapping process is easy, but correctly tuning the Actor requires experience and intuition, especially if you do not remember exactly where the magnetic sensors were positioned on your performer. It is recommended that you keep a photographic record of your captures, and load an image of your performer in the Viewer window background to see the position of the sensors.

- Actor assets on page 1353
- Marker sets on page 1377
- Creating an Actor on page 1354
- Establishing a Zero Point on page 1380
- Importing a Marker set on page 1383
- Exporting a Marker set on page 1385

Importing a Marker set

To import a Marker set:

1 Select Import from the Marker Set menu in the Actor Settings.

2 From the Open directory dialog box that appears, choose a Marker set to import.

- Marker sets on page 1377
- Creating a Marker set on page 1377
- Exporting a Marker set on page 1385

Renaming a Marker set

To rename a Marker set:

1. Select Rename from the Marker Set menu.
2. Type a new name in the Current Marker Set field.

- Actor assets on page 1353
- Marker sets on page 1377
- Importing a Marker set on page 1383
- Exporting a Marker set on page 1385
- Creating a Marker set on page 1377

Deleting a marker from a Marker set

To delete a marker from a Marker set:

➤ Select the name of the marker in the Model column, and press Delete on the keyboard.

WARNING If you click Delete in the Marker Set menu, you will delete the entire Marker set.

- Actor assets on page 1353
- Marker sets on page 1377
- Deleting a Marker set on page 1384

Deleting a Marker set

To delete a Marker set:

➤ Select Delete from the Marker Set menu.

- Actor assets on page 1353

- Marker sets on page 1377
- Creating a Marker set on page 1377
- Importing a Marker set on page 1383
- Exporting a Marker set on page 1385
- Renaming a Marker set on page 1384

Exporting a Marker set

To export a Marker set:

1. Select Export from the Marker Set menu.
2. From the Save directory dialog box that appears, type a file name to save the current Marker set as an *.hik* file.

The *.hik* file format lets you save Marker sets and reuse them on other Actors.

- Marker sets on page 1377
- Creating a Marker set on page 1377
- Importing a Marker set on page 1383

Optical motion data

81

Optical motion capture involves the recording of data from reflective sensors attached to a performer's body. The movement of the performer is recorded using cameras placed at different angles that capture the translation of each sensor.

There are a few problems inherent with the capture of optical motion data that occur frequently. You can use the MotionBuilder Optical editor to correct these problems.

- Optical systems and data on page 1387
- Optical terminology on page 1389
- Problems with Optical data on page 1390

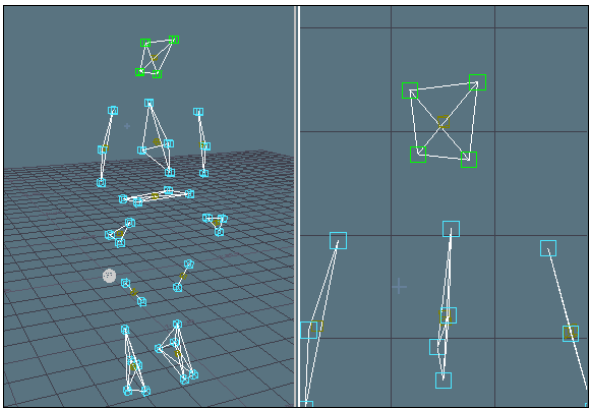
Optical systems and data

There are several different types of optical motion capture system, but they all work in essentially the same manner. Each type uses a series of cameras placed at different angles to track the position of reflective sensors attached to a performer.

Even if you are using optical data files that were captured by someone else, it is useful to know the basics of optical data.

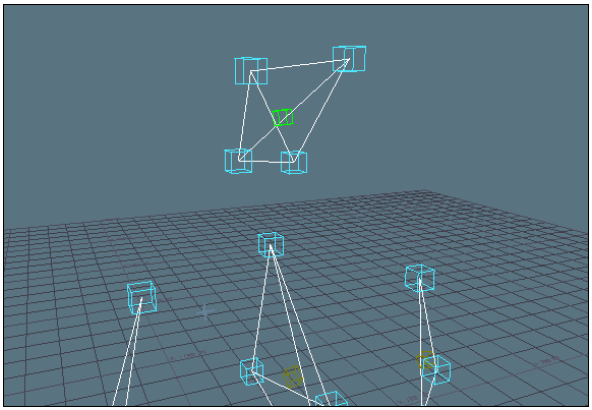
Optical data are sets of translation data. This data consists of many different points with only translations and no rotation or scale data.

To extract rotation data used to position an unlabeled (occluded) marker, you create a Rigid body which is a collection of at least three sensors that define a solid body part. For example, many optical capture setups define four markers for the head.



Selected four markers define the head Rigid body

As the head is tilted, some sensors move up while others move down. When the four optical markers are grouped as a Rigid body, this translation is interpreted as rotation and is indicated by the marker in the center of the Rigid body.



Center Rigid body marker indicating rotation

Rigid bodies are also an important part of correcting occlusion and partial occlusion. Since an occluded or unlabeled marker is connected to other optical markers, the optical system attempts to calculate the position of the occluded marker based on the other markers in the Rigid body. This calculation may not be sufficiently accurate and may need to be corrected manually.

■ Optical terminology on page 1389

Optical terminology

Almost all optical devices, file formats, and capture systems have their terminology that refers to optical capture and reconstructing optical data. This section lists the terms used to describe optical capture, cleaning, and reconstruction methods.

Optical Root

Represented as a sphere, the Optical root is the main reference for optical data imported into MotionBuilder. You can translate, rotate, and scale all markers attached to the optical marker.

Sensor

A sensor is a reflector or light source attached to a performer's body. Sensors are tracked by optical cameras during the capture process. Captured data is combined to create segments.

Marker

Markers are used to identify segments. One or more segments, after being labelled or identified, combine to create a marker of continuous data.

Segment

Refers to data captured from a sensor during an optical capture session. During optical cleaning, you label segments to associate them with markers. Unlabeled segments display as blue asterisks.

Current Segment

The current segment is selected in the Optical editor. When a segment is selected and active (not set to Done in the Label pane), it is colored green.

Rigid Body

Two or more markers that are grouped to correct occlusion are called a Rigid body.

Gap

A gap is the space before, after, or between a marker's segments that do not contain sensor data.

Done

Done refers to the state of a marker in the optical system. When set to Done, the marker is no longer an active optical marker and cannot be used within the Optical settings. Done optical markers are non-active markers whose data can be filtered and modified in the FCurves window.

Sample

The position of a sensor recorded by each camera at each frame is called a sample. All samples from each camera are processed by a computer which generates a three-dimensional representation of each sensor's position in time. These are also sometimes referred to as keyframes.

Problems with Optical data

The method of capturing optical data can create the following distinct problems:

- Occlusion on page 1401
- Partial Occlusion on page 1403
- Swapping on page 1398

Each problem can be corrected using either the capture system's proprietary software or MotionBuilder.

Most of the time, optical data is stored in a motion library and the data is already cleaned and fixed by the motion library vendor. If this is the case, you won't have to correct the optical data yourself and it is ready for Character mapping.

Whether you are capturing optical data yourself or using raw, uncorrected optical data files, it helps to understand occlusion, partial occlusion, and swapping. Separate topics describe each of these problems in more detail.

- Optical terminology on page 1389
- Reconstructing optical data on page 1391

Reconstructing optical data

This topic explains how to use the Optical settings to reconstruct and correct some common optical problems. A suggested workflow is as follows.

To reconstruct optical data:

1. Import an Optical motion file. You can import files to transfer optical data, raw data and skeletal data files between MotionBuilder and other software packages, applications, and dedicated hardware.
2. Make sure a Navigator window is open so that you can view the optical data for the selected optical marker.
3. Label all segments appearing at the beginning of your motion file, or at a location where the most segments are seen. When you label a segment, it becomes a marker. See Segments and Labelling on page 1392.
4. Create Rigid bodies using the markers you labelled in step 3. See Creating a Rigid body on page 1395.
5. Create an Actor and use the optical markers to define the Actor's marker set. This is an optional step but highly recommended. Using an Actor makes it easier to view problems such as marker swapping and noise. See Creating an Actor on page 1354.
6. Eliminate marker swapping. While labelling markers, you may find that two markers that have passed close to one another have been swapped. Eliminating Swapping on page 1399.
7. Fix noise and partial occlusion by studying and correcting Rigid body quality. See Correcting Rigid body quality on page 1396.
8. Fill in gaps. MotionBuilder provides two methods of filling in gaps: filling with unlabeled segments and filling with interpolation. See Filling Gaps with Unlabeled Segments on page 1400 and Filling Gaps with Interpolation on page 1407.
9. Switch all optical markers to Done so that further filtering may be applied using the FCurves window.

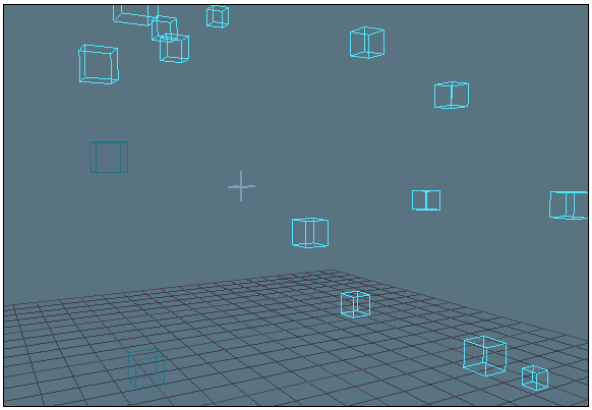
- Optical systems and data on page 1387
- Problems with Optical data on page 1390
- Optical motion data on page 1387

Optical asset

An optical root for captured or imported optical data. The Optical asset is only available in MotionBuilder.

Segments and Labelling

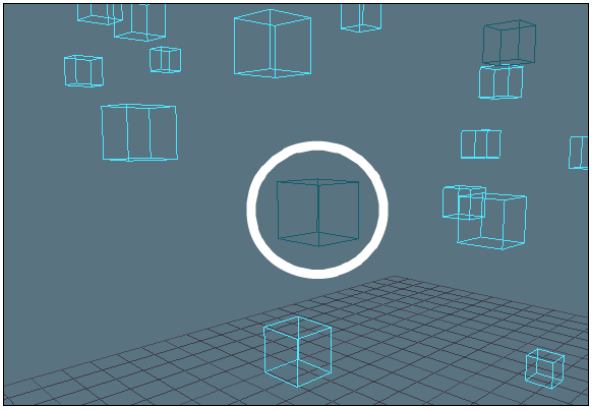
In MotionBuilder, segments refer to the captured data from an optical motion capture session. Unlabeled segments are segments that have not been labelled to markers. Unlabeled segments appear as an asterisk in the MotionBuilder scene. Asterisks cannot be directly selected.



Unlabeled markers shown as a dark blue asterisk

When a segment is labelled, it is associated with a marker in the Marker list. A marker can be associated with more than one segment, but not at the same time. This is how the Optical settings deal with occlusion: by labelling a segment before the sensor is occluded and then labelling the segment when the sensor reappears. A marker then has all the data segments captured for a certain sensor. MotionBuilder interpolates the missing data between two segments using a gap. Data in a gap is created using the extracted Rigid body information.

Markers are light blue if they contain a segment at the current time and dark blue if they are occluded.



Occluded segments shown as dark blue cubes

Markers show up as occluded only after they have been associated with at least two data segments, or have been connected to other markers using a Rigid body.

The dark blue markers serve as a mathematical estimate of where the occluded marker should be in the scene. This estimate is based on interpolation between data segments and placement based on Rigid bodies.

Most optical capture systems already create a Marker set. This Marker set is shown in the Label menu. If you are not satisfied with the Marker set, MotionBuilder lets you remove and re-label them.

■ Optical systems and data on page 1387

Labelling markers

To label markers:

1. Select Label from the Label pane.
2. Select the marker to be re-labelled from the Marker list or the Viewer window.

   You can also use the Add and Remove buttons at the bottom of the Marker list to add or remove markers.
3. In the Viewer window, click the asterisk (unused segment) to be labelled.

The segment appears in the Optical editor. You may have to scroll the Timeline indicator if the segment that you are looking for is presently occluded.

4 Drag the Timeline indicator in the Optical editor to find which asterisk should be selected for the next segment. The combination of the Label Helper and Rigid bodies proposes the best segment.

- Problems with Optical data on page 1390
- Optical Editor on page 1408

Rigid bodies

After all the markers are properly labelled to segments, you can build Rigid bodies. This helps match markers and reconstruct gaps in data. Rigid bodies also extrapolate rotation data.

Before you add a Rigid body:

- A Rigid body can be built from as few as two markers, but it is recommended that you use three or more. Three or more markers let you acquire all rotation data from the Rigid body.
- When selecting markers for a Rigid body, look for markers that appear to be arranged in deliberate groups.
- A marker cannot be used in more than one Rigid body.

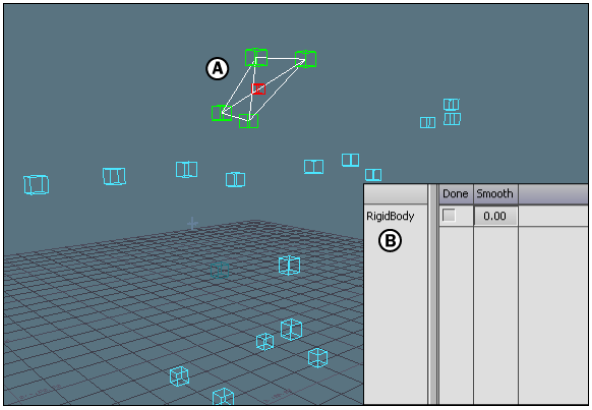
There are two methods for creating Rigid bodies: one method creates a Rigid body from a selection of markers, the second method lets you select each marker for the Rigid body as you go.

- Creating a Rigid body on page 1395
- Correcting Rigid body quality on page 1396
- Removing a Rigid body on page 1396
- Monitoring Rigid body quality on page 1397

Creating a Rigid body

To create a Rigid body:

1. *Ctrl*-click to select a group of markers that you want to act as a Rigid body.
2. In the Rigid Bodies pane, click Add to create a Rigid body from the selected markers.



A. **Labelled segments joined as a Rigid body shown in the Viewer window** *B.* **Rigid body added to the Rigid Body list**

An anchor point is created at the center of the Rigid body, referred to as a Rigid body marker. The Rigid body is also calculated.

NOTE It is very important to create Rigid bodies on a frame where your optical markers are arranged in a T-stance or an extended pose (arms and legs fully extended, reaching towards their limits). You can recalculate Rigid bodies using the Snap button.

■ Removing a Rigid body on page 1396

Removing a Rigid body

To remove a Rigid body:

1. Select the Rigid body to be removed from the Scene browser, Marker list, Rigid Body list, or Viewer window. To select a Rigid body in the Viewer window, select its anchor point.
2. Click Remove. A dialog box appears asking if you are sure you want to remove the Rigid body.

   The current Rigid body refers to the selected Rigid body. If you have selected more than one, the last selected Rigid body is the current one.
3. Do one of the following:
   - Click Ok to remove the marker from the Marker list. Only the marker is removed. Segments labelled to this marker are unlabeled and added to the number of unlabeled segments.
   - Click Cancel to abort the removal of the marker. The marker and its labelled segments are unchanged.

- Rigid bodies on page 1394
- Correcting Rigid body quality on page 1396

Correcting Rigid body quality

1. Select the Rigid body you want to correct from the Rigid Body list.
2. Examine the Quality Bar and look for a pure black, or close to pure black region.
3. Step through the markers that comprise the selected Rigid body to find the marker containing bad data. Double-click to select each marker individually.

   The marker with the segment that contains bad data should have a peak or jump that matches the black region.
4. Move the Timeline indicator inside the segment with the bad data.
5. M-click on the start or end of the data segment and drag until the peak disappears.

The area between either the edge of the original data segment and its start or end is colored light green.

NOTE To extend a data segment or gap in the Optical editor, M-click and drag on the edge of the area to be increased.

The light green segment is re-interpolated, removing the noise and updating the Quality Bar. Continue searching for other black areas at the start or end of data segments.

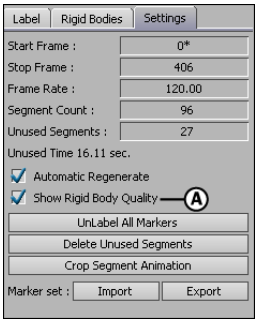
- Removing a Rigid body on page 1396
- Monitoring Rigid body quality on page 1397

Monitoring Rigid body quality

After creating a Rigid body, you can monitor its quality in the Optical editor.

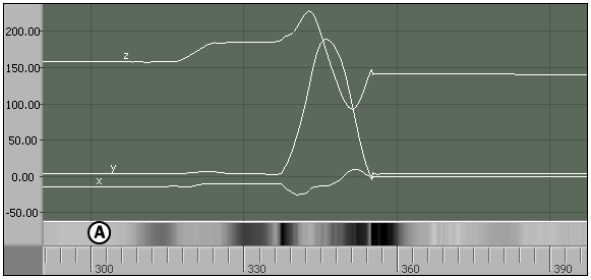
To monitor Rigid body quality:

1. Select Settings from the Optical Options pane.
2. Click Show Rigid Body Quality.



A. **Rigid Body Quality option selected**

A bar appears at the bottom of the Optical editor indicating the quality of the selected Rigid body. (See Show Rigid Body Quality on page 1415 for more information.)



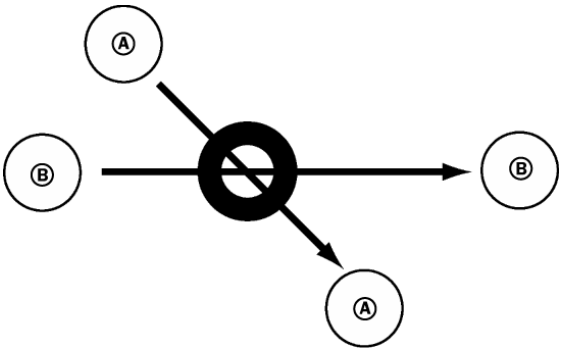
Optical editor *A.* **Quality bar**

- Rigid bodies on page 1394
- Correcting Rigid body quality on page 1396
- Removing a Rigid body on page 1396

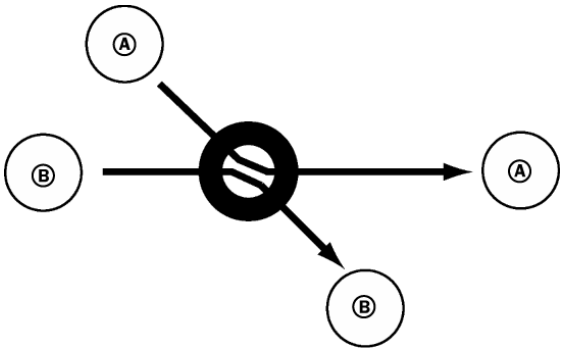
Swapping

Swapping may occur when two markers either cross or pass close to each other. The trajectory of the two markers is misinterpreted by the capture system and the wrong data segments are labelled for each marker.

For example, the following figures demonstrate how swapping may occur.



Sensors A and B cross paths in front of the camera and continue on straight trajectories



Sensors A and B cross paths in front of the camera and appear to veer away on odd trajectories

The first figure shows what actually occurs and the second figure shows how these markers may be misinterpreted by the capture system.

- Eliminating Swapping on page 1399
- Optical systems and data on page 1387

Eliminating Swapping

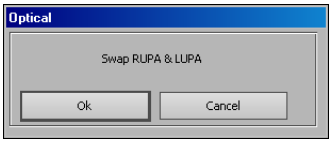
Use the Swap with Marker button in the Segment or Gap options to swap two markers that may have been swapped because of occlusion.

To swap two markers:

1. Do one of the following to select the swapping method from the Insert menu in the Label pane:
   - Click Insert Whole Segment to swap entire segments.
   - Click Insert From Cursor to End to swap the segments from the Timeline indicator to the end of the scene.
   - Click Insert from Start to Cursor to swap the segment from the beginning of the scene to the Timeline indicator.
2. Select a marker in the Viewer window or from the Marker list in the Label pane.
3. In the Optical editor, move the Timeline indicator to where you want the swapping to begin or end (if you are not swapping the entire take).

4 Click Swap with Marker and, in the Viewer window, click on the second marker that you want to swap.

A dialog box appears asking if you are sure you want to swap the data segments of the two selected markers.



Optical Swap dialog box

5 Click Ok to swap the two markers or click Cancel to abort swapping.

- Problems with Optical data on page 1390
- Swapping on page 1398

Filling Gaps with Unlabeled Segments

When all Rigid bodies are created and there are still unlabeled data segments, this is referred to as a gap.

To fill gaps with unlabeled segments:

➤ Browse through the list of markers and analyze their movements to see gaps where the data should be. You can fill these gaps with segments by automatically searching for unlabeled segments.

The red crosshair shows the possible data segments that most likely fill the gap, and rebuild the current marker's data by joining the two data segments. Keep dragging the Timeline indicator back and forth along the gap to visually analyze what unlabeled segment represents the best fit. Select the unlabeled segment that seems the most appropriate.

NOTE You might find an unlabeled segment that is not considered a probable choice, but whose movement fits in the gap. You can force the segment's data into the current gap by I-clicking the unused segment, which displays as a blue asterisk.

Searching for a marker's missing segments

This topic shows how to search unlabeled segments for a single marker, but the steps involved are the same for matching the current Rigid body or all markers.

To search for missing segments:

1. Select Current Marker from the All Markers menu.
2. Select a marker from the Marker list.
3. Activate Auto Play.
4. Do one of the following:
   - If you are not satisfied with the chosen match, click Skip to bypass the match.
   - If the segment matches the marker, click Accept. The unlabeled segment is labelled and associated with the current marker.

   Whether you click Skip or Accept, MotionBuilder continues trying to find the next unlabeled segment. When no unlabeled segments are within the Match Area, the message "No segment found" appears.

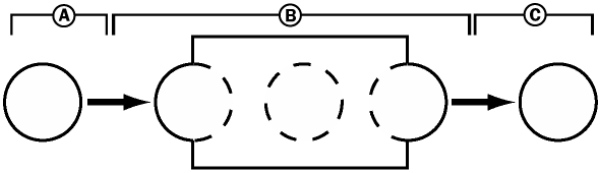
- Problems with Optical data on page 1390

Occlusion

One problem inherent with optical motion capture is occlusion, when a sensor is hidden from all but three cameras. This occurs when a performer passes by an obstructing object, or when the performer's body comes between the sensor and the camera. Occlusion is impossible to avoid because no single camera angle can capture all sensors at once. Cameras cannot look through a performer's body to find hidden sensors.

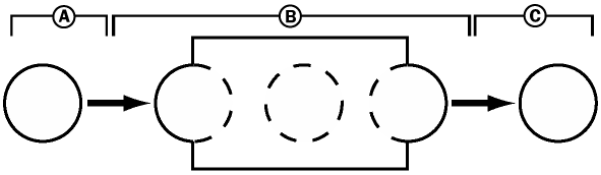
When occlusion happens, the sensor disappears from the camera's view, and the computer has no way of knowing where it went. When occlusion ends and the sensor reappears, some optical capture systems treat the sensor as a new sensor and add a data segment at the location where the sensor reappears.

For example, let's assume a sensor is travelling in space and becomes occluded by an object. The camera records the trajectory, as illustrated in the following graphic.



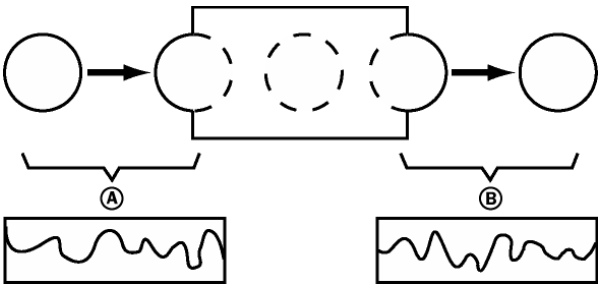
A. **Sensor traveling through space** *B.* **Object obstructing the camera's view of the sensor** *C.* **Sensor emerging from behind the obstruction**

How an optical capture system may interpret the situation is shown in the following graphic.



A. **Sensor's position tracked and recorded as a segment** *B.* **Sensor can no longer be tracked** *C.* **A sensor appears and the system records a new segment**

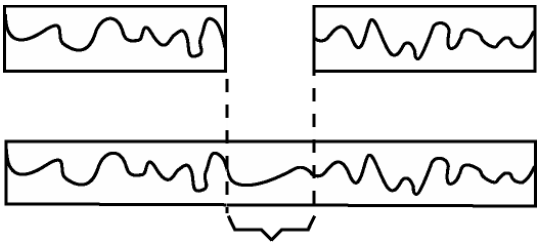
When the sensor reappears, the optical system has no way of knowing that it is the same sensor recorded as segment 1, so it begins a new data segment.



New data segment begins *A.* **Segment 1 is recorded** *B.* **New segment is recorded using the same sensor**

Therefore, the raw data capture generates a large number of disconnected data segments. It is not uncommon for a thirty-second capture session to generate hundreds of different data segments.

For all of this data to be of any use, all these segments have to be connected together to create continuous data for each sensor shown in the following graphic.

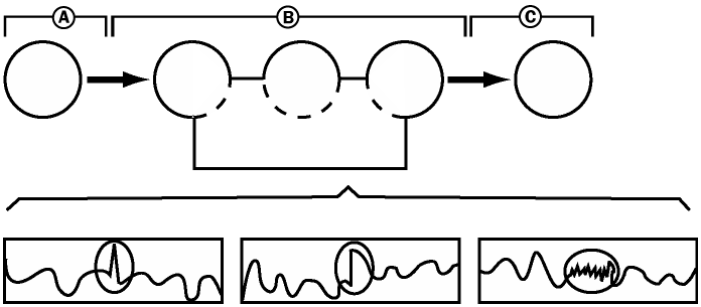


Connecting data segments from the same optical markers

- Problems with Optical data on page 1390
- Optical systems and data on page 1387
- Partial Occlusion on page 1403

Partial Occlusion

Partial occlusion may generate noise or a misinterpretation of the marker's position when either a sensor is placed too close to another on the performer's body, or when a sensor is partially hidden from one of the cameras.

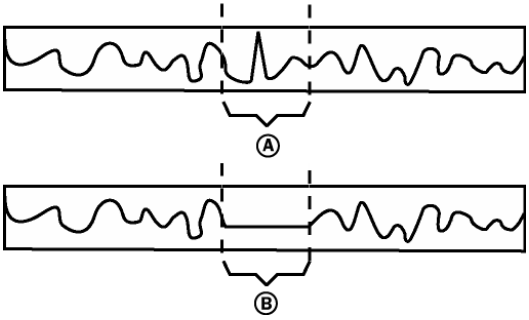


A. **Sensor tracked and recorded correctly** *B.* **Sensor partially occluded** *C.* **Sensor tracked correctly**

If you examine the data generated by a sensor that has been partially occluded as shown in the preceding figure (B), you can see peaks, shifts, or noise. These are commonly found just before a sensor becomes fully occluded.

In these cases, the data is good on either side of the noisy part of the data segment, so you need a way to trim out only the noisy portion of the function curve, and keep the correct data on either side.

The Optical tool lets you split a data segment into two segments, so that you can keep the data you want and discard the noise as shown in the following graphic.



A. **Artifact in an otherwise correct curve** *B.* **Artifact removed and gap filled by constant interpolation between the data segments**

Recognizing artifacts (unnatural data effects) demands careful analysis of the data segment at the point where the marker begins to move erratically. Playing back the take at a slow speed is a good way to find where the markers begin to drift, jump, or shift.

- Problems with Optical data on page 1390
- Optical systems and data on page 1387

Removing Peaks and Noise

Just before a marker disappears from occlusion, it may be partially occluded, causing noise, peaks, or other jumps in the capture data. During playback, you may notice that the marker appears to be moving normally, then it begins to fly off on an incorrect tangent. The Quality Bar shows this as a black area. These normally appear near the end of a data segment.

There are two methods of correcting bad data segments:

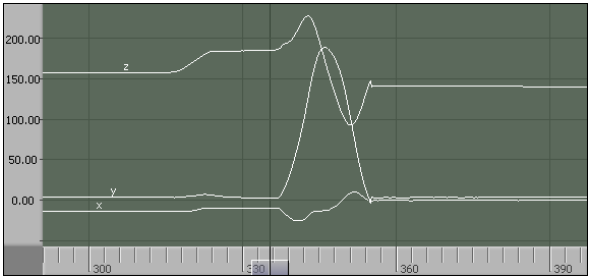
- Split and remove the part of the data segment containing the peak, noise, or jump. This method is used for removing bad data within a segment.
- Change the start or end of the data segment to remove the bad data. This forces MotionBuilder to interpolate the data before or after the data segment, usually resulting in better, more accurate movement, especially within a Rigid body. (See Correcting Rigid body quality on page 1396)

Using Gap Interpolation to Remove Noise

Gap interpolations are also used to interpolate between two segments where there is noise. The segment that contains the noise is split, then removed. Gap interpolation reconnects the two segments.

To split the segment:

1 Place the Timeline indicator at the beginning of the noise as shown.



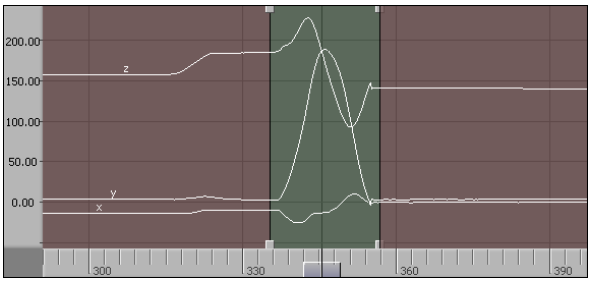
Timeline indicator positioned at the beginning of the noise

Because the Timeline indicator is placed in a segment, the Segment menu is activated in the Optical Options pane.

2 Click Split Segment in the Segment menu. The segment is split into two separate segments.

3 Place the Timeline indicator at the end of the noise in the new segment, and split this segment as described in step 1 and 2.

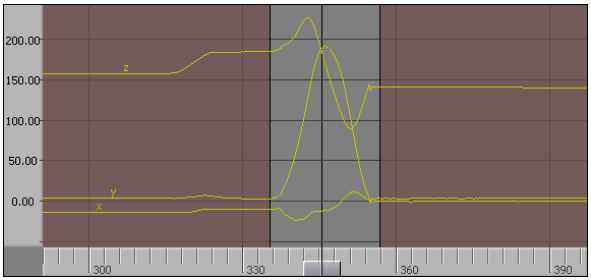
You now have three segments with the center segment containing the noise to be removed.



Two segments created

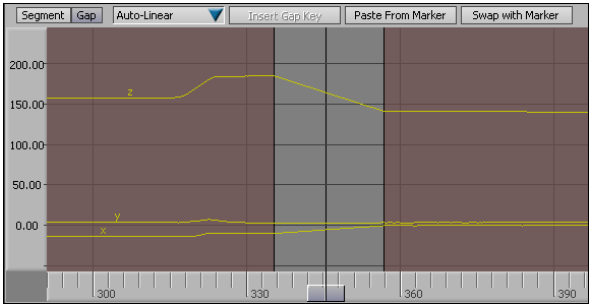
4 Place the Timeline indicator inside the segment to be removed and click Remove Segment in the Segment menu.

A gap is created. By default, its interpolation is set to Auto-Rigid Body which calculates the data based on the Rigid body.



Gap between two segments

If you want, you can change the Gap Interpolation. For example, the following figure shows the gap using Auto-Linear interpolation. For more information, see Filling Gaps with Interpolation on page 1407.



Gap interpolated using Auto-Linear interpolation

- Filling Gaps with Interpolation on page 1407
- Removing Peaks and Noise on page 1404
- Correcting Rigid body quality on page 1396

Filling Gaps with Interpolation

To fill gaps with interpolation:

1. Select the marker with the gap that you want to fill using interpolation.
2. Move the Timeline indicator to the gap that you want to interpolate. The Gap options display above the Optical editor.
3. Select one of the gap interpolation methods (Auto-Linear, Auto-Constant, and so on) from the Gap Interpolation field. By default, it is set to Auto-Rigid Body.
4. Change the gap interpolation to Control Curve. The interpolation keeps the shape of the previously selected Gap interpolation.
5. For more control over the shape of the data in the gap, add Gap keys.

- Problems with Optical data on page 1390

Optical Settings

The Optical settings let you edit and correct optical data associated with an optical root. When you import a data file containing optical data, an optical root is automatically created.

The Optical Settings are divided into three main areas:

- Optical Editor on page 1408
- Optical Options pane on page 1409
- Segment and Gap Options on page 1416

Use the Optical Settings to edit *active optical data*. When processing optical data, the Optical settings set up Rigid bodies that solve occlusions in real-time.

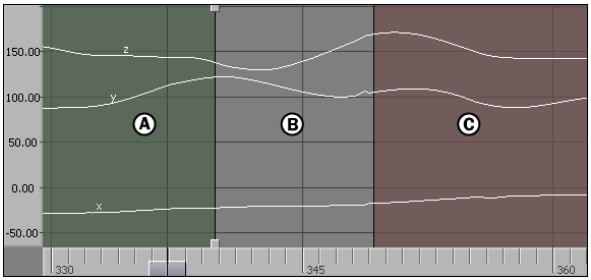
Active optical data refers to optical markers that are not set to Done in the Label pane (Optical Options). When set to Done, optical markers are no longer active in the Optical settings and can be filtered using the FCurves window.

The difference between active optical data and non-active optical data (markers set to Done) is a basic concept that should be understood before using the Optical settings. There are many other basics and terminology that may be of help when using the Optical settings.

Optical Editor

The Optical editor lets you correct optical data, fix poor gap interpolation, switch swapped markers, and perform other optical data reconstruction. The Optical editor is empty until you select an optical marker from either the Scene browser or the list of markers in the Label pane.

The Optical editor shows all the data segments labelled by the selected marker. Segments display using one of three colors which indicate either the type of data or the segment's status.



A. **Green: Current segment** *B.* **Gray: Interpolated data** *C.* **Red: Labelled data segment**

The following table describes the three colors of segments and what they indicate.

Segment Color	Represents
Red	Indicates an inactive labelled data segment.
Green	Indicates an active data segment on which actions are performed, referred to as the *current segment*. To make a segment the current active segment, move the Timeline indicator within the segment and make sure that the label is not set to Done. Setting a label to Done indicates that it is inactive in the Optical settings and active in the FCurves window, for FCurve editing and/or filtering.
Gray (Gap)	Shows interpolated data before, after, or between labelled segments. Gray segments are also referred to as gaps, caused by occlusions in the data.

- Optical systems and data on page 1387
- Optical Settings on page 1407

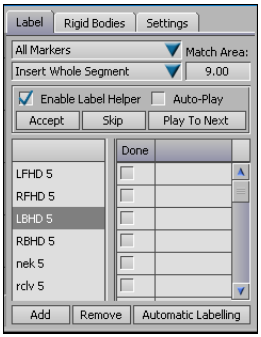
Optical Options pane

The Optical Options pane lets you label markers, create Rigid bodies, and perform other commands on optical data. The Optical Options pane consists of three tabs:

- Label tab on page 1409
- Rigid Bodies tab on page 1413
- Settings tab on page 1414

Label tab

The Label tab lets you add, remove, and change the names and states of markers. You can also automatically label segments using the Automatic Labelling option.



Label pane

Search Mode

Use the Search Mode menu to select the search method for finding missing segments when automatically playing your motion for either the current marker, the current Rigid body, or all markers.

NOTE The Search Mode is only used by the Auto Play function.

The Search Mode menu contains the following options:

Search mode	Description
Current Marker	Finds unlabeled segments for the currently selected marker to be placed in the current segment.
Current Rigid Body	Finds unlabeled segments for a marker based on its position within a Rigid body.
All Markers	Finds unlabeled segments for all markers in the Marker list.

Match Area

Set a value in the Match Area field to specify the radius of the marker search.

The Match Area is a search distance used only in conjunction with the Automatic Labelling buttons Accept, Skip, Play to Next, and the Auto-Play option.

Insert Menu

Use the Insert menu below the Search Mode menu to select the segment swap regions.

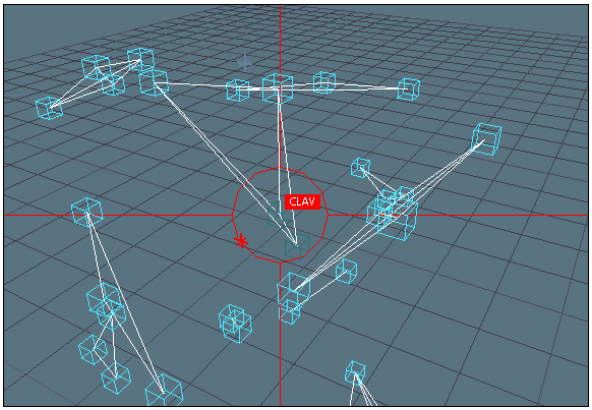
The Insert menu contains the following options:

Insert option	Description
Insert Whole Segment	Swaps entire segments.
Insert From Cursor to End	Swaps the segments from the Timeline indicator to the end of the scene.
Insert from Start to Cursor	Swaps the segment from the beginning of the scene to the Timeline indicator.

Enable Label Helper

Activate the Enable Label Helper option to visualize the search area and proposed assignments. The Label Helper is a red crosshair and a circle that

gives you a visual reference of the distance between the search area and the assignments.



Unlabeled segment shown with a red crosshair, a circle, and the label name

Auto-Play

Activate Auto-Play to play the take and survey all the unlabeled segments within the Match Distance radius of any unlabeled marker at each frame.

Each segment found is displayed with the most likely unlabeled segment using a red crosshair and a circle (Label Helper).

Accept, Skip, and Play To Next

Use these buttons during auto-play or automatic and manual labelling to skip the found segment, accept the found segment, and label it using the proposed marker.

Marker List

The Label pane contains the Marker list, which is a list of all the markers used to label data segments in the current motion file. Depending on the optical capture system used to create the motion file, data segments may already be labelled as markers.

Navigate the Marker list using the Up and Down arrow keys. Shift-up and Shift-down skips between markers grouped within the same Rigid body.

The Marker list is split into two columns:

Column	Description
Marker Name	Shows the name of the marker. Click the marker name to select the marker in the Viewer window and show its data in the Optical editor area of the Optical settings. Double-click its name to rename the marker.
Done	Activate the Done column to lock the marker from the Optical settings. Locking a marker transfers data from the segment to the assigned marker, making the data available to other MotionBuilder tools such as filtering in the FCurves window. Re-activating a marker (not-Done) after using the FCurves window regenerates the FCurves based on the Optical system. This means that FCurve edits are lost permanently. This is one way of undoing multiple filtering steps created in the FCurves window for single or multiple markers.

Add, Remove, and Automatic Labelling buttons

You can remove markers and label them automatically using the buttons below the Marker list.

Add

Adds a marker to the bottom of the Marker list.

Remove

Removes the selected marker. Its segments become unused.

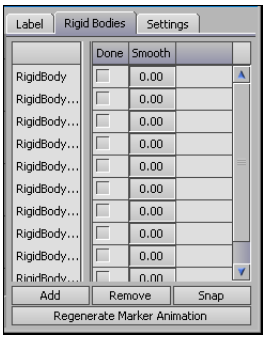
Automatic Labelling

Automatically labels segments that disappear and then reappear as the result of occlusion.

Rigid Bodies tab

Creating Rigid bodies is a method of grouping markers together to fix problems such as occlusion and partial occlusion. A Rigid body cannot be created if there are no markers.

The Rigid Bodies pane lists all the Rigid bodies created for use with the current motion file.



Rigid Bodies pane

Rigid Body List

Navigate the Rigid Body list using the Up and Down arrow keys. The Right and Left arrow keys step backwards or forwards through the motion file.

The Rigid Body list is split into three columns:

Column	Description
Rigid Body Name	Shows the name of the Rigid body. Click the name column to select the Rigid body, show its location, and show which markers it contains in the Viewer window. Double-click a Rigid body name to rename it.
Done	Locks the Rigid body when you have finished with optical reconstruction.
Smooth	Resamples data to remove segment noise. This can be an alternative to filter smoothing for live input when real-time smoothing is required.

Add, Remove, Snap

Use the Add and Remove buttons to add and remove Rigid bodies. Use Snap to center the anchor point.

Add

Creates a Rigid body at the bottom of the list based on the selected markers. This is necessary when all offsets are calculated. It is very important that the marker positions represent an extended pose, for example, a T-stance.

Remove

Removes the selected Rigid body from the list.

Snap

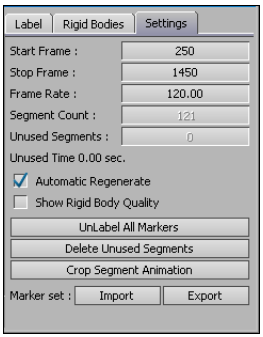
Centers the anchor point for the currently selected Rigid body or for the entire list. This basically resets the offset calculations, equivalent to creating a Rigid body marker.

Regenerate Marker Animation

Use the Regenerate Marker Animation button to regenerate the sample data based on its Rigid body. You can regenerate animation for the currently selected Rigid body or for the entire list.

Settings tab

The Settings tab contains options to set preferences and modes that are used to correct Rigid body quality, label markers, and clear or swap segments. You can also import and export Marker sets.



Settings pane

Start Frame

Displays a value for the start time of the motion file. Double-click the Start Frame field to enter a value for the start time.

Stop Frame

Displays a value for the Stop Frame of the motion file. Double-click the Stop frame field to enter a value for the stop time.

Frame Rate

Displays the frame rate of the motion file. This value cannot be changed.

Segment Count

Displays the total number of segments in the motion file. This value cannot be changed.

Unused Segments

Displays the number of segments that have not been labelled by markers. Unused segments are also referred to as unlabeled segments.

Unused Time

Displays the total amount of time for all unlabeled segments.

Automatic Regenerate

Activate the Automatic Regenerate option to automatically regenerate optical data as it is being constructed. This option must be active if you want to view changes in the Optical settings in real-time.

Several options in the Optical Options pane are not available if Automatic Regenerate is disabled.

Show Rigid Body Quality

Use the Show Rigid Body Quality option to display a grayscale band at the bottom of the Optical editor indicating the quality of the selected marker relative to its Rigid body.

Data which may suffer from partial occlusion is indicated in the Quality Bar using different shades of gray. Pure black indicates very poor data, noise, or peaks. Pure white indicates good data.

Before you can use this option, you must create at least one Rigid body.

See also Monitoring Rigid body quality on page 1397.

UnLabel All Markers

Use the UnLabel All Markers button to remove all links between markers and data segments. The list of markers remains, but each marker is no longer assigned to a data segment.

Delete Unused Segments

Use the Delete Unused Segments button to remove all segments that have not been labelled by a marker. You should only do this after you have completely reconstructed your optical data and the remaining unused data segments do not affect your animation.

Crop Segment Animation

Use the Crop Segment Animation button to remove unwanted optical data. This option is useful if you have a large amount of optical data and you only want to keep a small part of it.

To use this feature, set the starting point of the data you want to keep in the Start Frame field. Set the end of the data in the Stop Frame field and click Crop Segment Animation. All data before the Start Frame time and after the End Frame time is deleted.

Import and Export buttons

Use the Import and Export buttons beside the Marker set to import and export Marker sets created in the Optical editor.

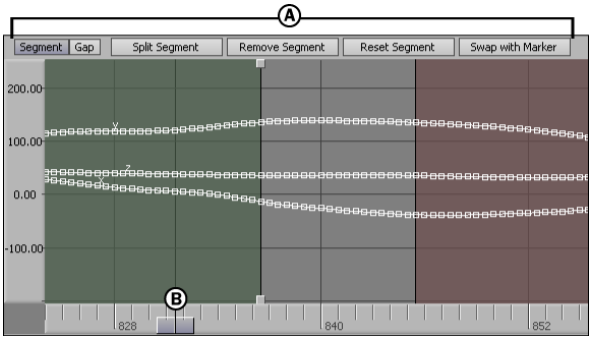
- Optical Settings on page 1407
- Optical systems and data on page 1387
- Segment and Gap Options on page 1416
- Optical Editor on page 1408

Segment and Gap Options

The Segment options or the Gap options display above the Optical editor, depending on whether the Timeline indicator is positioned over a labelled segment or a gap in the Optical editor.

Segment Options

The Segment options display above the Optical editor, and are available only when the Timeline indicator is positioned over a labelled segment in the Optical editor as shown in the following figure.



A. **Segment options displayed** *B.* **Timeline indicator positioned within a segment**

Split Segment

Splits the current segment. This is useful if you want to remove part of a data segment that contains a spike, noise, or other results of partial occlusion.

NOTE Split Segment permanently splits the segment and cannot be reset by the Reset Segment function.

Remove Segment

Removes the current segment from its marker. This is useful if you have labelled a segment with the wrong marker and you want to label the segment to another marker.

Reset Segment

Resets the data segment to its original state. This is useful after you have modified a segment using a control curve or performed other operations and you want to return the segment to its original form.

If the original segment was split, this action won't reassemble the segments, but resets all other modifications made to the current segment.

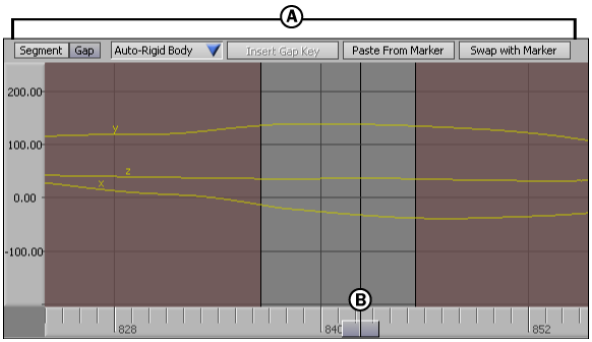
Swap with Marker

Swaps data from the currently selected marker to another marker. The swapping method is determined by the settings in the Insert menu in the Label pane.

For more information on using Swap with Marker, see Eliminating Swapping on page 1399.

Gap Options

The Gap options are available only when the Timeline indicator is positioned over a gap in the Optical editor as shown in the following figure.



A. **Gap options displayed** *B.* **Timeline indicator positioned within a gap**

In some cases, it is impossible to fill gaps with data segments. For example, when dealing with instances of occlusion where the sensor could not be captured. In these cases, use the appropriate interpolation setting to reconnect two segments.

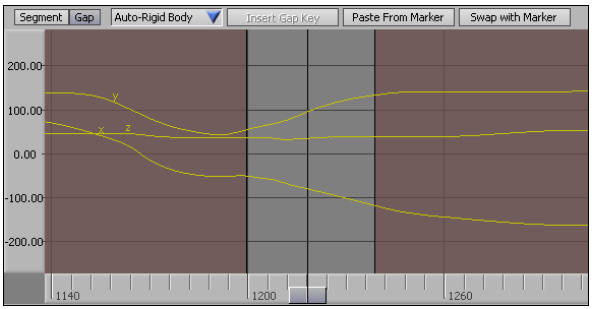
Gap Interpolation

The options in the Gap interpolation menu let you change the interpolation of a gap. There are six different modes: Auto-Rigid Body, Auto-Constant, Auto-Linear, Auto-Bezier, Control Curve, and Sample Curve.

When choosing the interpolation, consider whether you want to paste data over the current data, edit the data, or manually reconstruct the data.

Auto-Rigid Body

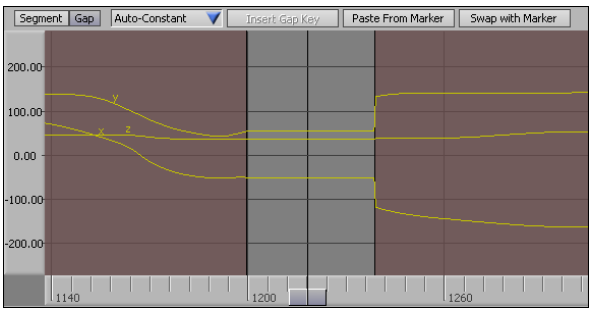
Use this mode when there is a lot of data in the gap. Auto-Rigid Body uses the data information of the other markers that are in the same Rigid body to build accurate data for the current marker. The higher the number of markers in the Rigid body, the more accurate the data.



Gap set to Auto-Rigid Body interpolation

Auto-Constant

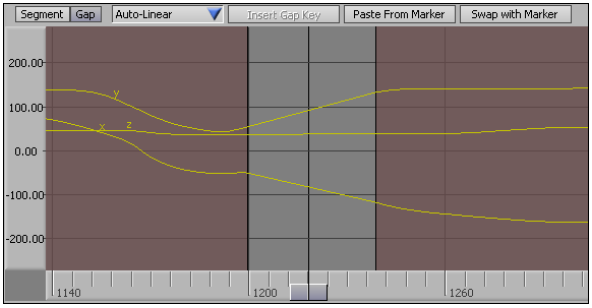
Use this mode to re-interpolate the gap without using the Rigid body information or to prepare the gap for control curve keyframing. Auto-Constant also generates a key of the same value as the first frame of the gap at the last frame of the gap.



Gap set to Auto-Constant interpolation

Auto-Linear

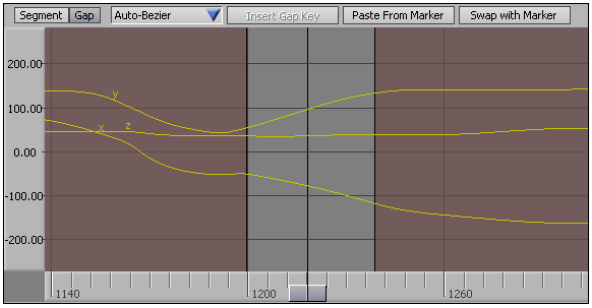
Use this mode to re-interpolate the gap without using the Rigid body information or to prepare the gap for Control Curve keyframing. Auto-Linear also joins the data from the surrounding segments using a linear curve.



Gap set to Auto-Linear interpolation

Auto-Bezier

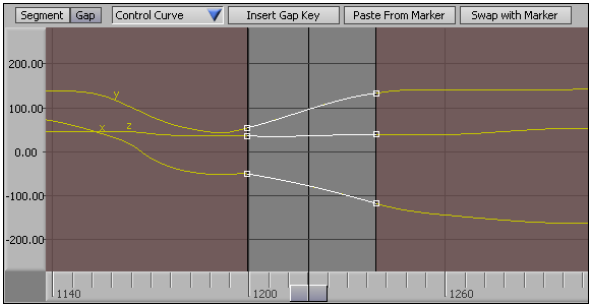
Use this mode when there is not a lot of data to reconstruct, when a smooth interpolation would give better results than the Rigid body information, or to prepare the gap for control curve keyframing. Auto-Bezier should fix most problems because its editable spline curve gives a smooth transition between the two segments.



Gap set to Auto-Bezier interpolation

Control Curve

Use this mode if you want to insert keyframes to edit the gap. The Control Curve Gap Interpolation lets you edit the gap by inserting keyframes and reconstructing the data manually, or by keyframing over the current Rigid body information.



Gap set to Control Curve interpolation

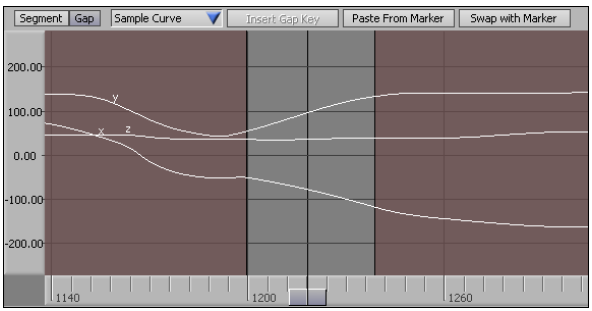
When Control Curve mode is selected, the Insert Gap Key button is enabled. See Insert Gap Key on page 1422.

If you want to start from the Rigid body information, choose Auto-Rigid Body, then switch to Control Curve, or press K to add a Gap key.

If you do not want to start from the Rigid body information, choose one of the other interpolation options (Auto-Constant, Auto-Linear, or Auto-Bezier), then switch to Control Curve. The Control Curve matches the previously selected interpolation.

Sample Curve

Use this mode to turn the gap into its raw sample data. This lets you modify each individual key. You may have to zoom in on the curve to view the individual keys.



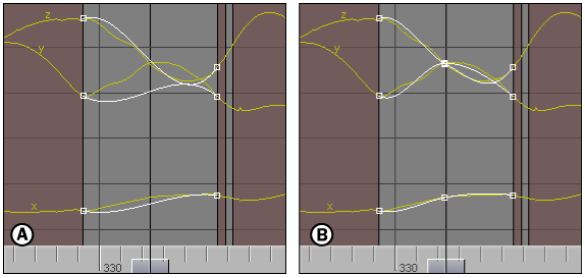
Gap set to Sample Curve interpolation

Insert Gap Key

Inserts a gap key on a control curve between two segments. This button is only available when the Gap Interpolation is set to Control Curve.

To insert gap keys within a gap, select Control Curve in the Gap Interpolation menu. Move the Timeline indicator to the location within the gap where you want to add a key and click Insert Gap Key. This added key does not modify the curves themselves, it glues the control curve to the original curve. You can then modify these keys and change the original curve.

Double-click the added key to select the gap key. When selected, you can drag the key to change its value or you can use its handles to adjust the slope of the control curve.



A. **Control curve before adding a gap key** *B.* **Same curve after adding a gap key**

Paste From Marker

Pastes data from one marker to another with a global offset. To paste, move the Timeline indicator within a gap, click Paste From Marker, then select the marker you want to paste in the Viewer window. This option generates a control curve in the current gap containing the animation from the other marker with an offset to fill the gap.

When you perform Paste From Marker in a gap, handles are generated with which you can adjust the interpolation.

Swap From Marker

Switches data from one selected marker to another. This option is identical to Swap From Marker in the Segment menu.

- Optical Editor on page 1408

Magnetic motion data

82

Magnetic motion capture involves the recording of data from magnetic sensors affixed to a performer's body.

In MotionBuilder, the Actor asset allows you to link that recorded magnetic data to character models in order to make them move.

This section covers the devices, topics, and procedures required when working with magnetic motion data and MotionBuilder.

- Motion sources on page 1252
- Actor assets on page 1353
- Creating a capture area on page 1426
- Magnetic capture and calibration on page 1425

Magnetic capture and calibration

Magnetic motion capture devices are sensitive to magnetic interference caused by metallic objects such as aluminium heating ducts, metal plumbing fixtures, and steel-reinforced concrete. This can cause noticeable distortion in captured data.

To minimize distortion, you can remove all metallic objects from the capture area. You can also build an elevated stage to raise the capture area and eliminate interference from beneath the studio floor.

Even after taking these precautions, your studio may still contain some magnetic distortion. To compensate for the remaining distortion, MotionBuilder creates an internal 3D distortion grid as part of the calibration process with your motion capture devices.

The 3D distortion grid represents the amount of distortion the sensors receive at different locations of the capture area. While creating the 3D distortion grid, the calibration pole is physically placed at the corner of each square, and the location of the sensors are recorded. A distortion grid is created using the data from all recorded corners.

Before calibrating, do the following:

- Find the best location for your floor grid by walking around your studio holding the calibration pole, and capturing the location of the sensors on the pole.
- Create a floor grid representing the capture area on your studio floor. The grid must be square and each grid unit must have the same dimensions, such as one square foot, or 30.5 cm. Linoleum with a square tile pattern generally works well as it usually has 6 or 12 tiles.

  NOTE Although it is not recommended, you may decide to do motion capture without calibrating your environment. This decision depends on the amount of magnetic distortion in your capture environment, as well as the type of production.

- Creating a capture area on page 1426

Creating a capture area

To create a capture area:

1. Decide where to place the capture area in your studio.

   Read over the following steps to get an idea of what you need to do. These steps describe how you can create a capture area, and can give you an idea of the best location as well as a reliable way of testing the amount of magnetic interference.

2. Place the floor grid.

   Decide on the size of each square in your floor grid. Use tiles or tape on the floor to roughly mark each corner of a square grid. Each unit of the grid should use the same dimensions. A 12 x 12 foot grid is a good starting size, but this does not mean that your eventual capture grid is this large. If you have a small studio with only enough space for a 6 x 6 grid, measure this grid and mark the corners with tape.

Place the emitter beside your floor grid about 2 feet (60 cm) off the floor. Keep the emitter in mind when deciding on the placement of your floor grid.

3 Build the calibration pole using the following guidelines:

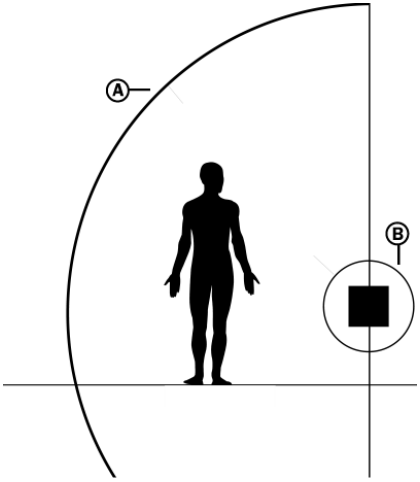
- Build your calibration pole using a non-metallic substance, such as wood or plastic. The pole should be as tall as the action you plan to capture. Avoid using cylindrical poles because the surface may produce ambiguous sensor positions, and it is also easier to place and align sensors on a flat, rather than a rounded, surface.
- Autodesk recommends that you use 8 sensors, although the number of sensors can be increased or decreased depending on the height of your studio and how high you want to capture data.
- To guard against interference from the pole's wiring, you should place the first sensor about five centimeters from the bottom of the pole. The next and all subsequent sensors should be the same distance apart as the dimension of each tile on the floor grid. For example, if you are planning to set up a floor grid with 30 centimeter squares (roughly 1 foot), place the sensors on the pole 30 cm apart.
- When attaching the sensors to the pole, make sure they all face the same direction and align on the pole. In addition, arrange the sensors in ascending order. For example, if the sensor closest to the floor is sensor number 1, the next sensors should be 2, 3, 4, and so on. You can also skip sensors. For example, if the first sensor is number 2, the next can be 4, 6, 8, and 10.

4 Place the emitter.

All magnetic systems work by radiating a magnetic field using an emitter. The placement of the emitter is one of the most important aspects of creating a successful motion capture area.

Autodesk recommends that you place the emitter between 1.5 to 2 feet from the outer edge of the capture area, raised approximately two feet off the floor . You should place the emitter to take advantage of the largest possible capture area.

You should also place the emitter away from machines or other devices that may cause magnetic interference, such as computer monitors. If your studio is small, you can place the emitter within the capture area under an elevated stage or hang it from the ceiling.



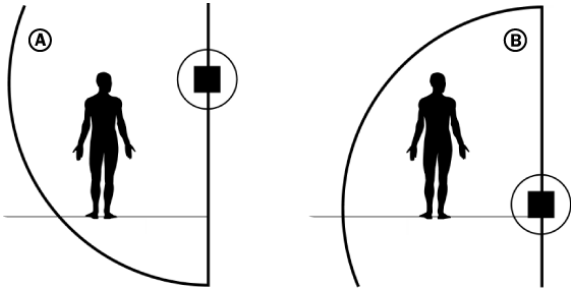
A. **External Range limit** *B.* **Internal Range limit**

The magnetic field is very strong; it is approximately 1.5 feet around all emitters. If the calibration pole or a wired performer stands within this area (Internal Range Limit), it is impossible for the position of the magnetic sensors to be accurately captured.

The magnetic field from the emitter also has a physical range (External Range Limit). If the calibration pole or a wired performer gets too close to the limit or moves outside the range, the position of the sensors cannot be properly captured.

Depending on the magnetic system and the number of emitters, the internal and external ranges may vary. Consult the documentation accompanying your magnetic device for more information on its capture range.

It is important to place the emitter at the proper height. A magnetic field is circular, with its longest range near its horizontal or vertical middle. For best results, place the emitter at a height where the longest part of the magnetic field rests over the capture area. Problems may occur during motion capture if an emitter is too high or too low .



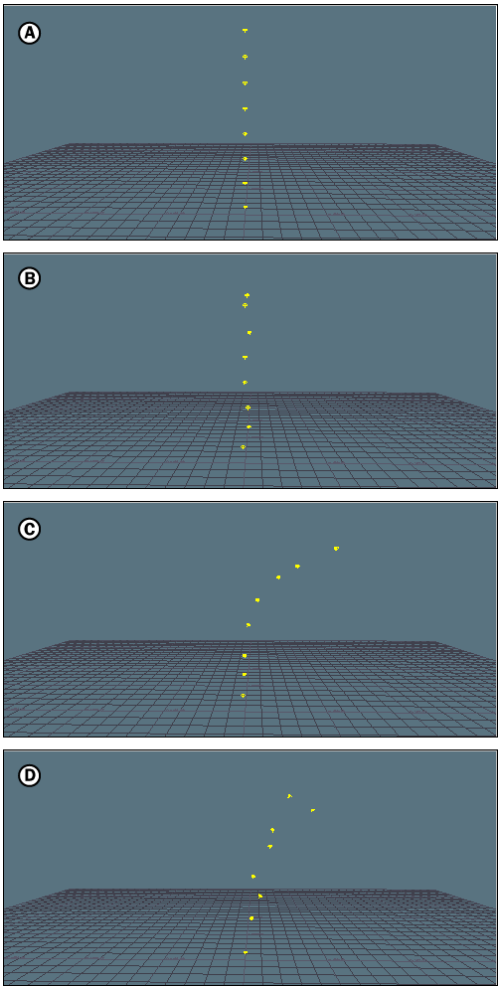
A. **Emitter is too high. The performer's feet may not be captured.** *B.* **Emitter is too low. The performer's hands may not be captured if they are raised over the head. Even more may be lost if the performer jumps.**

5 Test the capture area.

After placing the floor grid, building the calibration pole, and placing the emitter, test the capture area to make sure it does not contain too much magnetic interference.

To test the area, MotionBuilder must be running and the appropriate magnetic device must be added and set up. Then move the pole around the edge of the proposed capture area and around arbitrary locations within the capture area. While you move the pole, watch the Viewer window to see how sensors react to your proposed capture area.

For example, in the following figure, A represents an ideal capture, because the sensors are straight, and are exactly as they appear on the pole. In the same figure, B shows that the sensors are not completely straight, but would be easy to calibrate. In the same figure, C shows that the sensors are limited for a capture but they can still be calibrated. However, in the same figure, D shows too much distortion produced by sensor 8 (second from top) relative to sensor 7 (top sensor).



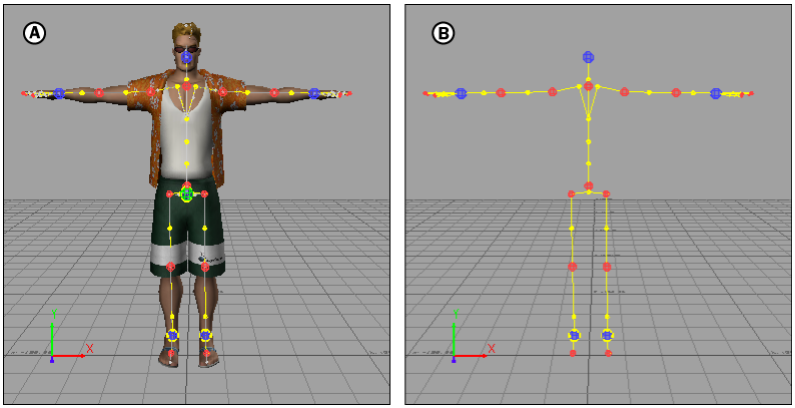
A. **Ideal capture** *B.* **Suitable capture** *C.* **Limited capture** *D.* **Poor capture**

■ Magnetic capture and calibration on page 1425

Part 3: Control rigs

A Control rig is a character manipulation tool that lets you change the position and orientation of a character to create or alter animation. You can only create Control rigs for characters that are characterized.

In the Viewer window, Control rigs display by default as a set of semi-transparent blue, red, and yellow markers on a character model's joints.



A. **Character with Control rig** *B.* **Control rig**

Control rigs are equipped with kinematic tools that let you control the character's skeleton intuitively and automatically achieve smooth and predictable results over the entire body. They provide body part pinning, automatic floor contact, and three different keying modes. All of these elements help you achieve quick, high-level manipulation of a complex structure.

Control rigs let you do the following:

- Create character animation from scratch.
  Control rigs are one of the three types of motion source that you can connect to your character to make it move. You can use the Control rig to manipulate your character, then set keyframes on its position over time to create animation.
- Create, save, and reuse poses as you manipulate.

For example, you may want to repeat a certain pose to create a cycle, or use a pose in multiple takes. You can even include any extra limbs, wings, or tails in these poses, using a Character Extension.

- Edit animation.
  When you import a skeleton with animation data into MotionBuilder, you have to plot that animation to a Control rig in order to edit it. When you finish creating or editing animation with a Control rig, you plot the animation back to the model's skeleton to prepare it for export to other 3D software.

  While editing character animation with the Control rig you can exaggerate or lessen the character's movements. You can also use the Control rig to permanently offset body parts when retargeting animation from one character to another.

- Compensate for missing data.
  If you are working with imported motion data, you can use the Control rig to fill in any missing animation.

You can save, modify, and load Control rigs just as you would any other asset. This is useful if you want to use the same settings for pinning, stiffness, reach, and pull on multiple characters.

Following are the topics included in this chapter.

- Types of Control rigs on page 1433
- Kinematics on page 1434
- Creating a Control rig on page 1437
- Attaching a Control rig to a character on page 1439
- Detaching a Control rig from a character on page 1441
- Deleting a Control rig on page 1442
- Selecting Control rig effectors on page 1442
- Manipulating spines, fingers, and tails on page 1443
- Aligning Control rigs on page 1443
- Viewing final solving on a Control rig on page 1445
- Control rig properties on page 1445
- Customizing Control rig appearance on page 1450
- Control rig effector properties on page 1455
- Pinning on page 1459

- Visual feedback on Control rigs on page 1463
- Auxiliary objects on page 1469
- Customizing Control rigs on page 1479
- Poses on page 1485

See also:

- Saving a Control rig on page 252

Related Topics

- Characterizing a character model on page 1277

Types of Control rigs

There are two types of Control rigs in MotionBuilder, one that uses only Inverse Kinematics, and one that uses a combination of Inverse and Forward Kinematics. These two rigs are available so that you can choose what type of control best suits your project. Some situations may require fine tuning that may not be possible using Inverse Kinematics alone. In this case, you can use the FK/IK combination rig. Both Control rigs use special markers that let you adjust the position and rotation of a character's bones and joints.

When using a rig that combines IK and FK, you can adjust the amount of reach between the two rigs. Adjusting the reach lets you control how much the rig follows the IK effectors in terms of rotation and translation.

- Control rigs on page 1431
- The Control rig hierarchy on page 1479
- Creating a Control rig on page 1437
- Customizing the Control rig hierarchy on page 1481
- Kinematics on page 1434

Kinematics

When you work with bones on a skeleton or effectors on a Control rig, the rules of kinematics are used to specify how the relative motion between these objects is calculated. There are two main kinematic rules, Forward kinematics on page 1434 and Inverse kinematics on page 1435.

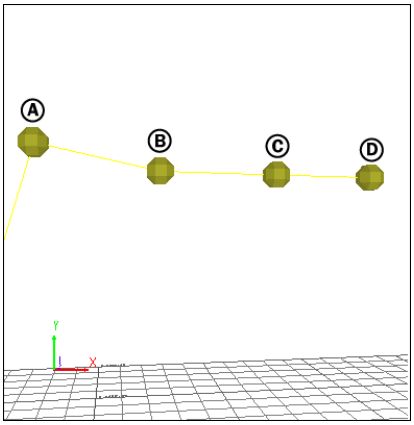
Most animators use a combination of Inverse Kinematics (IK) and Forward Kinematics (FK) to manipulate characters. You can select and manipulate pivot points to affect individual bones using FK, or you can use IK to move a hierarchy of bones.

Most situations require fine-tuning that is only possible using a combination of both FK and IK, so it is a good idea to have a solid understanding of both.

Forward kinematics

Forward Kinematics is the method of transforming a group of connected joints where the movement of the root (or top) of the chain influences all joints along the chain until reaching the end joint. All joints along the chain influence the succeeding joints in the chain, but not the preceding joints. In other words, Forward Kinematics propagates down the chain.

The easiest way to explain this rule is to compare it to a simple chain. The following figure uses four joints to represent an arm.



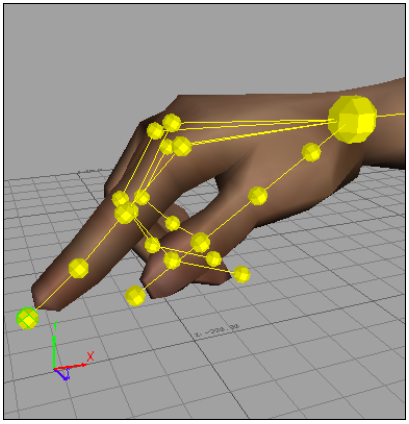
Arm FK chain *A.* **Shoulder or root joint** *B.* **Elbow joint** *C.* **Wrist joint** *D.* **Hand or end joint**

In the arm FK chain, rotation of the shoulder joint (A) is propagated down through the elbow (B) and wrist (C) to the hand (D). If only the elbow (B) is

rotated, only the wrist (C) and hand (D) move, but not the shoulder (A). In other words, the joints in an FK chain have a parent-child relationship in which the child node (B) follows the behavior of the parent node (A). Usually, the animator must define these complex rules for all of the joint motions on a character, but in MotionBuilder, the work is done for you by the Control rig.

Forward Kinematics gives you complete control over individual bones in the skeleton, letting you manually position each individual joint in a chain. Some situations may require this kind of fine tuning that may not be possible using Inverse Kinematics alone.

For example, the following figure shows FK effectors on each finger of a character in MotionBuilder. These effectors were translated and rotated to close the hand, something that would not have been possible with IK.



FK lets you manipulate individual joints such as those in the fingers.

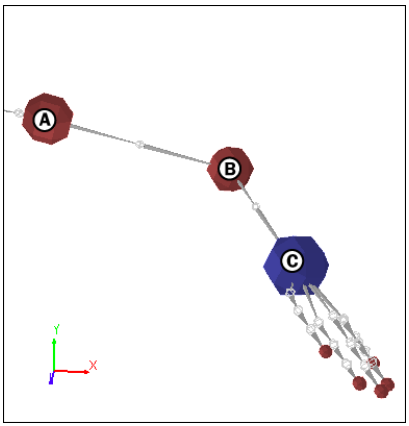
Thus, one of the features of FK is that it gives you complete control over individual bones in the skeleton, letting you manually position each individual joint in a chain.

Inverse kinematics

Inverse Kinematics (IK) is the method of transforming a group of connected joints where the movement of the end joint influences all the joints upwards through the chain. Since you are determining the goal of the action by positioning the end effector of a chain, end effectors are sometimes referred to as goals, and IK as “goal-based movement”. All joints influence preceding

joints, but not succeeding joints. In other words, inverse kinematics propagates up the chain.

The following figure uses three joints to represent an arm. This time, it is the rotation of the wrist joint (C) that is propagated up through the elbow (B) to the shoulder (A).



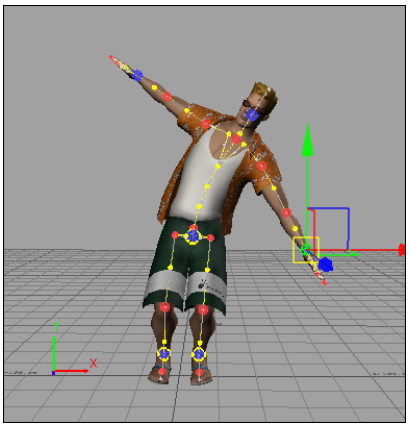
IK arm chain *A.* **Shoulder effector** *B.* **Elbow effector** *C.* **Wrist effector**

Any transformation of the IK chain, even a finger tip, is propagated up through the finger joints, hand, wrist, elbow, and shoulder.

Since IK is goal-based, there are an infinite number of positions the IK chain can take to reach the same goal. It is necessary to specify additional effectors that give the main IK chain “hints” in which direction the joints should bend.

MotionBuilder calculates how to position the rest of the chain to reach this goal. This lets you create realistic movement, since all body parts move in relation to other parts. You position the goal, and MotionBuilder positions the rest of the body.

For example, the following figure shows the result of moving a character's left wrist effector in MotionBuilder. Since the wrist effector is the end effector for the arm hierarchy, the rest of the arm and consequently the body follow and reach toward that effector.



Inverse Kinematics affects related body parts.

The Control rig is responsible for determining which way the joint is pointed. There are also supplementary effectors you can add to a Control rig that correspond to an existing IK effector. Auxiliary effectors and pivots provide additional IK control for a character's reach, and display on the corresponding IK effector.

Essentially, the IK rig lets you position your character quickly and intuitively by moving effectors at the end of a chain to manipulate a hierarchy of bones. Some situations may require fine tuning that may not be possible using Inverse Kinematics alone. In this case, you can combine Inverse Kinematics with Forward Kinematics to create exactly the position you need.

- Control rigs on page 1431
- Auxiliary objects on page 1469

Creating a Control rig

In order to create a Control rig, you must first have a characterized character. The Control rig is created based on the structure of the character.

To create a Control rig:

1. In the Scene browser, expand the Characters folder and double-click the characterized character for which you want to create a Control rig.

The Character settings for the selected character display in the Navigator window.

2 In the Navigator window, select the Character Definition tab.

3 In the Control Rig area, click Create.

The Create Control Rig dialog box appears.

4 Depending on how you plan to animate your character, choose which type of Control rig you want to create:

- Click FK/IK to create a rig with IK (Inverse Kinematics) and FK (Forward Kinematics) effectors.
  IK effectors let you intuitively manipulate a character using a setup that simulates how a human body reacts when moving, and the FK effectors let you selectively fine-tune individual body parts. If you plan to do any fine-tuning, you should create a rig with both FK and IK effectors.

- Click IK Only to create a rig with only IK effectors.
  When using an IK only Control rig, all features associated with the FK rig are not present. For example, in the Character Controls window, the Reach T and Reach R sliders are not available. The Control rig constantly reaches towards the IK rig.

If the current character already has one or more Control rigs, a dialog box appears confirming that you want to create an additional Control rig. You can click Create New Rig to add an additional Control rig.

All Control rigs you create are added to the Control Rig section of the Scene browser. Each additional Control rig is named Control rig plus a sequential number.

5 Switch to X-Ray display mode (*Ctrl+A*) in the Viewer window and view the Control rig on the character's skeleton.

By default, the small yellow effectors are FK, and the larger blue and red effectors are IK. You can customize the look of your Control rig effectors using the Properties window.

You can now use the Character Controls window to select Control Rig Input from the Edit menu and activate Ctrl Rig In in the Active area in order to specify that you want the Control rig input to drive this character.

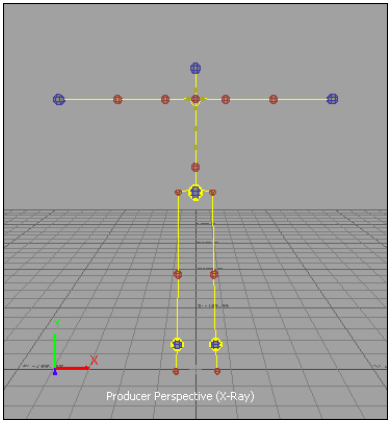
- Characterizing a character model on page 1277
- Visual feedback on Control rigs on page 1463

■ Saving a Control rig on page 252

Attaching a Control rig to a character

To attach a Control rig to a character:

1 Load a Control rig into the scene.



A Control rig loads in the scene.

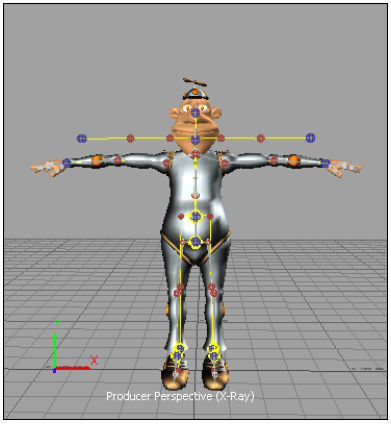
The Control rig displays in the Viewer window, and is listed in the Scene browser.

NOTE The Control rig effectors only display in the Viewer window if you saved them when you saved the Control rig. See Saving a Control rig on page 252 for more information.

---

2 Select File > Merge, then navigate to select a character *.fbx* file. Click Merge in the Merge Options dialog box to merge the character into the scene.

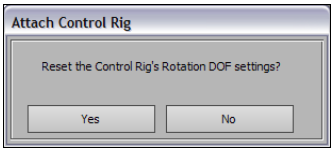
The character loads into the scene with the Control rig, but they are not yet connected.



The Control rig is not yet connected to the merged character.

3 In the Scene browser, drag the Control rig asset onto the character.

4 Select Yes or No if the Attach Control Rig dialog box appears asking if you want to reset the Control rig's Rotation DOF settings.



Attach Control Rig dialog box

5 Do one of the following if the Reset Control Rig Hierarchy dialog box appears:

Reset Control Rig Hierarchy dialog box

- Click "Yes" if you want to reset the Control rig hierarchy to the default structure. See The Control rig hierarchy on page 1479 for more information on the default rig.

- Click “No” if you want to keep the current Control rig structure, including any reparenting or customization you have created.

If the structure of your Control rig does not match the character, MotionBuilder creates or disables effectors as needed to make the Control rig fit. For example, if you connect a Control rig from a character that has fingers to a character that does not, the finger effectors are disabled.

You can now manipulate and keyframe this character using the new Control rig. If the character had an original Control rig, it is detached and replaced with the new Control rig. The original Control rig is still available and listed in the Scene browser, but it is no longer connected to the character.

NOTE You can also select Control rigs and attach them to characters using the Input option in the Edit menu of the Character Controls.

- Control rigs on page 1431
- Creating a Control rig on page 1437
- Detaching a Control rig from a character on page 1441
- Deleting a Control rig on page 1442
- Saving a Control rig on page 252
- Character Controls on page 1553

Detaching a Control rig from a character

To detach a Control rig from a character:

➤ Right-click the Control rig attached to your character in the Scene browser and select Detach Control Rig from the contextual menu.

The Control rig is detached from the character, but still exists in the scene. The Control rig is still listed under the Control Rig heading in the Scene browser, and can be attached to any characterized character in the scene.

- Control rigs on page 1431
- Attaching a Control rig to a character on page 1439
- Deleting a Control rig on page 1442

Deleting a Control rig

To delete a Control rig:

1. Select the Control rig you want to delete in the Scene browser.
2. Do one of the following:
   - Right-click and select Delete from the contextual menu.
   - In the Character Definition pane, click Delete in the Control rig area.
3. Click Ok in the dialog box that appears asking if you want to delete the Control rig.

- Control rigs on page 1431
- Detaching a Control rig from a character on page 1441
- Creating a Control rig on page 1437
- Character Definition pane on page 1506

Selecting Control rig effectors

To select an effector:

Select it in the Viewer window or click its corresponding cell in the Character representation.

To select multiple effectors:

Ctrl-click to select them in the Viewer window, or *Ctrl*-click multiple cells in the Character representation.

To select all effectors:

Click any empty space in the Character representation background.

To select all effectors in a body part:

Shift-click an effector within the body part hierarchy that you want to select. For example, *Shift*-click the left wrist to select all effectors for the left arm.

- Control rigs on page 1431

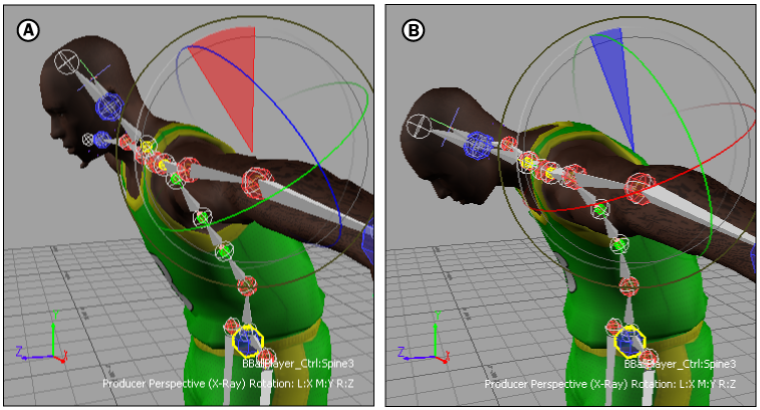
Manipulating spines, fingers, and tails

To create a natural bend as you manipulate a body part such as the spine, fingers, or a tail, activate the Local Reference mode available in the Viewer window.

Local Reference mode lets you simulate additive rotation behavior as you rotate objects that are part of the same continuous hierarchy, such as objects in the spine. The rotation of each object in the hierarchy is calculated relative to its parent.

NOTE The regular Additive Reference mode on page 681 is not available when you have Control rig effectors selected and use Full Body or Body Part keying mode.

In the following figure, you can see the difference between rotating a series of spine bones in Global Reference mode and in Local Reference mode.



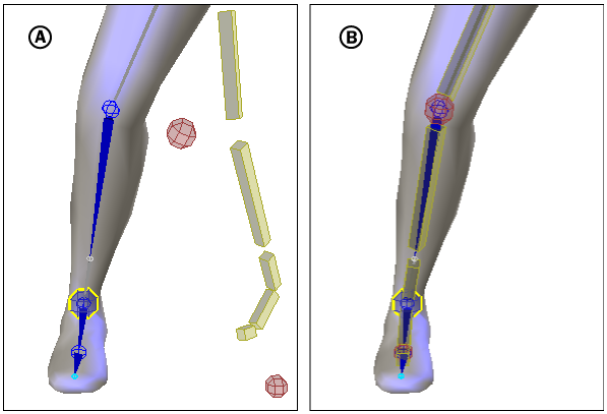
Rotating FK effectors in the spine. *A.* **Using Global Reference mode.** *B.* **Using Local Reference mode.**

Aligning Control rigs

When you have a complex Control rig set up, it can be difficult to visualize how your manipulations create the final solving on the character's skeleton. Because the FK and IK systems are solved differently and can interpolate in different directions between keyframes, the Control rig can appear disconnected even when there are no problems with the final animation on the bones.

It can also be difficult to keep track of prop objects parented to the FK or IK effectors (such as a weapon constrained to the wrist), and where they are positioned in your final animation. Because they can follow either the IK or the FK system depending on how you animate the Reach properties, prop objects can also appear disconnected from the character, even if they will appear normally in the final solving.

The Align Control rig option in the Properties window lets you visually merge the IK and FK systems together to show the final solving on the character's bones clearly. This gives you a preview of your final animation, and shows you the final solving from which the position of child objects is calculated.



A character's leg between keyframes *A.* **Align Control Rig is disabled.** *B.* **Align Control rig is active.**

Displaying the two systems forced together gives you a more intuitive way to manipulate the rig, as it replicates direct manipulation of the character's bones. The IK and FK elements can still be manipulated individually, are solved differently, and have different function curves, but you can manipulate them and their children while previewing the final solving.

By default, the Align Control rig option is activated when you create a Control rig. If you need to view the solving of the IK and FK systems individually in order to fine-tune your animation, disable the Align Control rig option.

NOTE The way the FK and IK systems are solved remains the same when the Align Control rig option is activated. The difference is that the two systems are synchronized visually in the Viewer window and you can clearly see the final solving that affects all child objects.

■ Control rig properties on page 1445

■ Viewing final solving on a Control rig on page 1445

Viewing final solving on a Control rig

To view the final solving of a character's Control rig:

1. Select the Control rig in the Scene browser.
2. In the Properties window, activate the Align Control rig option.

This forces the IK and FK systems to visually merge together, showing the final result of your animation on the character's bones. Any child objects of the Control rig are calculated from this final solving.

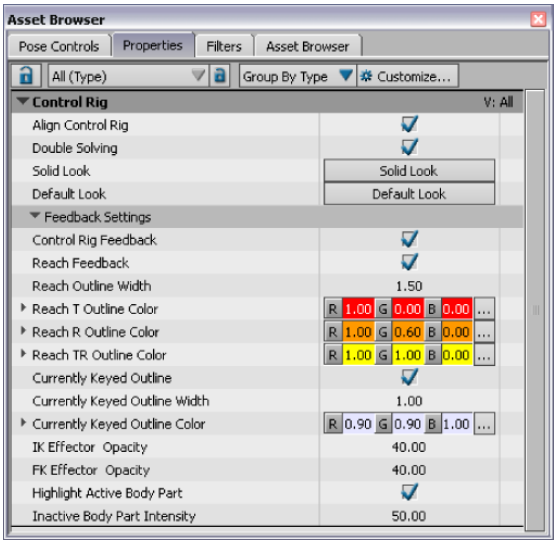
■ Selecting Control rig effectors on page 1442

■ Visual feedback on Control rigs on page 1463

Control rig properties

The Control Rig group of properties display in the Properties window when you have a Control rig selected in the Scene browser.

NOTE The "Use MB 5.5 Axis Orientations" property option is no longer available. As a result, a warning message now appears when you load MotionBuilder scenes that contain a character or characters that use the "Use MB 5.5 Axis Orientations" property option. The recommended workaround for this change is to update the Control rig to remain compatible with MB scene files created in MotionBuilder versions post version 7.5 Extension 2. To update the rig.



Control rig properties

Align Control rig

When activated, this option forces the IK and FK systems that make up the Control rig align together, showing you the final solving for the character's bones. This option is activated by default.

See Aligning Control rigs on page 1443 for more information.

Double Solving

Lets you use complex character setups in which one part of the character directly or indirectly drives another part of its own body, or part of another character. This option makes MotionBuilder evaluate character solving repeatedly so that body parts driven by other body parts are always positioned correctly.

For example, you can set up a character carrying a weapon so that the left hand drives the weapon, and the weapon drives an Auxiliary effector of the right hand. This creates a situation in which the left hand indirectly drives the right hand. With Double Solving activated, the position of the left hand (and the weapon) is solved first, then another round of solving determines the position of the right hand.

When Double Solving is disabled, the position for all body parts is calculated simultaneously, so any body part constrained by another body part may not reach the expected position.

NOTE If you plan to manipulate characters in Expert mode and use the Pull settings, Double Solving is calculated correctly only if one side of the character-driving-character set up has Pull values. For example, if a character is set up so that the right hand pulls the left, or if two characters are set up so that the first character pulls the second, Double Solving is not affected. However, if you set up the left hand to pull back on the right, or the second character to pull back on the first, activating Double Solving will not give the expected result since reaching both Pull goals simultaneously is not possible. You may notice a decrease in MotionBuilder's performance if you have a complex scene where several characters use Double Solving and influence each other's body parts.

Solid Look

Changes the geometry of FK effectors to display as solid bone-like objects. IK effectors display normally.

Default Look

Makes the Control rig display with default IK and FK effectors.

Feedback Settings

This group of properties lets you show, hide, and change the way visual feedback is displayed on the Control rig.

Property	Description
Control Rig Feedback	Shows or hides all visual feedback elements on the Control rig.
Reach Feedback	Shows or hides the Reach feedback outline that displays on effectors with Reach values defined.
Reach Outline Width	Changes the width of the outline that displays when an object has Translation Reach, Rotation Reach, or both values defined. When Reach is set to zero, no outline displays.
Reach T Outline Color	Changes the color of the outline that displays around objects with Translation Reach values defined. By default the Reach T Outline is red.

Property	Description
Reach R Outline Color	Changes the color of the outline that displays around objects with Rotation Reach values defined. By default, the Reach R Outline is orange.
Reach TR Outline Color	Changes the color of the outline that displays around objects with Rotation and Translation Reach values defined. By default, the Reach TR Outline is yellow.
Currently Keyed Outline	Shows or hides the pale blue outline that displays on effectors that are keyframed at the current time. You can change the color of this outline using the Currently Keyed Outline Color property.
Currently Keyed Outline Width	Changes the width of the outline on currently keyed objects in the Control rig. By default, the Currently Keyed Outline has a Width value of 1.
Currently Keyed Outline Color	Changes the color of the outline that displays on currently keyed objects in the Control rig. By default, the Currently Keyed Outline displays in light blue.
IK Effector Opacity	Changes the opacity of IK effectors. By default, IK effectors have an opacity value of 40. When set to zero, the markers are wireframe. The higher the value, the more opaque the effectors become.
FK Effector Opacity	Changes the opacity of FK effectors. By default, FK effectors have an opacity value of 40. When set to zero, the markers are wireframe. The higher the value, the more opaque the effectors become.
Highlight Active Body Part	When activated, active body parts are highlighted and inactive body parts are faded. When disabled, the entire Control rig displays with uniform highlighting. You can change the level of intensity on inactive effectors using the Inactive Body Part Intensity property.

Property	Description
Inactive Body Part Intensity	Adjusts the intensity of color for inactive body parts. When you are in Body Part keying mode, all effectors that are not part of the selected body part display with faded coloring. This property lets you adjust the level of fading on those inactive body part effectors.

Updating a Control rig to remain compatible with older versions

If you load MotionBuilder scenes that contain a character or characters that use the “Use MB 5.5 Axis Orientations” property option, you need to update the Control rig to remain compatible with MotionBuilder scene files created in MotionBuilder versions post version 7.5 Extension 2.

o update a Control rig to remain compatible with older versions:

1. Load in a version of MotionBuilder prior version 2009 your file containing the character that uses the “Enable MB 5.5 Limits” property.
2. Select all the skeleton's bones and open the Properties window.
3. Select the All (Type) view in the View menu to display all available properties.
4. Expand Degrees of Freedom > Rotation > Post Rotation and disable the “Enable MB5.5 Limits” option.

   Once you disable the “Enable MB5.5 Limits” option, you are ready to update the rig.
5. If there is no animation, follow the instructions in steps, 6, 7, and 8. If there is animation, proceed to step 9.
6. Put the character in a T-stance.
7. In the Navigator scene browser, delete the character constraint.
8. From the Asset Browser’s *Templates* folder, drag and drop a new Character constraint on your character's bones in the Viewer window and choose Characterize.
9. If there is animation, plot the animation onto the skeleton.

10 In the Character Controls window, put the character in a t-stance.

11 In the Navigator scene browser, delete the character constraint.

12 From the Asset Browser's *Templates* folder, drag and drop a new Character constraint on your character's bones in the Viewer window and choose Characterize.

13 Scrub the timeline to verify the animation is still present.

14 Plot animation to a new rig.

- Control rigs on page 1431
- Kinematics on page 1434
- Control rig properties on page 1445

Customizing Control rig appearance

You can change the way a Control rig displays in the Viewer window. This can be useful if you need to work with Control rigs in a particular way. For example, if you are keyframing effectors, it is helpful to enlarge the effectors so that you can select the more easily. Also see Marker Settings on page 1456

To customize the appearance of a Control rig or effectors:

1 Switch to X-Ray mode in the Viewer window (*Ctrl+A*).

2 Expand Control rig folder in the Navigator window Scene browser.

3 Open the Properties window.

4 See the following sections for specific changes.

Changing the rig

To change the look of a Control rig:

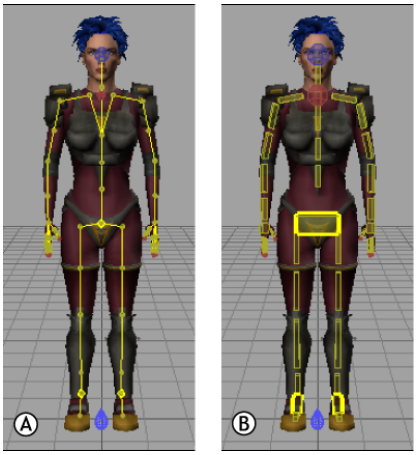
1 Switch to X-Ray mode in the Viewer window (*Ctrl+A*).

2 Expand Control rig folder in the Navigator window Scene browser.

3 Open the Properties window.

4 See the following sections for specific changes.

5 In the Properties window, click either Solid look or Default look.



Control rigs: *A.* **Default** *B.* **Solid**

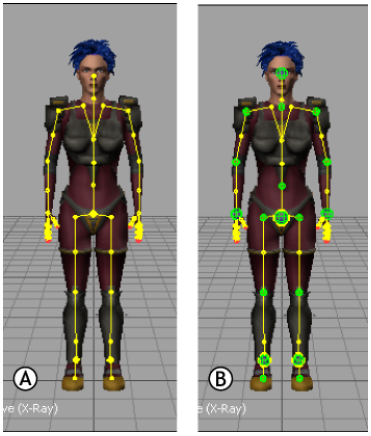
Showing or hiding Control rig effectors

If you cannot see the Control rig effectors, activate the Properties window Visibility option.

1 In the Properties window, set the Select property View menu to All (Type).

2 Expand the Markers section.

3 Activate or disable the Visibility option.



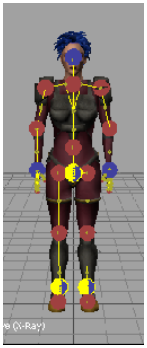
Control rig effectors: *A.* **Visibility off** *B.* **Visibility on**

Changing the effector size

To change the size of IK effectors:

1. Follow the steps in the previous section (Customizing Control rig appearance on page 1450).
2. In the Properties window, set the Select property View menu to All (Type).
3. To select all IK effectors on a Control rig, go to the Character controls window and activate IK from the Show menu. (For a clearer view, you can also deactivate FK and skeleton so you only see the IK effectors on the rig.)

   For individual effectors, you can also select them in the Viewer window or Schematic view.
4. In the Properties window, Expand Markers and Activate the Visibility option.
5. Set a new size in the Size field.



IK effectors set to 500.00

NOTE You can also change the shape, color, and transparency of the markers in the same menu.

To change the size of FK effectors:

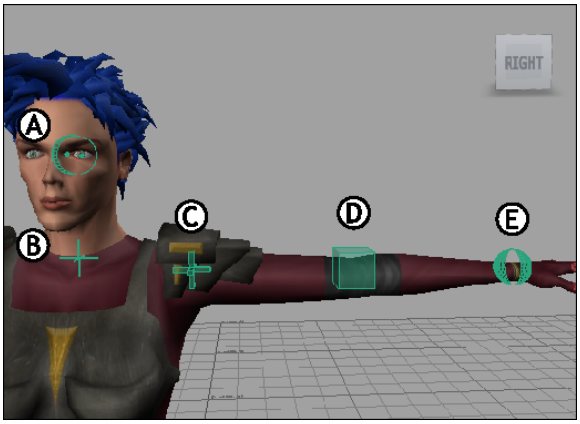
1. Follow the steps in the previous section (Customizing Control rig appearance on page 1450).
2. In the Properties window, set the Select property View menu to All (Type).
3. Go to the Character controls window and activate FK from the Show menu. (For a clearer view, you can also deactivate IK and skeleton so you only see the FK effectors on the rig.)
4. To select all FK effectors on a Control rig, double-click in an empty area of the Character controls window Character representation.

   You can also select individual effectors in the Viewer window or Schematic view.
5. In the Properties window, Expand Markers and Activate the Visibility option.
6. Set a new size in the Size field.

FK effectors set to 500.00

NOTE You can also change the shape, color, and transparency of the markers in the same menu.

Changing the shape of Control rig effectors



Effector looks: *A.* **Capsule** *B.* **Light Cross** *C.* **Hard Cross** *D.* **Cube** *E.* **Sphere**

To change the shape of a Control rig effector:

1. Follow the steps in the previous section (Customizing Control rig appearance on page 1450).
2. In the Properties window, set the Select property View menu to All (Type).
3. Select either Sphere, Cube, Hard Cross or Light Cross from the Look menu.

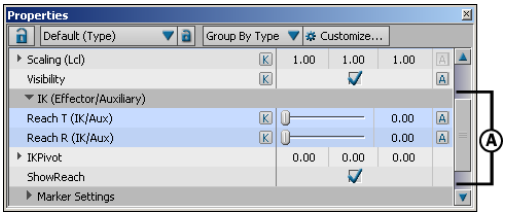
Control rig effector properties

The Control rig properties display when you select individual Control rig effectors (markers). The properties that display vary slightly depending on whether you select an IK or FK effector.

To modify properties, select the Control rig effectors you want to change in the Viewer window, then modify the properties. The changes apply to the Control rig in real time.

IK Properties

These properties let you adjust the IK Control rig effectors and Auxiliary objects.



Properties window *A.* **IK effector properties**

Reach IK Effector/Auxiliary

These properties are the same as the sliders that appear in the Character Controls window. They represent the Reach values for IK Control rig effectors, or for the Auxiliary objects associated with IK effectors. See Character Controls on page 1553 for more information on these Reach properties.

IK Pivot

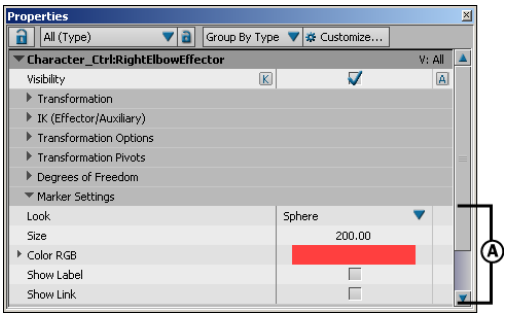
The IK Pivot properties let you adjust the position of Auxiliary pivots that are created for IK Control rig effectors. You can define offsets for Auxiliary pivots using these value fields, or you can switch to Pivot Selection mode in the Viewer window and translate the Auxiliary pivots in order to offset them. See Auxiliary pivots on page 1471 for more information.

Show Reach

This option lets you show or hide the outline that displays on Control rig effectors when they have Reach values. See Reach and Pull Feedback on page 1558 for more information.

Marker Settings

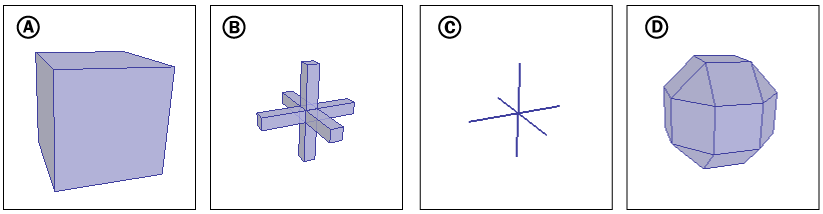
The Marker Settings properties let you change the shape, size, and color of the effectors that make up a Control rig. By default, IK effectors display as red or blue spheres. See Customizing Control rig appearance on page 1450 for procedures.



Properties window *A.* **Marker Settings**

Look

The Look menu lets you select the shape of Control rig effectors. See Changing the shape of Control rig effectors on page 1454. The following table and image describe the four Look options:



Control rig effector options *A.* **Cube** *B.* **Hard Cross** *C.* **Light Cross** *D.* **Sphere**

Option	Description
Cube	Effectors display as cubes.
Hard Cross	Effectors display as thick crosses.
Light Cross	Effectors display as wireframe crosses.
Sphere	Effectors display as a sphere. This is the default appearance.

Size

By default, red IK effectors are size 75 or 100, and blue IK effectors are size 150 or 175. Use the Size property to change the size of a selected effector. See Changing the effector size on page 1452.

Color RGB

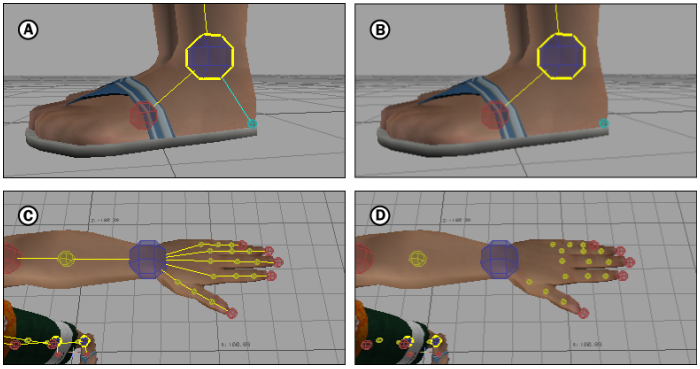
The Color RGB fields let you adjust the color of Control rig effectors. You can also double-click the Color RGB field to open the Color window and select a new color for the selected effector.

Show Label

This option lets you show or hide a text label that displays the name of the Control rig effector.

Show Link

This option lets you show or hide the line that displays between FK effectors and their child objects, and between IK effectors and their Auxiliary pivots.



Show Link option *A.* **Active Auxiliary pivot Show Link** *B.* **Disabled Show Link** *C.* **Active FK effectors Show Link** *D.***Disabled Show Link**

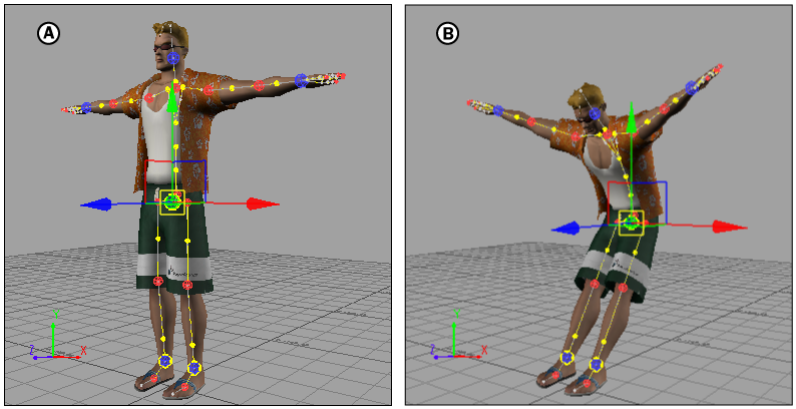
■ Control rigs on page 1431

Pinning

83

When you are manipulating a character with a Control rig, you can pin down the effectors to restrict body movement and influence how other joints behave relative to the pinned effector. This lets you selectively manipulate parts of your character without affecting the entire hierarchy.

For example, if you pin both wrists and ankles in translation and rotation, you can see that no matter how you move the character's body, the wrist remains in the same position .



Effector pinning *A.* **Character with wrists and ankles pinned in translation and rotation** *B.* **The wrists and ankles remain in place even when the Hips are translated along the Z-axis.**

See Pinning a Control rig effector on page 1460 and Unpinning a Control rig effector on page 1461.

When you create a biped Control rig, IK effectors on the character's feet are pinned in translation and rotation by default. On a quadruped Control rig, the feet are pinned in both translation and rotation.

The Character Controls window Effector Pinning area contains options that let you pin and unpin effectors. See Effector Pinning area on page 1574 for more information.

Pinning Keyboard Shortcuts

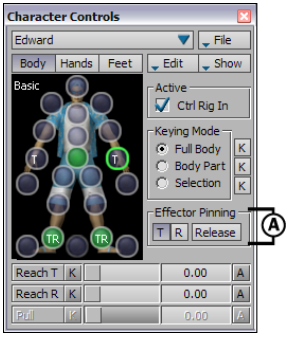
The following table describes keyboard shortcuts for pinning and unpinning effectors:

Press	To
W	Toggle translation pinning on and off selected cells.
E	Toggle rotation pinning on and off selected cells.
Q	Temporarily unpin effectors.

- Pinning on page 1459
- Selecting Control rig effectors on page 1442

Pinning a Control rig effector

To pin a Control rig effector, select the effector you want to pin down, then activate the T, R, or both options in the Effector Pinning area of the Character Controls.



Character Controls window
A. **Effector Pinning area**

- Pinning on page 1459
- Character Controls on page 1553

Unpinning a Control rig effector

To unpin a Control rig effector, select the effector you want to unpin, then disable the T, R, or both options in the Effector Pinning area of the Character Controls.

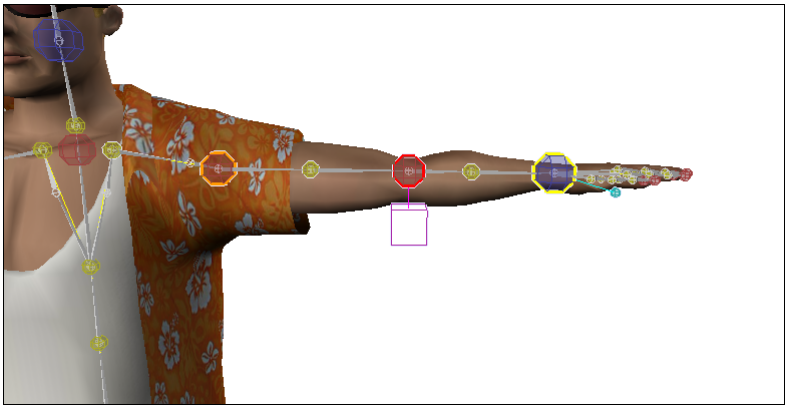
You can also use the Release option in the Effector Pinning area, or keyboard shortcuts to toggle pinning (see Pinning Keyboard Shortcuts on page 1460).

- Pinning on page 1459
- Pinning a Control rig effector on page 1460
- Character Controls on page 1553

Visual feedback on Control rigs

84

Control rigs now display improved visual feedback as you animate a character . Each feedback element is designed to help you identify which part of the rig you are working with, how your character is moving, and how it is affected by manipulations over time.



VIsual feedback elements display on a character's Control rig

You can turn the visibility of the feedback elements on or off, or change the color and style of each element using the Properties window. You can also develop your own custom feedback elements using Relations constraints.

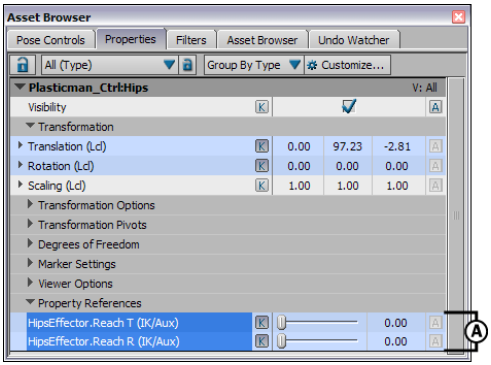
■ Control rig properties on page 1445

Reach feedback on FK effectors

FK effectors in a Control rig do not have Reach properties. However, the properties for each FK object in the Control rig include property references to the Reach properties of a corresponding IK effector. This makes it possible for the FK objects to show the IK Reach feedback.

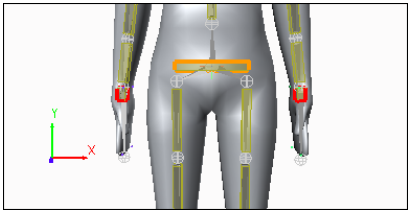
NOTE Only Control rigs created in MotionBuilder 7.5 and up have FK effectors with Reach property references. If you are working with older Control rigs, you can add the Reach property references by disabling then re-activating the character's Characterize option.

For example, if you select the FK effector for the hips and view its properties, property references to the Reach T and Reach R properties for the IK hips effector are also listed.



Properties of an FK effector for the hips. *A.* **Two reference properties for the IK effectors of the hips are also listed.**

These reference properties let you hide the IK effectors, work only with bone-like FK effectors, and still view the Reach feedback for your Control rig .



The FK effectors on the hips and wrists display Reach Outline visual feedback for hidden IK effectors.

If you do not want to view IK Reach feedback on FK objects, or if you want to change which IK and FK effectors are associated, you can delete and re-create property references as required. See Property references on page 758 for more information.

- Visual feedback on Control rigs on page 1463
- Creating a property reference on page 759
- Control rig properties on page 1445
- Auxiliary objects on page 1469

Controlling visual feedback on Control rigs

You can show, hide, or change the appearance of any of the visual feedback elements for Control rigs using the Feedback Settings group of properties.

For example, you can change the color of the outline that displays on effectors with Reach values using the Reach T Outline Color, Reach R Outline Color, and Reach TR Outline Color properties. For a list of properties that adjust the Control rig feedback, refer to Control rig properties on page 1445.

To show or hide the visual feedback elements on a character's Control rig:

1. Select the Control rig in the Scene browser.
2. In the Properties window expand Feedback Settings.
3. Activate or disable the Control Rig Feedback option.

   When activated, all visual feedback elements display on the Control rig. When disabled, all visual feedback is hidden.

You can also show or hide each of the individual feedback elements using the appropriate option. For example, to show or hide the Reach feedback, activate or disable the Reach Feedback option.

- Visual feedback on Control rigs on page 1463
- Control rig properties on page 1445
- Viewing currently keyed elements on a Control rig on page 1466
- Changing the opacity of Control rig effectors on page 1466

Viewing currently keyed elements on a Control rig

To view elements that are keyframed at the current time on a Control rig:

1. Select the Control rig in the Scene browser.
2. In the Properties window expand Feedback Settings and ensure that the Control Rig Feedback and Currently Keyed Outline options are activated.

   By default, a pale blue outline displays on all elements that are keyframed at the current time. You can change the color and width of the outline using the Currently Keyed Outline properties.

- Visual feedback on Control rigs on page 1463
- Controlling visual feedback on Control rigs on page 1465
- Kinematics on page 1434

Changing the opacity of Control rig effectors

To change the opacity of Control rig effectors:

1. Select a Control rig in the Scene browser.
2. In the Properties window expand Feedback Settings.
3. Do one of the following:
   - To adjust the IK effectors, change the IK Effector Opacity property.
   - To adjust the FK effectors, change the FK Effector Opacity property.

By default, all effectors have an opacity value of 40. When set to zero, the markers are wireframe. The higher the value, the more opaque the effectors become.

Auxiliary objects

85

Auxiliary objects can be added to a character's Control rig effectors to provide another level of IK control over your character . There are two types of Auxiliary object:

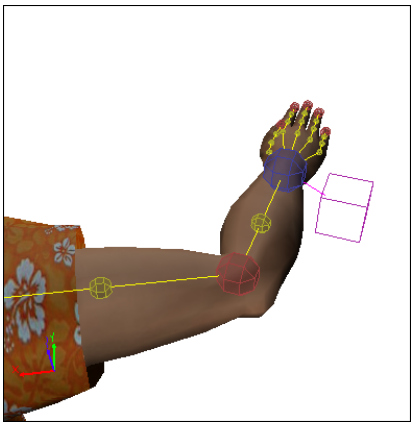
- Auxiliary effectors on page 1469
- Auxiliary pivots on page 1471

Auxiliary objects *A.* **Auxiliary effector** *B.* **Auxiliary pivot**

Auxiliary effectors

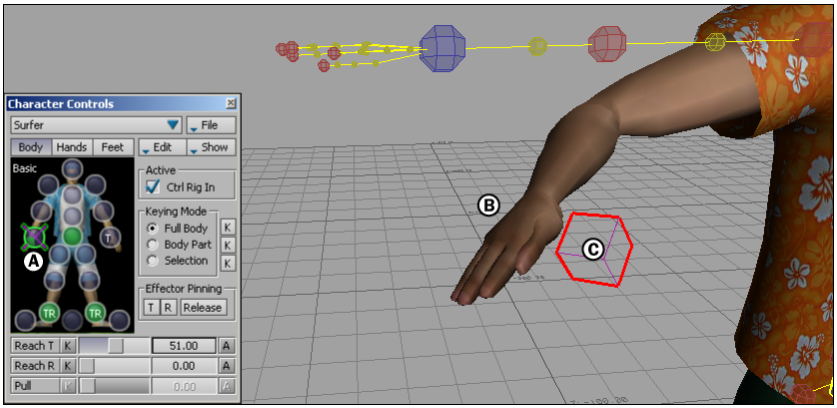
Auxiliary effectors are supplementary effectors in a Control rig that correspond to existing IK effectors. Every IK effector in a Control rig can have multiple Auxiliary effectors.

By default, an Auxiliary effector displays as a wireframe cube in the Viewer window . You can change the look, color, and size of Auxiliary effectors in the Properties window.



An Auxiliary effector displays on a wrist effector.

You can translate an Auxiliary effector to the position you want its corresponding IK effector to reach, then control the amount of reach between the IK effector and the Auxiliary effector using the Reach options . See also Reach Actor/Character on page 1580 for more information.



Adjusting Auxiliary reach *A.* **Right wrist effector Auxiliary effector selected** *B.* **Hand reaches between IK effector and Auxiliary effector.** *C.* **Auxiliary effector is translated away from right wrist.**

Auxiliary effectors are useful in many situations to provide an additional level of IK control. For example, you can use Auxiliary effectors to ensure that a character's arm always reaches towards a prop, such as a weapon.

You can also use Auxiliary effectors to stabilize a character's feet so that they do not slide on the floor. To do this, you can create an Auxiliary effector for

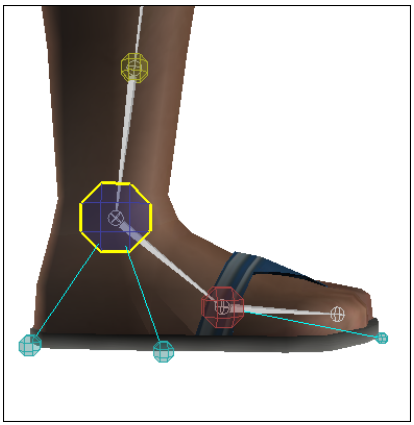
the primary IK foot effectors, then place the Auxiliary effector on the floor where the foot slides. Define the Reach values to maximum reach (100%).

When you play your take, the foot effector reaches toward the Auxiliary effector at the frame where the foot begins to slide, and the Reach T and Reach R sliders move as the animation plays. To see the keyframes on the Action timeline, select the Auxiliary effector in the Character Controls.

Auxiliary pivots

Auxiliary pivots are objects that let you quickly define and animate multiple rotation pivot points for IK Control rig effectors. You can use Auxiliary pivots for any character animation, and they are particularly useful if you want to manipulate the feet or hands of a character using more than one rotational point.

By creating multiple Auxiliary pivots for an IK effector in a character's foot, for example, the feet can rotate around multiple independent pivot points in order to create natural-looking walk cycles .



Three Auxiliary pivots display for two IK effectors in a character's foot.

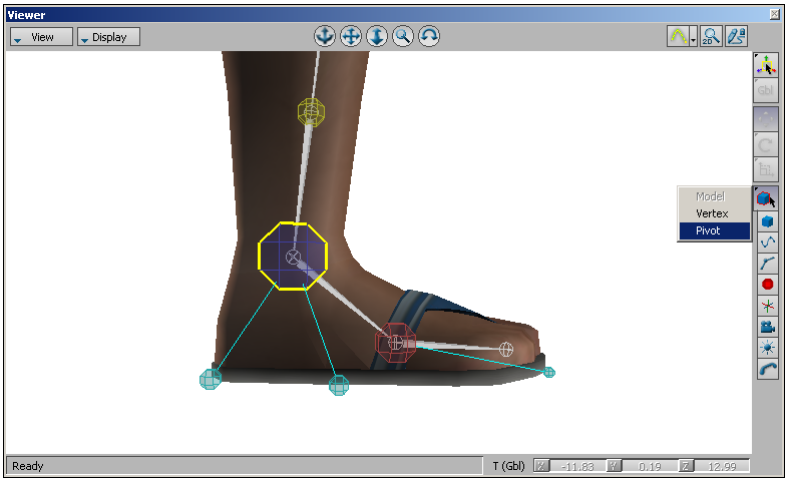
As you set keyframes, you can switch between Auxiliary pivots, making the foot rotate around the ankle, the heel, the base of the toes, the tip of the toes, and even the sides of the foot. For more information on switching between pivots, see Setting a master Auxiliary pivot on page 1477.

Auxiliary pivots are based on the position of the IK effector they are created for, so they do not have an independent position in the scene. You can think

of them as sub-controls that let you manipulate the IK effector from different vantage points. Rotating any pivot also affects the effector, just as if the effector itself is manipulated.

To manipulate Auxiliary pivots, select Pivot mode from the Selection Mode menu in the Viewer window. Pivot mode is automatically selected when you create a new Auxiliary pivot. You can then select and define offsets for the pivots by dragging them to new positions relative to the IK effector.

When you are in Pivot mode, transforming the pivot affects only the Auxiliary pivot itself. To use the pivots to manipulate an effector, switch to Model mode. For more information on the Selection Mode menu, see Viewer window on page 49.



Viewer window *A.* **Select Pivot from the Object Mode menu.**

TIP You can base poses on selected Auxiliary pivots using the Pose Controls window.

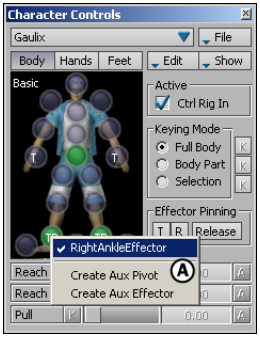
- Control rigs on page 1431
- Pose Controls window on page 1492
- Creating Auxiliary effectors and pivots on page 1473
- Setting a master Auxiliary pivot on page 1477
- Manipulating Auxiliary pivots on page 1476

Creating Auxiliary effectors and pivots

To create an Auxiliary effector or pivot:

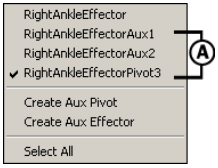
➤ Right-click a cell in the Character representation, then choose Create Aux Pivot or Create Aux Effector from the contextual menu.

Auxiliary effectors are placed at the same position and rotation as the corresponding effector, and Auxiliary pivots are placed at a slight offset from the effector so they are easily visible.



Character Controls *A.* Cell contextual menu

Auxiliary effectors and pivots are named for the original effector with the suffix “Aux” or “Pivot” plus a sequential number. For example, if you create two Auxiliary effectors for the RightAnkle effector, then create one pivot, the first Auxiliary is named RightAnkleEffectorAux1, the second is RightAnkleEffectorAux2, and the first pivot is called RightAnkleEffectorPivot3.



Cell contextual menu for the right ankle effector *A.* All Auxiliary effectors and pivots are listed.

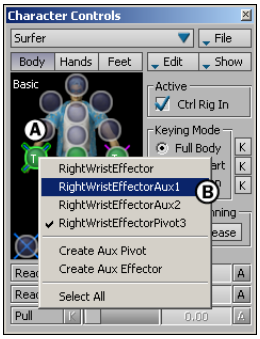
■ Auxiliary objects on page 1469

Selecting Auxiliary effectors and pivots

To select Auxiliary effectors and pivots:

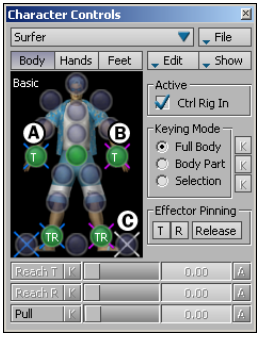
➤ Right-click the corresponding cell in the Character representation and select them from the contextual menu.

You can also select Auxiliary effectors and pivots in the Viewer window.



Character Controls *A.* **Auxiliary pivot is currently active on the right wrist effector.** *B.* **An Auxiliary effector is selected in the cell's contextual menu.**

After an Auxiliary object is selected it becomes the active object in the Character representation cell. The next time you select this cell, you select the active object. A blue, purple, or white X displays on any cell that has associated Auxiliary objects to indicate which is the active object. If the effector itself is active, the X is white. For active Auxiliary pivots the X is blue, and for active Auxiliary effectors, the X is purple .



Active objects on Character representation cells *A.* Auxiliary pivot is active *B.* Auxiliary effector is active *C.* Effector is active

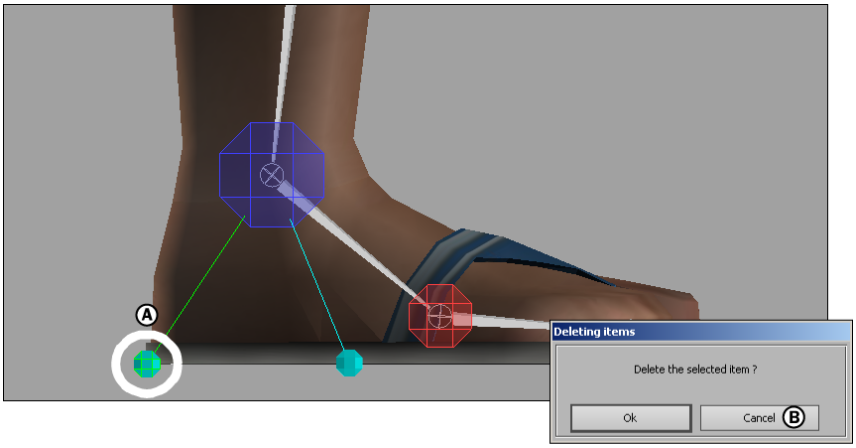
To switch back to selecting the effector itself when you click a cell, select the effector's name in the cell contextual menu.

- Auxiliary objects on page 1469
- Creating Auxiliary effectors and pivots on page 1473
- Deleting Auxiliary effectors and pivots on page 1475

Deleting Auxiliary effectors and pivots

To delete Auxiliary effectors and pivots:

1. Select the Auxiliary effector or pivot you want to delete in the Viewer window and press Delete.
2. Click Ok in the dialog box that appears.



A. **Press Delete with an Auxiliary object selected in the Viewer window.** *B.* **Click Ok in the Deleting items dialog box.**

- Auxiliary objects on page 1469
- Creating Auxiliary effectors and pivots on page 1473

Manipulating Auxiliary pivots

To manipulate Auxiliary pivots:

1. Select Pivot from the Object Mode menu in the Viewer window toolbar, then select the pivot you want to manipulate.
2. Use the standard transformation options to manipulate the selected pivot.

Pivot mode is automatically selected when you create a new Auxiliary pivot. You can then select and define offsets for the pivots by dragging them to new positions relative to the IK effector.

When you are in Pivot mode, transforming the pivot affects only the Auxiliary pivot itself. To use the pivots to manipulate an effector, switch to Model mode. For more information on the Selection Mode menu, see Viewer window on page 49.

- Control rigs on page 1431

- Creating Auxiliary effectors and pivots on page 1473
- Selecting Auxiliary effectors and pivots on page 1474
- Camera View toolbar on page 60

Setting a master Auxiliary pivot

After positioning the Auxiliary pivots, you can select the Auxiliary pivot around which you want other objects to rotate. Separate Reach properties for each individual pivot let you specify which pivot is the master at any given time. As you keyframe, you can use the IK and FK key buttons in the Key Controls to specify which pivot you want other objects to rotate around.

For example, if you create four Auxiliary pivots for one effector in the foot, you might first want the foot to rotate around a pivot close to the tips of the toes.

To set a master pivot:

1. Select the pivot you want to define as the master in the current frame.
2. Click IK in the Key Controls window.

This sets the Reach for the selected pivot to 100, and sets the Reach for all other pivots to 0. When you manipulate this pivot, everything else rotates around it. You can confirm that the Reach properties for the selected pivot have been set to 100 in the Properties window.

If you want to set a keyframe in which nothing rotates around the Auxiliary pivots for a body part, click the FK Key button in the Key Controls. This sets the Reach properties for all of the pivots to zero, and all of the pivots have no affect on the effector.

- Auxiliary objects on page 1469
- Deleting Auxiliary effectors and pivots on page 1475

Customizing Control rigs

86

There are several ways you can customize your Control rigs to suit the manipulations you want to create. You can customize the appearance of the Control rigs to suit your project, re-parent hierarchies to achieve different behaviors as you manipulate, and you can build hierarchies to create extra body parts, such as wings or a tail. You can also create Auxiliary objects to add another level of control.

Refer to the following topics for detailed ways to customize your Control rig:

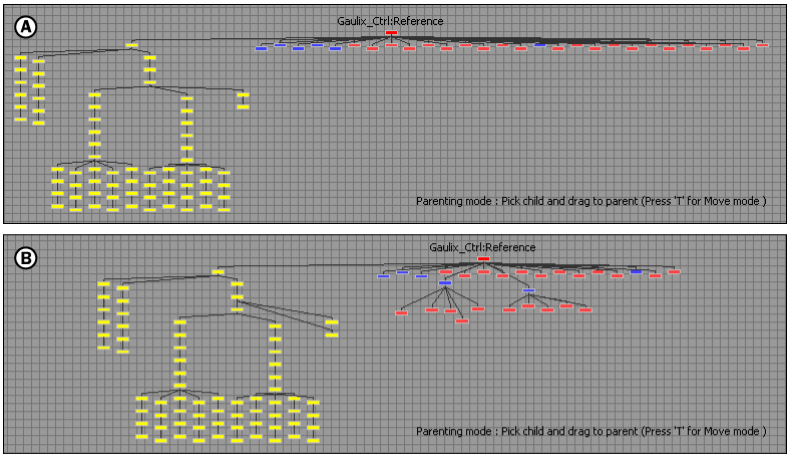
- Changing the appearance of Control rigs on page 1482
- Customizing the Control rig hierarchy on page 1481
- Creating Auxiliary effectors and pivots on page 1473

Once you have customized your Control rig you can save and re-load it for use with any other character, just as you can with any other asset.

- Customizing Control rigs on page 1479
- Parenting and hierarchies on page 400
- The Control rig hierarchy on page 1479
- Auxiliary objects on page 1469
- Saving a Control rig on page 252

The Control rig hierarchy

When you first create a Control rig, the IK effectors are global and occupy one level under the Control rig reference, while the FK effectors are arranged in a hierarchy that reflects your character's bone structure. Since effectors can act independently at this level, the animation may produce poor interpolation results over time.



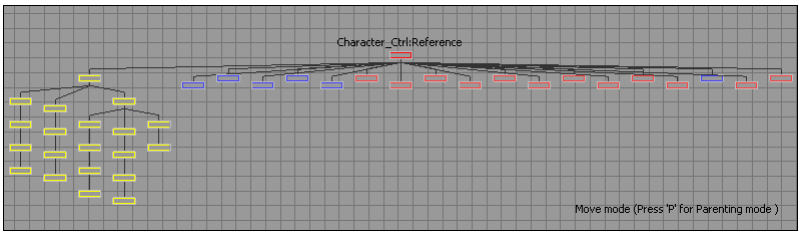
A. **Basic Control rig hierarchy.** *B.* **Control rig customized with re-parenting.**

You can alter how the animation interpolates by changing how effectors react relative to each other. To do this, you can re-parent effectors and change hierarchies in the Control rig.

To provide additional control, you can also create another level of Inverse Kinematics using Auxiliary effectors or pivots. For example, you can make an arm reach further toward an Auxiliary effector without changing the parenting hierarchy.

You can also create other hierarchies in a Control rig by re-parenting certain nodes to added elements. For example, you can add a null element to a Control rig as a parent, and make other effectors the children of the null. By manipulating the null, you can manipulate the hierarchy of bones.

By default when you create a Control rig, the effectors are arranged in a simple hierarchy. You can easily view, arrange, and manipulate the hierarchy of the Control rig using the Schematic view.



A Control rig hierarchy displays in the Schematic view.

- Customizing the Control rig hierarchy on page 1481
- Nodes on page 391
- Parenting and hierarchies on page 400
- Schematic view on page 392
- Creating parent-child relationships on page 403

Customizing the Control rig hierarchy

To customize a Control rig hierarchy:

1. In the Viewer window, switch to Schematic view (*Ctrl-W*).
2. Click in the Schematic view, then press F to frame the hierarchy.
3. Press P to activate Parenting mode.
4. Re-parent any of the Control rig effectors by selecting the nodes that represent them and dragging them to a parent.

TIP Turn on Auto Arrange as you re-parent effectors so you can see the hierarchies you are creating. In the Schematic view, right-click and select Auto Arrange.

- The Control rig hierarchy on page 1479
- Nodes on page 391
- Parenting and hierarchies on page 400
- Schematic view on page 392

- Creating parent-child relationships on page 403

Changing the appearance of Control rigs

There are various ways in which you can change the look of your Control rigs. For example, you can change the shape and color of effectors, scale selected effectors, or change the color properties of selected nodes or bones.

To change the look of Control rig effectors:

➤ Select the effectors you want to change, then adjust the Marker Settings properties that display in the Properties window.

You can also refer to the following topics:

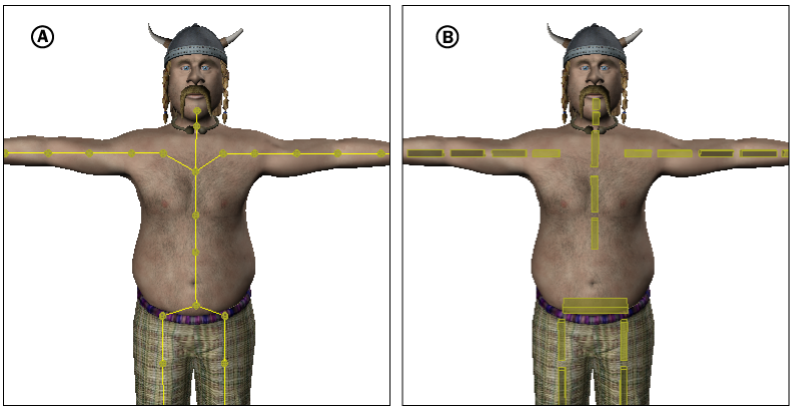
- Changing the opacity of Control rig effectors on page 1466
- Changing the appearance of FK effectors on page 1482
- Customizing Control rigs on page 1479
- Control rig properties on page 1445
- Control rig effector properties on page 1455

Changing the appearance of FK effectors

To change the appearance of FK Control rig effectors:

1. In the Scene browser, select the Control rig.
2. In the Properties window, do one of the following:
   - Click Default Look to make the effectors appear as the default yellow spheres connected by lines.

Click Solid Look to make the effectors appear as solid bone-like objects.



A. **Default Look FK effectors** *B.* **Solid Look FK effectors**

NOTE When you use the Default Look option, you can hide the line that connects effectors by selecting the effectors and disabling the Show Link option in the Marker Settings properties. See Show Link on page 1457 for more information.

Poses

87

A pose is a snapshot of a selected character's or object's position. This may include the position of the entirety of an object or a character's whole body, or only selected parts. Poses can be created for anything that has an effector. For characters, you can even create poses of hand and finger positions.

Since poses are created and pasted in conjunction with Control rigs, you can retarget poses onto any character or object that has a Control rig. Libraries of poses can be saved and loaded for use from one MotionBuilder session to another, and for use with different characters.

Following are the topics included in this chapter.

- Creating a pose on page 1486
- Renaming a pose on page 1486
- Pasting a pose on page 1487
- Copying a pose on page 1489
- Updating a pose on page 1490
- Deleting a pose on page 1491
- Pose Controls window on page 1492
- Match options on page 1493

See also:

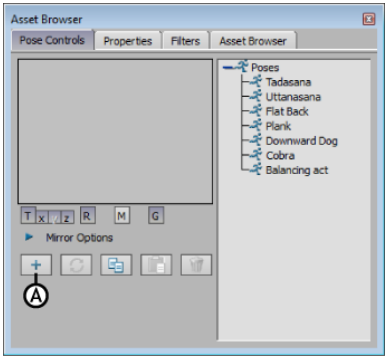
- Object pose workflow on page 748
- Control rigs on page 1431

Creating a pose

To create a pose:

1 Arrange your character in the position you want to capture.

2 In the Pose Controls window, click Create.



Pose controls *A.* **Create button**

The current character's position is copied and added to the Pose browser. The new pose displays at the end of the list, takes the name of the character, and is sequentially numbered (for example, Pose, Pose 1, Pose 2, and so on).

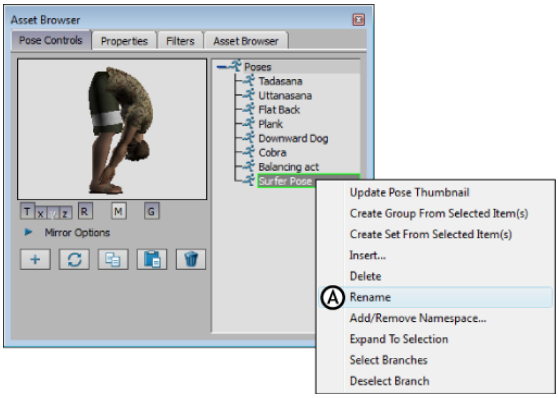
Keep your poses organized by creating them in a selected folder, or by adding them into folders.

- Poses on page 1485
- Deleting a pose on page 1491

Renaming a pose

To rename a pose:

1 Right-click the pose you want to rename, and select Rename from the contextual menu.



Pose controls *A.* **Rename option**

2 Type a new name in the Rename field that appears and press Enter.

- Poses on page 1485
- Updating a pose on page 1490

Pasting a pose

To paste a pose:

1 Select a character from the Current Character menu in the Character Controls.

2 Select a pose from the Pose browser.

3 In the Pose Controls window, do one of the following:

- Click Paste
- In the Pose browser, double-click a pose

NOTE If no pose is selected in the Pose browser when you click Paste, the last pose stored in memory is pasted. A pose is stored in memory when you click Copy, Create, or Update.

To paste a full body pose:

1 In the Character Controls window, select Full Body as the Keying mode.

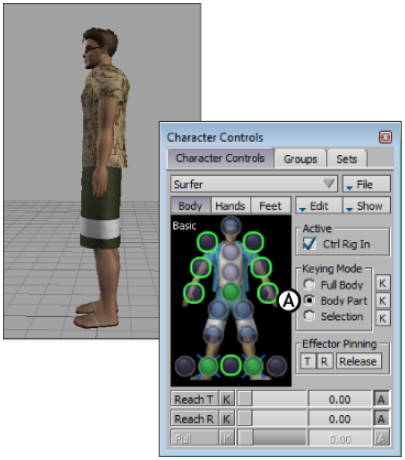
2 In the Pose Controls window, select any Match options you need.

3 Click Paste.

To paste a pose on a selected body part:

1 In the Character Controls window, select Body Parts as the Keying mode.

2 Select the body part from the Character representation.

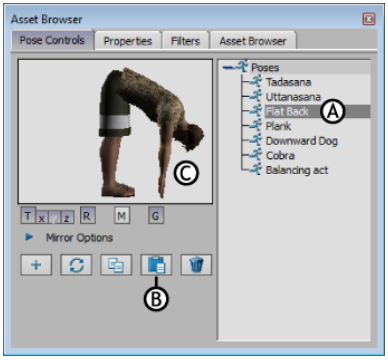


Character Controls *A.* **Body Parts is the selected Keying mode and the character's arms are selected.**

3 In the Pose Controls window, click Paste.

For example, in the following figure, the character's original pose is a T-stance position. By selecting Body Parts and the character's left arm, pasting a pose replaces only the character's left arm position, leaving the rest of the body in a T-stance.

NOTE To paste a hand pose, select a hand effector below the wrist. The wrist is considered part of the arm body part, rather than the hand.



Pasting poses *A*. **Select the pose** *B*. **Click Paste button** *C*.**Pose pasted onto the targeted body parts**

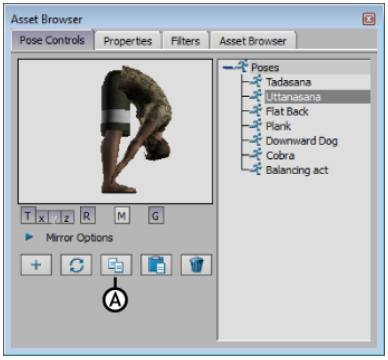
TIP Select Stance Pose from the Edit menu in the Character Controls to reset the position of a character to a T-stance at any time.

■ Poses on page 1485

Copying a pose

To copy a pose:

1. From the Pose browser, select the pose you want to copy.
2. Click Copy.



Pose controls *A.* **Copy button**

NOTE This action copies the pose to memory, replacing any previously copied pose. Clicking Copy also deselects any selected poses in the Pose browser.

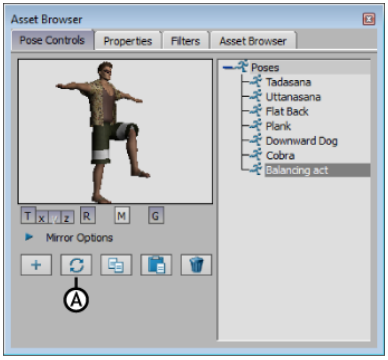
■ Poses on page 1485

Updating a pose

To update a pose:

1. Select the pose you want to update in the Pose browser.
2. Modify the new pose using either the Control rig or by transforming the object, and click Update.

   The current pose replaces the existing pose in the Pose browser (and the thumbnail image is updated also).



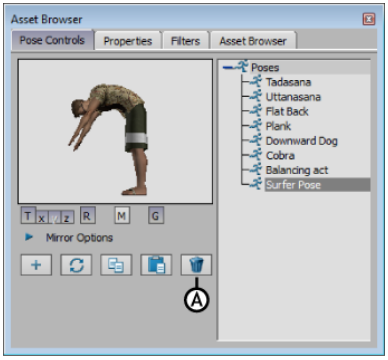
Pose controls *A.* **Update button**

■ Poses on page 1485

Deleting a pose

To delete a pose:

1. Select the pose in the Pose browser and click Delete. (To delete more than one pose, Ctrl-click additional poses.)
2. In the Pose Editor dialog box, click Ok to delete the selection, or click Cancel to abort the request.

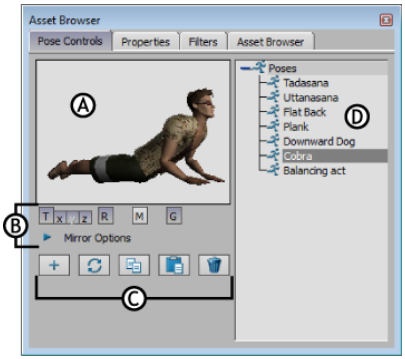


Pose controls *A.* **Delete button**

You can also delete selected poses using the Delete option in the contextual menus of the Pose and Scene browsers.

Pose Controls window

From the Pose Controls window you can create a library of poses that can be copied and pasted between characters (or objects) or onto a single character.

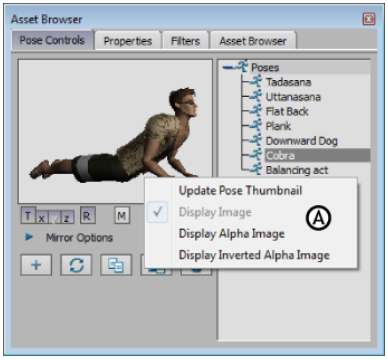


Pose Controls window. *A.* **Pose thumbnail** *B.* **Match options** *C.* **Create, Update, Copy, Paste, Delete pose functions** *D.* **Pose browser**

To show the Pose Controls window, select Pose Controls from the Window menu, or use a layout in which the Pose Controls window displays.

Pose thumbnail

The pose thumbnail allows you to see a snapshot of the pose which is captured at the time the pose is created. To judge the aesthetic of a pose, right-click the thumbnail to choose either an alpha or an inverted alpha silhouette.



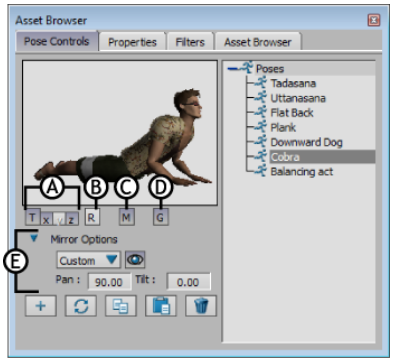
Pose Controls *A.* **Thumbnail contextual menu**

You can update the thumbnail at any time (without making any other changes to the pose) by zooming or panning around different angles of the scene and then clicking Update. See Update Pose Thumbnail on page 1504.

Poses Thumbnail *A.* **Alpha image** *B.* **Inverted Alpha image**

Match options

The Match options determine how a selected pose is pasted on the current character or object.



Match options *A.* **Translation** *B.* **Rotation** *C.* **Mirror** *D.* **Gravity** *E.* **Mirror Plane options**

You can match a pose to the location of the current character based on IK and FK Control rig effectors, Auxiliary effectors and pivots, or any object included in a Character Extension.

NOTE The following match options also apply to object poses and object-pose manipulation. Matching channels between objects are automatically mapped together, while information in a pose about properties that an object does not have is ignored. For more information about object poses, see Mapping pose and keying group properties on page 748 and Object pose workflow on page 748.

Translation (T)

When the Translation option is active and you paste a pose onto a character, the character's current translation is preserved as the pose is pasted. The translation of the pose is made to match the translation of the selected object to which you are pasting.

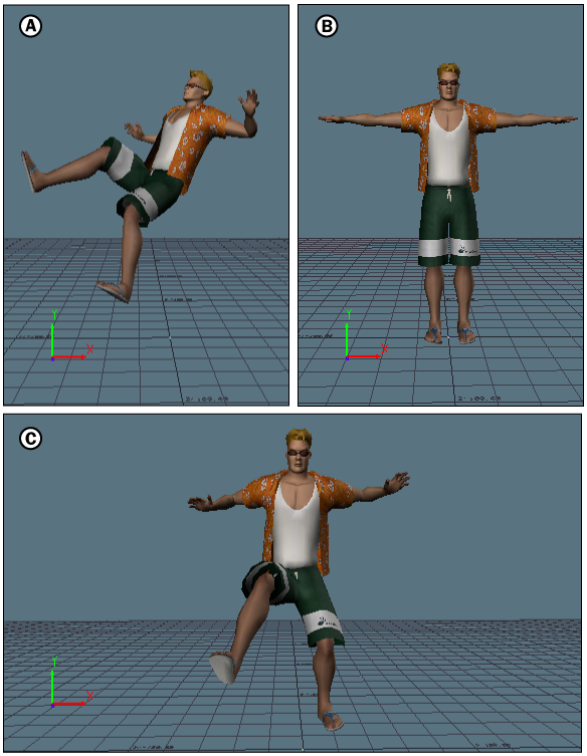
To paste and match the translation of the pose to a selected character's translation on any specific axis, use the Translation x, y, and z options.

Option	Description
Translation (x, y, z)	The Translation x, y, and z options let you specify which global axis (or axes) you want to match when pasting poses based on an object's translation. By default, all of the x, y, and z options are activated so that when you paste a pose with Translation active,

Option	Description
	the pose is pasted based on the position of the selected effector on all three axes.

Rotation (R)

When the Rotation option is activated, you can paste and match a pose to the rotation of the selected object. For example, in the figure below, the Rotation option is active, and a character's Hips effector is selected. On the pose to be pasted, the Hips are oriented at an angle, away from the camera. On the character pose A is pasted on, the Hips are facing the positive Z-axis, or facing the camera.



Pasting with the Rotation (R) option active. *A.* **In the pose to be pasted, the selected Hips effector is oriented at an angle from the camera.** *B.* **The character the pose is pasted on faces the camera.** *C.* **The pose is pasted and the character**

assumes pose A, but keeps its original orientation, facing the camera.

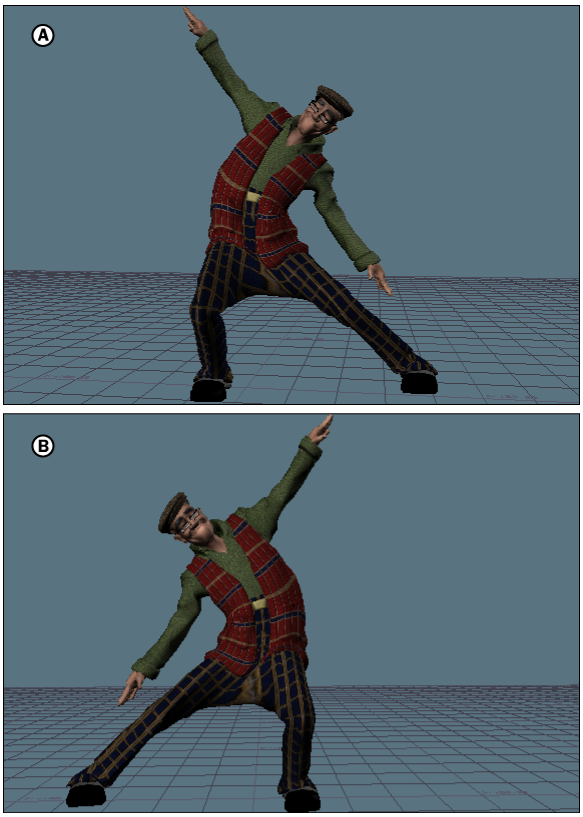
When pose A is pasted on the character in B, the orientation of the character in the resulting pose (C), is based on the rotation of the Hips effector in B. The character assumes pose A, but retains the rotation and translation of the Hips in pose B, still facing the camera.

If the Mirror option is also active, a red indicator displays on the selected effector to match, indicating that the mirror-pasted pose will be based on the rotation of this effector. To hide the red indicator, disable the Mirror Visibility option.

NOTE You cannot set a specific Mirror Plane when Rotation is active. If you want to change the orientation of the character as you paste, disable the Rotation option before you use the Mirror and Mirror plane options.

Mirror

This option lets you mirror a pose on the current character. For example, you can mirror a pose from the left side of a character's body onto the right side of the body. The Mirror option can be used with any of the other Match options to mirror-paste poses.



Pasting a Full Body pose with Mirror active *A.* **Original pose** *B.* **After pasting**

Activating the Translation and Rotation options with the Mirror option preserves the orientation of the selected object to match as you mirror-paste. A red indicator displays on the selected object to match when you use the Rotation and Mirror options together.

If you want to change the orientation of the mirrored pose as you paste, disable the Rotation option and use the Mirror Plane options to select a different plane on which to mirror the pose.

You can mirror full body poses, or you can mirror selected body parts. To mirror a pose on a character's whole body, select Full Body as the Keying Mode in the Character Controls window and activate the Mirror option. When both are active, pasting mirrors the whole body pose onto the selected character.

To mirror a pose on a character's selected body part, select Body Parts as the Keying Mode in the Character Controls window and activate the Mirror option. When both of these options are active, pasting a pose mirrors only on the selected body part, so you can paste finger or hand positions from one arm to another, for example.

For more information on Keying modes, see Keying Mode menu on page 853.

Gravity

When you are copy-pasting onto the same character, activating the Gravity option ensures that the feet stay at the original level of the pasted pose, keeping a natural orientation of the feet on the floor.

When the Translation (T), Rotation (R), and Gravity options are active, pasting a pose onto a character matches the translation on the global X- and Z-axes, and rotation on the global Y-axis. The original global Y translation value and the original global X and Z orientation values are preserved.

Gravity works best when you are copying and pasting poses between the same character. Pasting poses between characters of different sizes may produce undesirable results, causing the feet of the target character to lift into the air to match the pose of the larger character. For best results, disable Gravity when pasting poses between different sized characters.

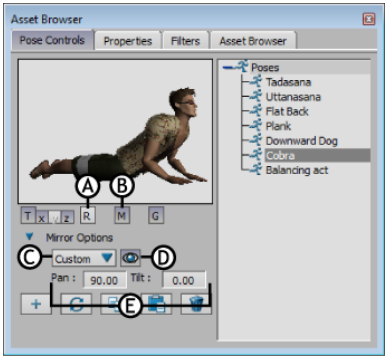
You can also disable the Gravity option if you are pasting poses in a situation where you want the character's feet to remain in the air. When Gravity is disabled, you can achieve a perfect match without respect to the floor.

NOTE The Gravity, Translation, and Rotation options are available only when the current character's Keying mode is set to Full Body in the Character Controls window.

Mirror Plane options

The Mirror Plane options let you mirror a pose relative to the character's position on the global axes. You can mirror full body poses, or selected body parts.

The Mirror Plane options are only available when the Mirror option is enabled and the Rotation (R) option is disabled. This is because the Rotation option is designed to preserve the orientation of a character as you paste poses onto it, while the Mirror plane options allow you to change the orientation of the character as you paste.



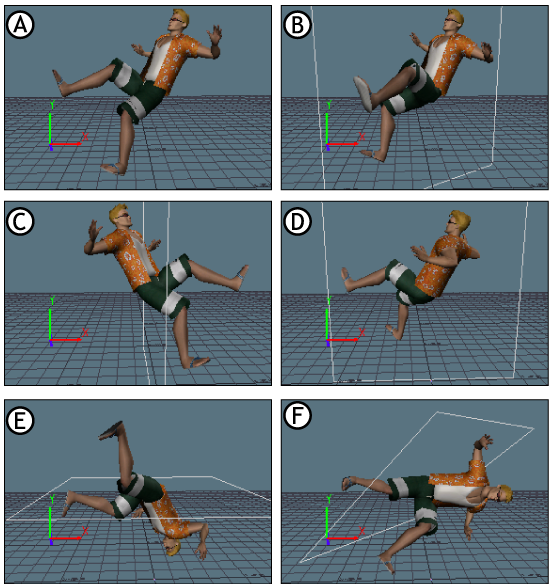
Mirror Plane options *A.* **Rotation is disabled** *B.* **Mirror is active** *C.* **Mirror mode menu** *D.* **Mirror Plane visibility option** *E.* **Pan and Tilt values**

To mirror a pose on the current character's whole body, select Full Body as the Keying Mode in the Character Controls window and activate Mirror in the Mirror Plane options in the Pose Controls. When both are active, pasting mirrors the full body pose onto the selected character.

For example, the following figure shows the effects of pasting a full body pose onto a character when the various mirror plane modes are active. The pose in the following figure A is the original pose. The right side of the character is mirrored onto the left side, and the orientation of the character changes as each mirror plane mode is used.

Mirror Plane Mode Menu

When the Mirror option in the Match options is activated, and the Rotation (R) option is disabled, you can use the Mirror Plane Mode menu to select the plane on which you want poses to be mirrored.



Mirror Mode menu options *A.* **Original pose** *B.* **Auto Mirror mode** *C.* **Z-Y plane** *D.* **X-Y plane** *E.* **X-Z plane** *F.* **Custom plane, with Pan and Tilt values of 50**

The following table describes the options in the Mirror Plane Mode menu:

Option	Behavior
Auto	Calculates the mirror plane based on the selected object to be matched and the enabled Match options.
Z-Y	The mirror plane is defined by the global Z-Y plane.
X-Y	The mirror plane is defined by the global X-Y plane.
X-Z	The mirror plane is defined by the global X-Z plane.
Custom	Lets you define a custom mirror plane using the Pan and Tilt values.

Pan

When Custom is selected in the Mirror Plane Mode menu, you can set the Pan value to rotate the Mirror plane around the global Y-axis.

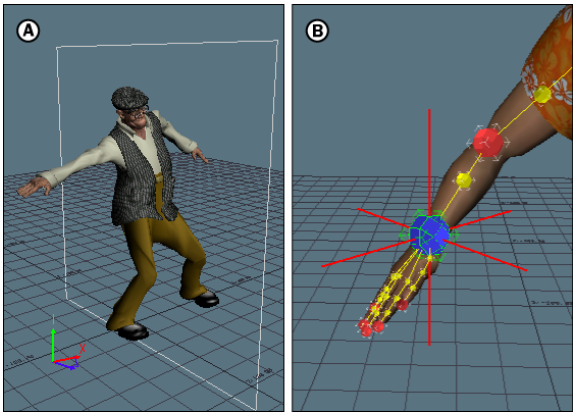
Tilt

When Custom is selected as the Mirror Plane mode, you can set the Tilt value to rotate the Mirror plane around the global X-axis.

NOTE The Pan and Tilt fields are only available if the Custom option is selected in the Mirror Plane Mode menu.

Mirror Visibility

When the Mirror option is active, you can activate and disable the Mirror Visibility option to show or hide the 3D mirror plane you have selected in the Mirror Plane Mode menu. When Rotation is active, the Mirror Visibility option shows or hides the red indicator that displays on the selected object to be matched.

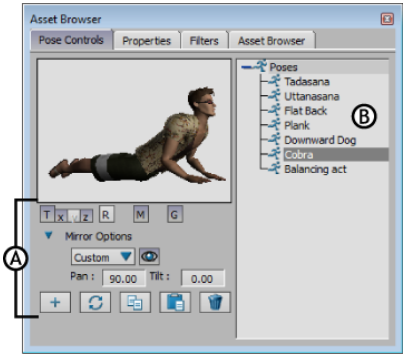


Mirror visibility *A.* **The mirror plane displays for a pose on the Z-Y plane.** *B.* **A red indicator displays on the right wrist effector to be matched.**

- Pose Controls window on page 1492
- Pasting a pose on page 1487

Pose browser

The Pose browser displays all the poses available for pasting onto selected characters. It is also where you create, update, and delete poses.



Pose Controls window *A.* **Match and Pose options** *B.* **Pose browser**

By default, there is one folder in the Pose browser named Poses. You can create new folders (see Pose contextual menus on page 1502), and organize your poses by dragging poses and folders onto one another.

You can also save selected poses and build a library of poses for pasting onto characters when needed. All the poses in the Pose browser also appear in the Poses group in the Scene browser of the Navigator window.

NOTE You can select poses to save using only the Scene browser.

Pose contextual menus

The Pose contextual menus let you insert folders and poses, rename poses, select, expand, collapse, and deselect branches within folders.

To open the Pose contextual menus, right-click a selected pose or folder in the Pose browser. There are two different contextual menus that appear, depending on whether you right-click a pose or a folder.

Insert Folder

Lets you insert a new folder in which to place poses. The folder is placed relative to the folder where you right-click.

For example, if you right-click on the Poses folder, the new folder is placed at the end of the tree in the Pose browser. If you click on another existing folder, the new folder is added at the selected folder level.

By default, the first folder that you add is named Poses Folder, and subsequent folders are named Poses Folder 1, Poses Folder 2, and so on.

NOTE The Insert Folder option only appears in the Pose contextual menu when you right-click on a folder.

Insert

Opens or switches to the Asset browser, letting you add poses or other assets to your scene. When dragging a file with saved poses into the Pose Controls window, make sure you release the *.fbx* file over a folder name or existing pose. If you do not, the poses may not be added from the *.fbx* file. Also, the *.fbx* file should only contain poses.

Delete

Lets you delete one or multiple selected poses from the Pose browser. To make multiple selections, Ctrl-click poses in the Pose browser.

Rename

The Rename option lets you rename a selected pose or folder in the Pose and Scene browsers.

Add/Remove Namespace

Opens the Add/Remove Namespace dialog box, which displays all the namespaces in the current scene and enables you to you add, replace, or remove namespaces, append namespaces to current namespaces, and prepend namespaces to all objects within a branch.

This menu is available for selected pose(s).

Expand To Selection

Expands any folders containing a selected pose. Folders that are highlighted in light gray contain selected poses.

Collapse Branch

Collapses all branches in the tree, hiding the contents of folders. To collapse all branches, right-click a folder and select Collapse All.

Select and Deselect Branch

The Select Branch option lets you select all the contents in a folder. The Deselect branch option lets you deselect all the selected contents in a folder.

To select a branch, right-click the folder containing the poses you want to select, and choose Select Branch.

To deselect a branch, right-click the folder containing the poses you want to deselect, and choose Deselect branch.

Update Pose Thumbnail

Change the zoom or pan around to a different angle of your pose and click Update to change the pose thumbnail.

This menu is available for selected pose(s).

- Poses on page 1485
- Creating a pose on page 1486
- Match options on page 1493

Character settings

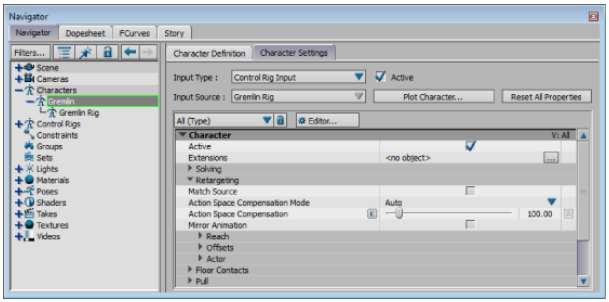
88

The Character Settings let you define your character model, link it to a motion source, and adjust the way it reacts to the motion source. They also let you create and manage your Control rigs.

Keep in mind that the Character Settings let you work with the Character asset. The Character asset works as a template to help you define your model for MotionBuilder and connect it to a motion source. The Character Settings do not adjust the character model itself.

The Character settings consist of two panes:

- Character Definition pane on page 1506
- Character Settings pane on page 1519

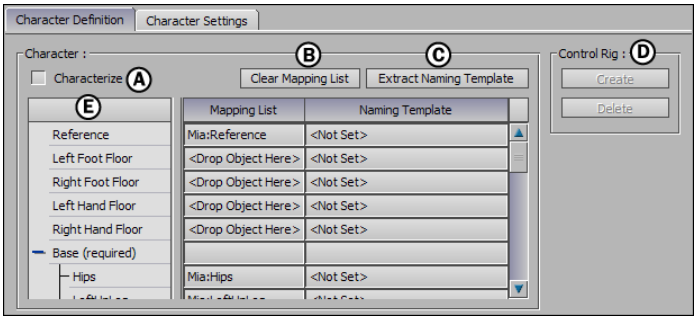


Character Settings

- Character assets on page 1271
- Retargeting animation character-to-character on page 1257
- Control rigs on page 1431

Character Definition pane

The Character Definition pane is where you define and characterize your model, and where you manage your Control rigs.



Character Definition pane *A.* **Characterize option** *B.* **Clear Mapping List button** *C.* **Extract Naming Template button** *D.* **Control Rig area** *E.* **Mapping List**

Characterize option

The Characterize option creates a link between the bone or joint objects defined for your character in the Mapping List and the character engine in MotionBuilder. Since all characterized characters link to this same engine, you can create a library of characters whose animation can be interchanged.

The Characterize option also stores the stance pose of your character, which can act as a starting or rest pose. When creating models for use in MotionBuilder, save your biped or quadruped model in a stance pose. There is a separate recognized stance pose for each type of model. See Bipeds and quadrupeds on page 1290.

Clear Mapping List button

The Clear Mapping List button removes all objects defined in the Mapping List. See Mapping List on page 1506.

Mapping List

The Mapping List is where you define the structure of each character model you bring into MotionBuilder.

The names of all objects that MotionBuilder recognizes as part of the structure of a character model are listed to the left. To define an object as part of your character, select it from your character's skeleton (in the Viewer window, Scene browser, or Schematic view) and Alt-drag it into the corresponding slot of the Mapping List.

For example, to define the Hips, you Alt-drag the Hips object from the character skeleton into the Hips slot of the Mapping List. This is how you tell MotionBuilder "On this character model, this is the hips bone" and so on.

The object you place in each slot of the Mapping List can be a joint, bone, null, or any other object from your model skeleton.

You can also automatically map objects in all the slots by dragging a Character asset on top of your model. This automatically matches the joints or bones in your character skeleton with the appropriate slots, provided your skeleton follows the naming conventions in the Mapping List. See Character mapping on page 1272 for more information on mapping out a character's structure.

To link your model to a motion source successfully, define a joint or bone object in each slot in the Base group of the Mapping List.

Depending on the method used to create your model, you might also have to specify a Reference object and additional Auxiliary, Spine, and Roll objects.

Slots that define particular areas of a character's body are organized into groups that you can expand or collapse as you complete the Character mapping process. The Mapping List is divided into the following slots or groups of slots:

- Reference slot on page 1508
- Left Foot Floor/Right Foot Floor slots on page 1508
- Left Hand Floor/Right Hand Floor slots on page 1508
- Base slots on page 1509
- Auxiliary slots on page 1510
- Spine slots on page 1511
- Roll slots on page 1512
- Special slots on page 1513
- Left Hand/Right Hand slots on page 1514
- Left Foot/Right Foot slots on page 1514
- Left In-Hand/Right In-Hand slots on page 1515

- Left In-Foot/Right In-Foot slots on page 1516
- Neck slots on page 1518
- Props slots on page 1518

Reference slot

While you do not need a Reference object during the mapping process, define an object in this slot to translate, scale, and rotate your entire model. The Reference object acts as the root of your entire model. The ideal reference object is a null or joint parented to your model's hips.

You should define a Reference object in the following circumstances:

- When the hips of your model are parented to another object. This parent is commonly the root of the hierarchy, and is positioned on the floor.
- When you are using data from a specific file format to map to your model. Some file formats require a Reference object.

NOTE Story Character Animation tracks cannot use data mapped to a Character Reference Node as part of its characterization. The Travelling Node in the Character Animation track prevents access to this data.

Left Foot Floor/Right Foot Floor slots

The Left Foot Floor and Right Foot Floor slots are for markers or other objects that represent the floor. You can specify different markers for each foot. Use these slots with the Feet Floor Contact settings (see Toes Floor Contact Setup properties on page 1336).

Left Hand Floor/Right Hand Floor slots

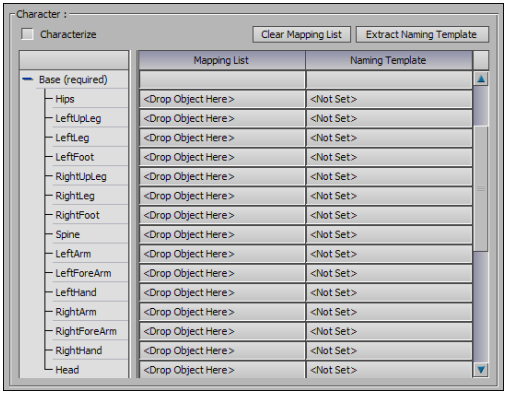
The Left Hand Floor and Right Hand Floor slots are for markers or other objects that represent the floor for the left or right hand of your character. You can specify different markers for each hand. Use these slots with the Hands Floor Contact settings (see Feet Floor Contact Setup properties on page 1328).

NOTE If you leave the floor slots blank, the plane at 0 on the Y-axis (the grid shown in the Producer Perspective camera view) is used for floor contact.

Base slots

The Base group of slots let you define the basic set of bones that are required for any skeleton loaded into MotionBuilder. Map objects into this group of slots in order for MotionBuilder to understand the structure of your character model and its skeleton.

You can name the bones of a skeleton according to MotionBuilder's naming conventions to map objects to these slots automatically. You can also manually map bones to these slots, but either way, these 15 Base bones must be defined.



Base group of (required) objects in the Mapping List

Refer to the following table for a description of each slot in the Base group. See Bone naming conventions on page 1317 to view a simple skeleton illustrating the placement of these bones.

Base slot	Description
Hips	The joint or bone that drives the hips of your model.
LeftUpLeg/RightUpLeg	The joint or bone that drives the upper left/upper right leg of your model. The LeftUpLeg/RightUpLeg joint or bone must be the child of the Hips joint or bone.
LeftLeg/RightLeg	The joint or bone that drives the left/right knee of your model. The LeftLeg/RightLeg joint or bone must be the child of the LeftUpLeg/RightUpLeg joint or bone.

Base slot	Description
LeftFoot/RightFoot	The joint or bone that drives the left/right foot of your model. The LeftFoot/RightFoot joint or bone must be the child of the LeftLeg/RightLeg joint or bone.
Spine	The joint or bone that specifies the chest of the destination skeleton. You can use this slot with the optional Spine slots for characters with a spine. Do not position the Spine joint or bone in the same position as the hips or poor mapping might result.
LeftArm/RightArm	The joint or bone that drives the left/right arm of your model. The LeftArm/RightArm joint or bone must be the child of the Spine joint or bone.
LeftForeArm/RightForeArm	The joint or bone that drives the left/right elbow of your model. The LeftForeArm/RightForeArm joint or bone must be child of the LeftArm/RightArm joint or bone.
LeftHand/RightHand	The joint or bone that drives the left/right hand of your model. The LeftHand/RightHand joint or bone must be the child of the LeftForeArm/RightForeArm joint or bone.
Head	The joint or bone that drives the head of your model. The Head joint or bone must be the child of the Spine joint or bone.

NOTE You are not required to create your model skeleton using the parent to child relationships described in this section. These relationships describe the recommended method of structuring your model skeleton. Feel free to define custom skeleton structures in the mapping list.

Auxiliary slots

The slots in the Auxiliary group are optional. They let you enhance your character by defining objects for the base of the toes and fingers, the neck, and the shoulders.

Auxiliary group of slots in the Mapping List

The following table describes each slot in the Auxiliary group.

Auxiliary slot	Description
LeftToeBase/RightToeBase	The joint or bone that drives the left/right toes of your model. This joint or bone must be the child of the LeftFoot/RightFoot joint or bone.
LeftShoulder/RightShoulder	The joint or bone that drives the left/right shoulder of your model. This joint or bone must be the child of the Spine joint or bone, and must be the parent of the LeftArm/RightArm joint or bone.
Neck	The joint or bone that drives the neck of your model. This joint or bone must be the child of the Spine joint or bone, and must be the parent of the Head joint or bone.
LeftFingerBase/RightFingerBase	The joints or bones that drive the left/right fingers of your model. This joint or bone must be the child of the finger base.

Spine slots

The Spine group of slots let you specify a spine with up to ten vertebrae (nine optional spines + 1 required Spine = 10). See Defining a spine on page 1284 for more information.

	Model	Template Name
+ Auxiliary		
− Spine		
Spine	Rufus:Spine	<Not Set>
Spine1	Rufus:Spine1	<Not Set>
Spine2	Rufus:Spine2	<Not Set>
Spine3	Rufus:Spine3	<Not Set>
Spine4	Rufus:Spine4	<Not Set>
Spine5	Rufus:Spine5	<Not Set>
Spine6	Rufus:Spine6	<Not Set>
Spine7	Rufus:Spine7	<Not Set>
Spine8	<No model>	<Not Set>
Spine9	<No model>	<Not Set>
+ Roll		

Spine group

Roll slots

The slots in the Roll group let you define objects that influence the roll of the bones in the arms and legs.

	Model	Template Name
+ Spine		
− Roll		
LeftUpLegRoll	Beast:LeftUpLegRoll	<Not Set>
LeftLegRoll	Beast:LeftLegRoll	<Not Set>
RightUpLegRoll	Beast:RightUpLegRoll	<Not Set>
RightLegRoll	Beast:RightLegRoll	<Not Set>
LeftArmRoll	Beast:LeftArmRoll	<Not Set>
LeftForeArmRoll	Beast:LeftForeArmRoll	<Not Set>
RightArmRoll	Beast:RightArmRoll	<Not Set>
RightForeArmRoll	Beast:RightForeArmRoll	<Not Set>
+ Special		

Roll group

When you create your model skeleton, we recommend that you add roll bones to the skeleton structure. Roll bones let you achieve more realistic envelope deformations by specifying a percentage of the roll axis movement on specific bones (see Roll Extraction on page 1530).

For you to transfer the roll properly, your bones or joints must be arranged as described in the following table:

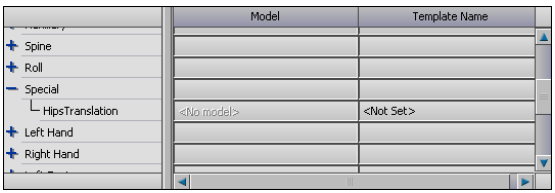
Roll slot	Description
LeftUpLegRoll/RightUpLegRoll	The joint or bone that rolls the LeftUpLeg/RightUpLeg. The LeftUpLegRoll/RightUpLegRoll joint or bone must be the child of the LeftUpLeg/RightUpLeg joint or bone.

Roll slot	Description
LeftLegRoll/RightLegRoll	The joint or bone that rolls the LeftLeg/RightLeg. The LeftLegRoll/RightLegRoll bone or joint must be the child of the LeftLeg/RightLeg joint or bone.
LeftArmRoll/RightArmRoll	The joint or bone that rolls the LeftArm/RightArm. The LeftArmRoll/RightArmRoll joint or bone must be the child of the LeftArm/RightArm joint or bone.
LeftForeArmRoll/RightForeArmRoll	The joint or bone that rolls the LeftForeArm/RightForeArm. The LeftForeArmRoll/RightForeArmRoll bone or joint must be the child of the LeftForeArm/RightForeArm joint or bone.

Special slots

Depending on your model skeleton and the amount of control you want over your animation, you might want to split translation and rotation of the hips between two different joints or bones.

The Special group of slots contains the Hips Translation slot that lets you define a second object for translating your model's hips. If you define a Hips Translation object, the hips translation data goes to that object, while the hips rotation data goes to the original Hips object defined in the Base group.



Special group with Hips Translation slot

The object defined in the Hips Translation slot should be a child of your character's Reference object.

If you choose not to define an object in the Hips Translation slot, both translation and rotation data are sent to the object defined in the Hips slot. See Hips Translation Mode on page 1532.

If you want, you can also select the method used to transfer rotation and translation to the Hips Translation and Hips objects using the Hips Translation Mode on page 1532 option in the Character Solving properties on page 1531.

Left Hand/Right Hand slots

The slots in the Left Hand and Right Hand groups let you define objects to add realistic hand and finger movements to your character. These groups contain slots for thumb, index, middle, ring, and pinky finger objects, as well as slots for an extra finger.

	Model	Template Name
+ Roll		
+ Special		
− Left Hand		
LeftHandThumb1	<No model>	<Not Set>
LeftHandThumb2	<No model>	<Not Set>
LeftHandThumb3	<No model>	<Not Set>
LeftHandThumb4	<No model>	<Not Set>
LeftHandIndex1	Beast 1:LeftHandIndex1	<Not Set>
LeftHandIndex2	Beast 1:LeftHandIndex2	<Not Set>
LeftHandIndex3	<No model>	<Not Set>
LeftHandIndex4	<No model>	<Not Set>
LeftHandMiddle1	Beast 1:LeftHandMiddle1	<Not Set>
LeftHandMiddle2	Beast 1:LeftHandMiddle2	<Not Set>
LeftHandMiddle3	<No model>	<Not Set>
LeftHandMiddle4	<No model>	<Not Set>
LeftHandRing1	Beast 1:LeftHandRing1	<Not Set>
LeftHandRing2	Beast 1:LeftHandRing2	<Not Set>
LeftHandRing3	<No model>	<Not Set>
LeftHandRing4	<No model>	<Not Set>
LeftHandPinky1	<No model>	<Not Set>
LeftHandPinky2	<No model>	<Not Set>
LeftHandPinky3	<No model>	<Not Set>
LeftHandPinky4	<No model>	<Not Set>
LeftHandExtraFinger1	<No model>	<Not Set>
LeftHandExtraFinger2	<No model>	<Not Set>
LeftHandExtraFinger3	<No model>	<Not Set>
LeftHandExtraFinger4	<No model>	<Not Set>
+ Right Hand		

Left Hand group

The number of each slot corresponds with each finger joint. For example, slots numbered with a “1” correspond to the finger or toe’s first joint while slots numbered with a “4” correspond to the finger’s last joint. The last joint or bone in each finger should be mapped to the fourth slot so that the finger tips are properly defined.

To use these slots, your model skeleton must have hands with fingers.

Left Foot/Right Foot slots

The slots in the Left Foot and Right Foot groups let you define the model’s feet and add realistic foot and toe movements to your character. To use these slots, your model skeleton must have feet with toes.

The Foot groups follow the same naming conventions as the Hand groups, so they contain slots for the thumb (big toe), index (second toe), middle (third toe), ring (fourth toe), and pinky (baby toe), as well as slots for an extra toe.

For example, the following figure shows the Left Foot slots in the Mapping List for a Beast character.

	Model	Template Name
Right Hand		
Left Foot		
LeftFootThumb1	<No model>	<Not Set>
LeftFootThumb2	<No model>	<Not Set>
LeftFootThumb3	<No model>	<Not Set>
LeftFootThumb4	<No model>	<Not Set>
LeftFootIndex1	Beast 1:LeftFootIndex1	<Not Set>
LeftFootIndex2	Beast 1:LeftFootIndex2	<Not Set>
LeftFootIndex3	<No model>	<Not Set>
LeftFootIndex4	<No model>	<Not Set>
LeftFootMiddle1	Beast 1:LeftFootMiddle1	<Not Set>
LeftFootMiddle2	Beast 1:LeftFootMiddle2	<Not Set>
LeftFootMiddle3	<No model>	<Not Set>
LeftFootMiddle4	<No model>	<Not Set>
LeftFootRing1	Beast 1:LeftFootRing1	<Not Set>
LeftFootRing2	Beast 1:LeftFootRing2	<Not Set>
LeftFootRing3	<No model>	<Not Set>
LeftFootRing4	<No model>	<Not Set>
LeftFootPinky1	<No model>	<Not Set>
LeftFootPinky2	<No model>	<Not Set>
LeftFootPinky3	<No model>	<Not Set>
LeftFootPinky4	<No model>	<Not Set>
LeftFootExtraFinger1	<No model>	<Not Set>
LeftFootExtraFinger2	<No model>	<Not Set>
LeftFootExtraFinger3	<No model>	<Not Set>
LeftFootExtraFinger4	<No model>	<Not Set>
Right Foot		

Left Foot group of slots

The number of each group of slots corresponds with each toe joint. For example, slots numbered with a “1” correspond to the toe’s first joint while slots numbered with a “4” correspond to the last joint of the toe. Each toe’s last joint or bone should be mapped to an end slot to define toe tips properly.

See Defining toe behavior on page 1275 for more information.

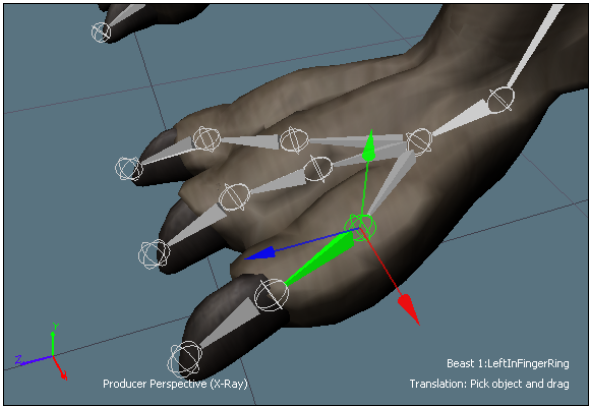
Left In-Hand/Right In-Hand slots

The Left In-Hand and Right In-Hand groups contain optional slots for defining the bones within each hand. These are the joints or bones that link the first joint or bone of each finger to the LeftHandBase or RightHandBase slots.

	Model	Template Name
Left In-Hand		
LeftInHandThumb	<No model>	<Not Set>
LeftInHandIndex	Beast:LeftInFingerIndex	<Not Set>
LeftInHandMiddle	Beast:LeftInFingerMiddle	<Not Set>
LeftInHandRing	Beast:LeftInFingerRing	<Not Set>
LeftInHandPinky	<No model>	<Not Set>
LeftInHandExtra...	<No model>	<Not Set>
Right In-Hand		

Left In-Hand group

For example, the following figure shows a skeleton with bones that are defined in the Left In-Hand optional slots.



Model with left In-Hand bones

The Left In-Hand and Right In-Hand groups contain in-hand slots for each finger (thumb, the index, middle, ring, and pinky), as well as a slot for an extra finger.

Each Left In-Hand/Right In-Hand object must be between the LeftFingerBase/RightFingerBase object and the first joint or bone of each finger. For example, the LeftInRing object must be the child of the LeftFingerBase object. The LeftInRing object must parent the LeftHandRing1 object.

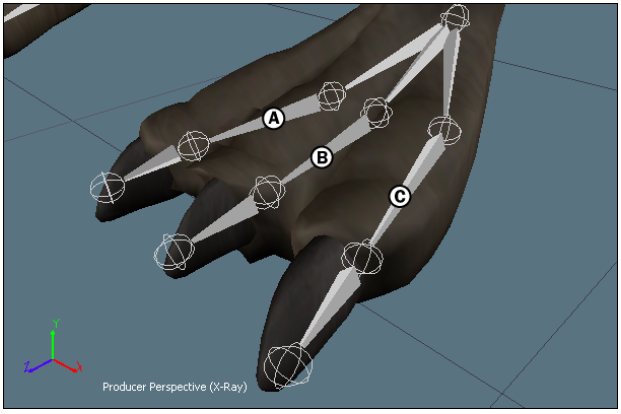
Left In-Foot/Right In-Foot slots

The Left In-Foot and Right In-Foot groups contain optional slots for defining the bones within each foot. These are the bones that link the first joint of each toe to the LeftToeBase or RightToeBase.

	Model	Template Name
+ Right In-Hand		
− Left In-Foot		
LeftInFootThumb	<No model>	<Not Set>
LeftInFootIndex	<No model>	<Not Set>
LeftInFootMiddle	<No model>	<Not Set>
LeftInFootRing	<No model>	<Not Set>
LeftInFootPinky	<No model>	<Not Set>
LeftInFootExtraFinger	<No model>	<Not Set>
+ Right In-Foot		

Left In-Foot group

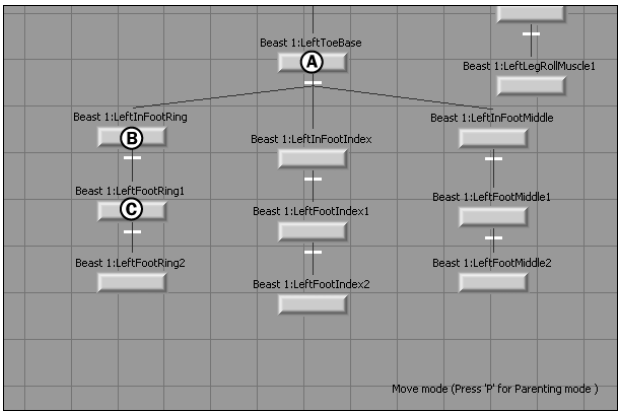
For example, the following figure shows a skeleton with bones defined in the Left In-Foot optional slots.



Left In-Foot objects *A.* **LeftInFootIndex** *B.* **LeftInFootMiddle** *C.* **LeftInFootRing**

The Left In-Foot and Right In-Foot groups contain in-foot slots for each toe (named thumb, index, middle, ring, and pinky), as well as a slot for an extra toe. The naming of these slots is based on the Left In-Hand and Right In-Hand groups as these groups are similar. The LeftInFootThumb slot represents the big toe on the left foot, the LeftInFootIndex represents the second toe on the left foot, and so on.

Each Left In-Foot/Right In-Foot joint or bone must be between the LeftToeBase/RightToeBase and the first joint or bone of each toe. For example, in the following figure, the LeftInFootRing object (B) must be the child of LeftToeBase (A) and the LeftInFootRing object (B) must parent the LeftFootRing1 object (C).



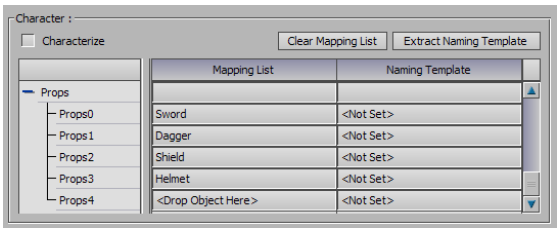
Hierarchy of Left In-Foot objects *A.* **LeftToeBase object** *B.* **LeftInFootRing object** *C.* **LeftFootRing1 object**

Neck slots

The Neck group contains ten slots that let you define multiple neck bones. A biped commonly uses only one neck joint or bone, while a quadruped commonly uses many neck joints or bones.

Props slots

The slots in the Props group let you add up to five prop objects, such as a weapon, umbrella, cane, or other items associated with your character.



Props group

Extract Naming Template button

The Mapping List gives you default naming conventions for all skeleton objects. If you have characters built with bones that have different naming conventions, use the Extract Naming Template button to create your own template of names. See Creating a bone-naming template on page 1319.

A naming template is an *.fbx* file that contains the naming conventions you used on a skeleton. Later, you can use this template to map the bone objects of other skeletons that use your naming conventions automatically. See Applying a bone naming template on page 1320.

Template Names column

This column lists the names of bones that are included in your custom bone-naming template. See Creating a bone-naming template on page 1319 for more information.

Control Rig area

The Control Rig area lets you create and delete Control rigs.

Create

Creates a Control rig for a selected, characterized character. A character can have multiple Control rigs, but only one Control rig can be attached to the character at a time.

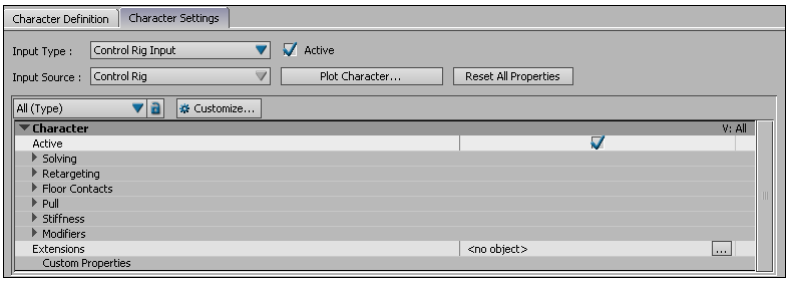
Delete

Deletes a selected Control rig.

- Character settings on page 1505
- Control rigs on page 1431
- Attaching a Control rig to a character on page 1439

Character Settings pane

The Character Settings pane lets you adjust character mapping between a selected data source and your characterized character.



Character Settings pane

The Character settings contain the following main areas:

- Input Type menu on page 1520
- Active option on page 1521
- Plot Character button on page 1521
- Reset All Properties button on page 1522
- Character Properties area on page 1522

Input Type menu

Lets you select the type of motion source you want to drive your character. After selecting the Input Type, then select the specific source from the Input Source menu.

Input Source menu

Lets you choose the specific motion source you want to drive your character.

You can choose between the following four input types and one output type.

Option	Function
Actor Input	Actor Input lets you choose an Actor as the motion source. Actors are used as a link between a character and motion data.
Character Input	Character Input lets you select another character as the source of motion data. For example, you can load one characterized character with animation plotted to its skeleton, then select that character as the input source to drive another character in the same scene.

Option	Function
Control Rig Input	Control Rig Input lets you use a Control rig to manipulate, position, and keyframe your character. You can use Control rigs to create keyframe animation or to modify existing animation. To modify existing animation on a character skeleton, first create a Control rig and plot that animation to the Control rig.
Control Rig Output	Control Rig Output lets you transfer animation from your model skeleton to a Control rig so you can edit it.
Stance Input	Stance Input resets a selected character to its stance pose. In some situations, you might need to redefine your Mapping List and characterize again. For example, if you have irregular envelope deformations caused by characters with conflicting bone rolls, you would need to map between the two characters. Or, you might have a source that is much larger or smaller than the model to which you are mapping. In these cases, select Stance Input, disable Characterize, drag the necessary bones or joints into the list again, then activate Characterize.

Active option

Use Active to enable the link between your model and the input type and source. Once active, you can use the options in the Character Properties area to adjust how your character reacts to the input source.

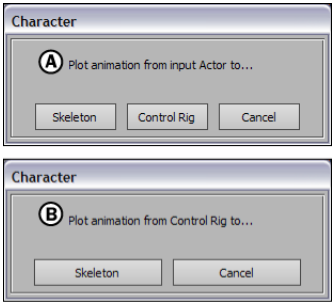
Active also enables the Control rig and lets you use the Character Controls window to begin animating your character.

Plot Character button

Plot Character transfers animation from the selected input source to your model skeleton or Control rig.

Depending on what you select as the input type and source, the dialog box that appears when you click Plot Character presents different options.

For example, in the following figure, the first dialog (A) displays when your input source is an Actor and the second dialog (B) displays if your input source is a Control rig. When your input source is an Actor or another character, you can also plot directly to your model skeleton.



Plotting options for different input sources *A.* **Actor input source** *B.* **Control rig input source**

Reset All Properties button

The Reset All Properties button lets you reset all the mapping options in the Character settings pane to their default values. You can choose to reset all solving and definition properties, only solving properties, or only definition properties.

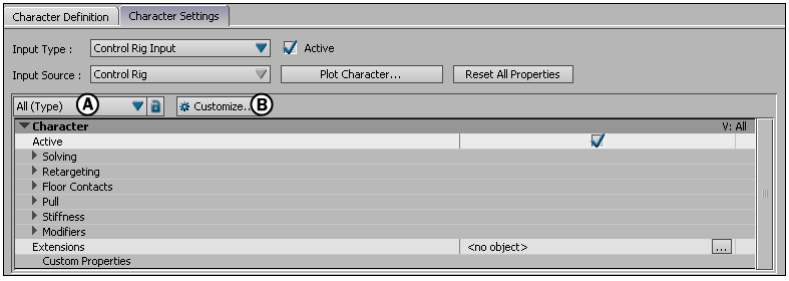
Solving properties include Pull, Resist, Reach, and Stiffness, while Definition properties include Hand Contact Positions and Feet Contact Positions.

Character Properties area

The Character Properties area lets you browse and adjust all of the properties associated with a selected character. You can change how your character reacts to the input source, how the Control rig behaves, whether floor contact for hands and feet are active, and many other properties.

There are seven Property views that list the same options as the Default view. Each view is organized to make it easier to find certain properties. For example, the Pull view only lists properties that pertain to effector pulling in the Control rig.

Use the Property View menu to select the view containing properties you want to work with. You can also click the Customize button to start creating your own view.



Character Settings pane *A.* **Property views menu** *B.* **Customize button**

The Character Properties area includes the following main groups of properties:

- Character Solving properties on page 1531
- Character Retargeting properties on page 1523
- Floor Contact properties on page 1325
- Pull properties on page 1527
- Stiffness properties on page 1528
- Modifiers on page 1530
- Extensions (See Character Extension properties on page 1348.)
- Character Solving properties on page 1531
- Character Retargeting properties on page 1523
- Floor contact on page 1323
- Pull on page 1579

Character Retargeting properties

The Retargeting group of properties lets you define special settings for Actor or character sources. The options in the Actor folder apply only to Actors.

Match Source

Match Source lets you adapt the stride and the position in space of a model to the selected source.

For example, a large model occupies more space when walking than a smaller model. Activating Match Source adapts the motion so that the strides and space between the two models are the same.

When Match Source is disabled, you can translate and rotate your model anywhere in your scene, and retain its mapping to the selected source.

When Match Source is active, you can only scale your model. To translate, rotate, or scale your model, define a Reference object (see Reference slot on page 1508).

Action Space Compensation Mode

This menu lets you choose how you want the Action Space Compensation property to work. By default, the Action Space Compensation Mode is set to Auto.

Option	Function
Off	Turns off Action Space Compensation.
Auto	Action Space Compensation automatically calculates and applies action space to the character and source.
User	Lets you change the value of Action Space Compensation. The higher the value, the longer the character strides are when it walks. The smaller the value, the smaller the strides.

Action Space Compensation

Calculates and compensates for the action space between a character and its source. It moves the character's feet and legs with the movement of the source's feet, but makes adjustments to the feet and leg movements based on scale differences. When Match Source is active, Action Space Compensation is set to 100%.

Match Source must be active for Reach Hands, Reach Feet, and Reach Chest to reach for the source.

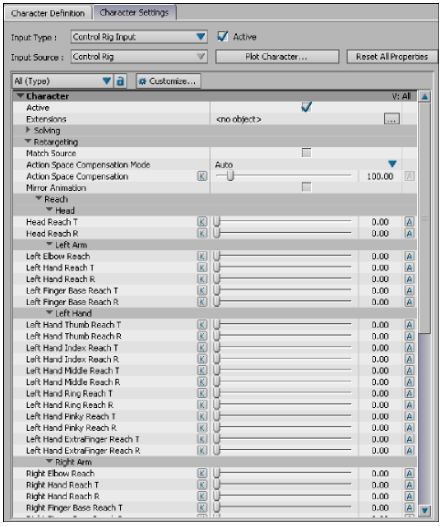
Mirror Animation

Activate Mirror Animation to mirror a character's position along the X-axis. For example, you can activate this option to transfer the source data on the left arm to the right arm, and vice versa.

If your source is a Control rig, activating Mirror Animation mirrors your motion as your animation is plotted from your model skeleton to the Control rig.

Reach

The Reach settings let you specify the percentage you want each specific bone of your character's skeleton to reach toward its motion source. Use the Reach settings when your character's source is either an Actor or another character.



Retargeting > Reach settings

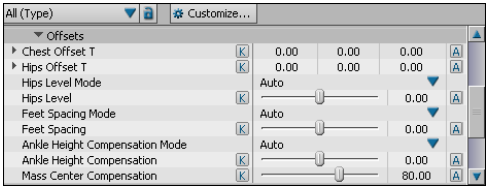
Almost all Reach T and Reach R settings are also accessible from the Character Controls window. Reach is different when your character's source is set to Control Rig In. See Reach and Pull area on page 1575 for more information.

To control the amount of reach, drag the setting's slider, or type a value in the numerical field. Use the following guidelines when manipulating reach with the sliders:

- At 100%, the character's body part reaches fully toward the source's body part.
- At 50%, the character's body part averages between the body part of the source and the character's position.
- At 0%, the effect on the model's specified body part is the same as disabling the option.

Offsets

The Offsets settings let you offset the body parts of your character.



Retargeting > **Offsets settings**

Setting	Function
Chest/Hips Offset T	Use the Chest and Hips Offset Translation options to precisely apply and adjust offsets to the chest and hips. For the offset to affect the chest, the Reach Chest option must be set to any value other than 0.
Hips Level Mode	When set to Off, Hips Level is disabled. When set to User, you can manually adjust the level of the hips by changing the value of the Hips Level. When set to Auto, Hips Level is automatic. By default, the Hips Level Mode is set to Auto.
Hips Level	Lets you control the level of the hips relative to its center of gravity. You can select User, Off, and Auto options from the Hips Level Mode menu.
Feet Spacing Mode	When set to Off, Feet Spacing is disabled. When set to User, you can manually adjust the spacing of the feet. When set to Auto, the Feet Spacing is automatic. By default, the Feet Spacing Mode is set to Auto.
Feet Spacing	Lets you adjust the amount of spacing between the feet of the model relative to the spacing between the feet of the source.
Ankle Height Compensation Mode	When set to Off, Ankle Height Compensation is disabled. When set to User, you can adjust the distance between the model's feet and the floor manually. By default, Auto mode ensures the feet relate correctly to the floor.
Ankle Height Compensation	If the scale of your model and the selected source differ, use Ankle Height Compensation to adjust the distance between the model's foot and the floor. You may also have to adjust

Setting	Function
	this option if your model's feet are large, or if your model has special height requirements (for example, shoes with high heels or boots).
Mass Center Compensation	Smooths leg movements by preventing a character's hips from pulling down too quickly when the legs are moving, and by preventing heavy footfalls.

Actor

The settings in the Actor group apply to an Actor input source. See Retargeting - Actor properties on page 1546.

Pull properties

In the Character Settings, the Pull group of properties let you determine the extent to which certain body parts are affected when other parts of the body are moved. For example, in the Left Arm group of Pull properties, you can adjust the Left Hand Pull Chest slider to adjust the amount that moving the left hand pulls the chest of the character.

These properties are identical to the Pull sliders found in the Character Controls window, with one exception. The "Extra" folder in the Pull group of properties includes the Pull Iteration Count option. The Pull Iteration Count can be animated, and it lets you set the number of times Pull is calculated. The greater the number of iterations, the more accurate the Pull calculation. However, a higher number of iterations may decrease system performance. By default, the Pull Iteration Count is set to 10.

NOTE When your input source is a Control rig and Full Body or Body Part keying mode is selected, Pull values are ignored during character manipulation. Pull settings are only observed when you play your animation. To view the effects of Pull while manipulating your character, disable Reach Override in the Character Controls window.

- Character settings on page 1505

Stiffness properties

In the Character Settings, the Stiffness group of properties let you determine the extent to which certain body parts resist when being transformed.

By default, the stiffness settings are set to replicate human movement. Some body parts that typically start by moving slowly, such as the hips, take more time or a more exaggerated movement to move quickly.

To control the amount of stiffness, drag the setting's slider, or type a value in the numerical field. Use the following guidelines when manipulating stiffness:

- At 100%, the body part is stiff and resists transformations.
- At 50%, the body part averages between fully stiff and fully fluid movement. Transformations start off slow and gradually speed up.
- At 0%, the body part moves fluidly and constantly without a slow start.

NOTE When your input source is a Control rig and Full Body or Body Part keying mode is selected, stiffness values are ignored during character manipulation. Stiffness settings are only observed when you play your animation. To view the stiffness while manipulating your character, disable Stiffness Override in the Character Controls window.

Some body parts have additional stiffness settings or function differently than described above. Additional settings and exceptions are described in the rest of this section.

Hips Stiffness

The Hips Stiffness setting lets you set the percentage of resistance for the hips. You can also expand the Hips stiffness setting to view the Enforce Gravity setting.

Setting	Description
Enforce Gravity	Forces the character's hips between its feet. By default, Hips Enforce Gravity is set to 60%. You must set Hips Stiffness to a value other than zero to take advantage of the Enforce Gravity setting.

Left/Right Arm Stiffness

The left/right arm stiffness settings include additional settings for adjusting the stiffness and limits of elbow bending. Left/Right Arm Stiffness must be set to a value other than zero to take advantage of these additional stiffness limits.

Setting	Description
Left/Right Elbow Max Extension	Use this setting to damp the left or right arm as it fully extends, to prevent elbow and limb snapping. The higher the value, the more gradually the limb extends. By default, a value of 50 corrects most limb snapping.
Left/Right Elbow Compression Factor	Use these settings to change the stiffness of an extended arm as it bends. At 100% (full effect) the extended arm doesn't bend, but instead pushes the character's chest, moving the character.

Spine Stiffness

Spine Stiffness is effective on Characters that have complicated spines. This option stiffens the rotation of a Character's spine so that bending the character appears more rigid when bending.

At 100%, the spine is rigid. Bending is not compensated for by every spine object. At 0%, the effect is the same as disabling the option, so the spine bends freely.

Left/Right Leg Stiffness

The left/right leg stiffness settings include additional settings for adjusting the stiffness and limits of knee bending. Left/Right Leg Stiffness must be set to a value other than zero to take advantage of these additional stiffness limits.

Setting	Description
Left/Right Knee Max Extension	Use these settings to damp the leg as it fully extends, to prevent knee and limb snapping. The higher the value, the more gradually the limb extends. By default, a value of 50 corrects most limb snapping.
Left/Right Knee Compression Factor	Use these settings to change the stiffness of an extended leg as it bends. At 100% (full effect) the extended leg doesn't

Setting	Description
	bend, but instead pushes the character's hips, moving the character.

■ Stiffness Override on page 1566

Modifiers

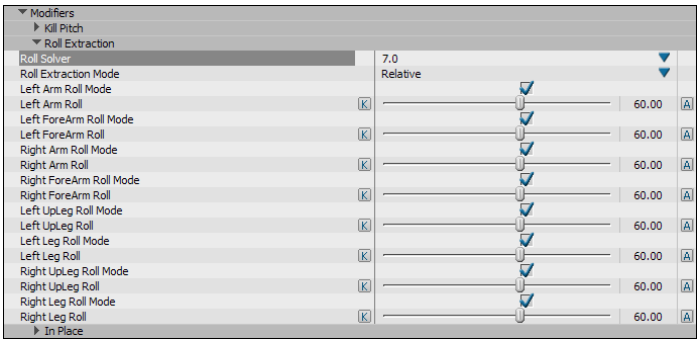
In the Character Settings, the Modifiers group of settings let you alter movements in various ways.

Kill Pitch

The Kill Pitch options let you remove the pitch axis on the left or right knees and elbows.

Roll Extraction

The settings in the Roll Extraction group adjust the roll of arms and legs, and work with the optional roll bones defined in the Roll group of slots (see Roll slots on page 1512).



Modifiers > Roll Extraction settings

Roll Solver

This menu lets you choose to use the MotionBuilder 7.0 Roll Solver or the MotionBuilder 7.5 Roll Solver. The Roll Solver is set to version 7.0 by default.

Select the 7.5 Roll Solver if you want the local axes of IK effectors for the elbows and knees to always sync with the local axes of the first FK roll objects in the arms and legs, and if you want to ensure that upper arm and leg Roll Extraction solving is always done correctly as you manipulate the elbows and knees.

Roll Extraction Mode

This menu lets you select Absolute or Relative.

The rest of the Roll Extraction settings let you specify the bones that receive a percentage of the roll axis movement. For example, if your model's forearm includes a roll bone, you can transfer part of the roll animation onto the roll bone using the Left or RightForeArm Roll settings.

To specify how much of the roll transfers from the limb to the roll object (the default setting is 60%), set a percentage using the following guidelines:

- At 100%, all of the roll transfers from the original limb to the roll bone, moving the roll bone and its parent.
- At 50%, the roll is equally distributed between the limb and the roll bone.
- At 0%, none of the roll is transferred to the rest of the limb, moving only the roll bone.

Solvers

Solving is the process of calculating the position of objects, then applying these results to the linked model. In MotionBuilder, solving is a term for the result of all calculations, rigs, and settings when using the character or physical solving engine.

Character Solving properties

The Solving group of properties in the Character Settings let you define how specific movements are solved.

Character Type

Switches your Control rig and Character type between a biped or quadruped posture type. Since biped and quadruped characters are different in structure, changing the posture type may produce unexpected results.

Fingers Solving

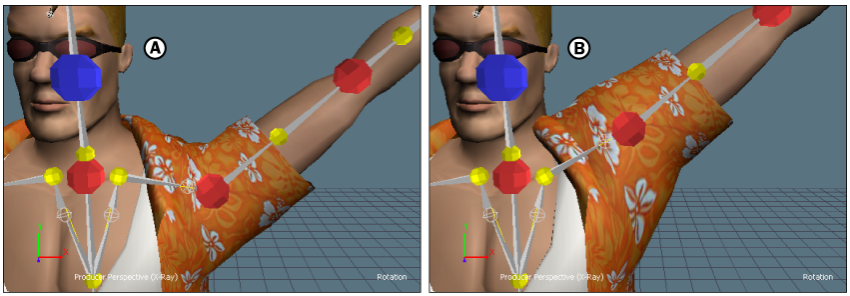
Use the Fingers Solving setting to enable or disable IK solving for fingers. In certain cases, for performance reasons, you may want to disable IK solving.

Realistic Shoulder Solving

When human shoulders rotate, they move upwards. To replicate this behavior, use the Realistic Shoulder Solving setting to adjust the amount of rotation that is applied to the shoulders when the upper arms rotate.

For example, in the following figure (A), displays a character when its upper arm is rotated with Realistic Shoulder Solving set to 0 (disabled). When the upper arm rotates, the rotation is not properly transferred to the shoulder bone, resulting in poor movement.

In the following figure, B, the character's upper arm is rotated with Realistic Shoulder Solving set to 100 (full). When the upper arm rotates, 100 percent of the rotation is transferred to the shoulders. Since the shoulder bones rotate, the character's shoulders appear to translate upwards in the same manner as human shoulders.



Upper arm rotated *A.* **Realistic Shoulder Solving disabled (set to zero)** *B.* **Realistic Shoulder Solving set to full (100)**

By default, Realistic Shoulder Solving is set to 0.

Hips Translation Mode

If you have defined a Hips Translation object in the Special group of slots, the Hips Translation Mode setting lets you select whether rotation data is applied to that object.

If you select World Rigid as the Hips Translation mode, rotation data is applied only to the Hips object defined in the Base group of slots. If you select Body Rigid as the Hips Translation mode, rotation data is applied to both the Hips

object defined in the Base group of slots, and to the Hips Translation object defined in the Special group of slots.

in the Base group *and* the Hips Translation object defined in the Special group, or if it is applied *only* the Hips object defined in the Base group.

This is useful when you have defined a second object for translating your model's hips and you do not want the second object to receive rotation data.

To use this setting, you must define a Hips Translation object (see Special slots on page 1513).

Setting	Description
Body Rigid	Sends rotation to both the Hips and Hips Translation objects.
World Rigid	Sends rotation only to the Hips object, but not the Hips Translation object.

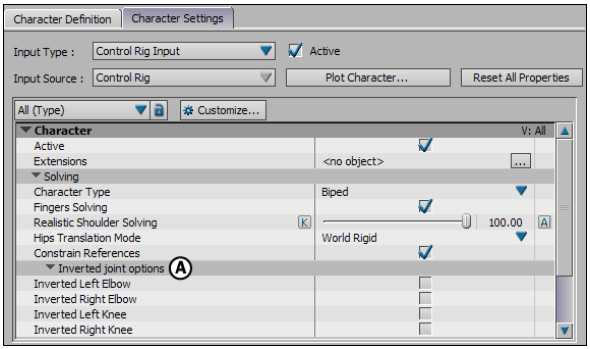
Constrain References

Activate this option if you are working with a project created in a previous version of MotionBuilder. Activating Constrain References constrains the Control rig reference object to the character Reference object.

Inverted joint options

The Inverted joint options let you change the way a character's knees and elbows bend as you manipulate the legs and arms.

These options can be especially useful if you are animating a bird, such as a flamingo or ostrich.

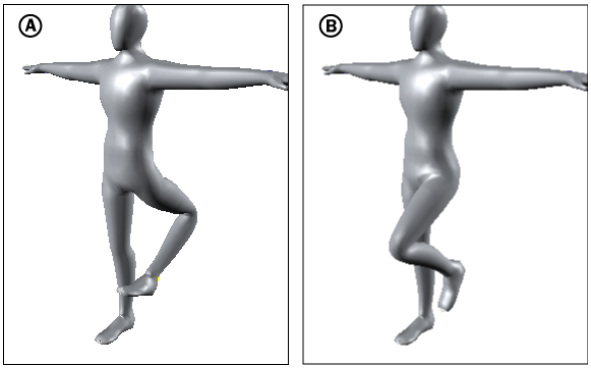


Character Settings *A.* **Inverted joint options**

WARNING Always turn the Inverted joint options on or off before manipulating your character.

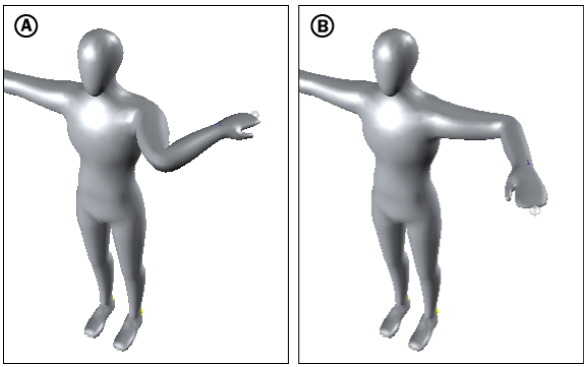
Option	Description
Inverted Left Elbow	When this option is activated, the character's left elbow bends backward as you manipulate the arm. When disabled, the character's left elbow bends normally.
Inverted Right Elbow	When activated, the character's right elbow bends backward as you manipulate the arm. When disabled, the character's right elbow bends normally.
Inverted Left Knee	When this option is activated, the character's left knee bends backward as you manipulate the leg. When disabled, the left knee bends normally.
Inverted Right Knee	When this option is activated, the character's right knee bends backward as you manipulate the leg. When disabled, the right knee bends normally.

In the following figure, the left leg is manipulated with the Inverted Left Knee turned on (see A) and with the Inverted Left Knee turned off (see B).



Left leg manipulated *A.* **Inverted Left Knee turned on** *B.* **Inverted Left Knee turned off**

In the following figure, the left arm is manipulated with the Inverted Left Elbow turned on (see A) and with the Inverted Left Elbow turned off (see B).

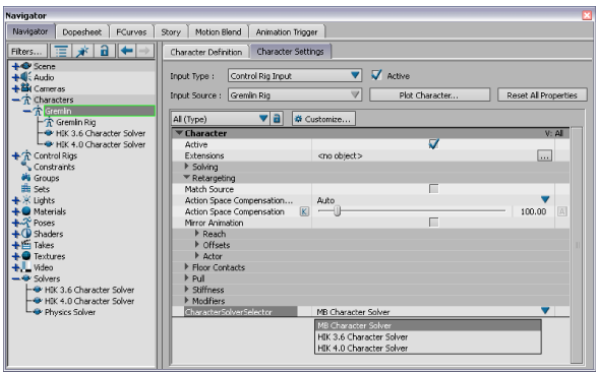


Left arm manipulated *A.* Inverted Left Elbow turned on *B.* Inverted Left Elbow turned off

Character Solver selector

The Character Solver selector menu lets you choose between MotionBuilder's default Character solver and any additional HumanIK libraries you may have added.

For more about HumanIK, see HumanIK (HIK) character solving on page 1541.



Character Solver Selector menu

NOTE To view any solvers other than the MotionBuilder Default Character solver, you must add an additional HIK solver to the character. You can add the HIK 4.0 Character solver or the HIK 3.6 Character solver into the scene by default.

Physics solver

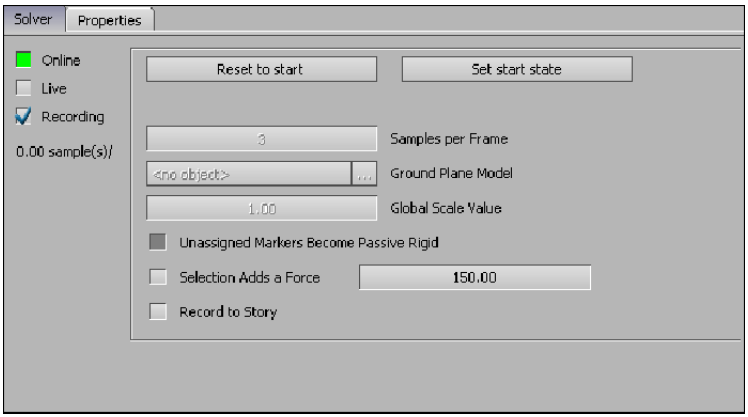
The Physics world is a reflection of dynamic elements from a scene, that is, any object with a property attached to it.

NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.

Solver pane

The Physics Solver pane are the controls you use to activate and record Rigid Body, Ragdoll, and Joint solving.

NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.



Physics solving indicators

These indicators are also buttons you can use to activate or disable Physics solving.

Indicator	Function
Online	Activates or "turns on" physics solving. In the Properties window, the Online option is referred to as "Active". **NOTE** You cannot add Physical properties (for example Rigid Body, Ragdoll or Joint) to objects while the Physics solver is online.
Live	Starts the physics solving behavior. Use the Live button as a testing area where you can actvate the solve independently of the timeline so you can test the manipulations and interaction of the objects. When the physics solving behavior is tuned appropriately, click Record to record the key-frame data. In the Properties window, the Live option is referred to as "Live State". **NOTE** When you set the Physics Solver to Live, if you select an object that has a Physical property, such as Ragdoll, Rigid Body, or Joint attached to it, you need to deselect the object otherwise the object will ignore the Physics Solver. If the Physical property object is selected when the Physics Solver is Live during recording, the FCurves are re-evaluated based on the Frame Rate shown in the Transport Controls.
Recording	Indicates that the physics solving is ready for recording. In the Properties window, the Recording option is referred to as "Record State".

NOTE When you want to record solving, make sure that the Online, Live, and Recording indicators are active and then press the Record in the Transport controls. See Creating a character collapse with Ragdoll on page 1697 ,Creating collision effects on page 1722, and Creating a Joint reaction on page 1680 for how to record solving behavior.

Reset to Start

Click the Reset to Start button to define the position from where your animation starts.

Set Start State

Click the Set Start Stste button to restore the affect object or model to its Start State.

NOTE If the Live button is active, the solving begins immediately after you click Reset to Start. To restore the object or model to the starting position without starting to immediately solve, disable the Live button.

Sample per Frame field

Set a value in this field to increase or decrease the precision of the solve record.

This field sets the number of keys/samples that you are going to take per frame. By default it is set to 3 so that the solve takes 3 keys per frame.

TIP The more you capture, the better the solve, and you can avoid problems like tunnelling. However, setting a higher amount to create high-quality solve creates performance speed issues.

Currently this field does not support decimal values, such as 0.5, as it increases the occurance of tunnelling problems.

Ground Plane Model field

Alt-drag an object or objects from the Viewer window or Schematic view into this field to define it as the “floor” to which the Physics solve will refers. You can also select an object from the Asset Selection list.

Global Scale Value

Sets a global scale.

Unassigned Models become Passive Rigid Bodies option

Activate this option when you want to create rigid, non-active assets from any un-assigned objects in the scene.

Selection adds a Force

When this option is active, the Physics solving creates a reaction whenever you click an object or model with the mouse. Activate this option to “tickle” or “poke” the object or model to provoke action. This is useful for testing Physics settings; activate Live, let objects fall, and click them to push them around. This way you can test things like friction, slip, and their interaction.

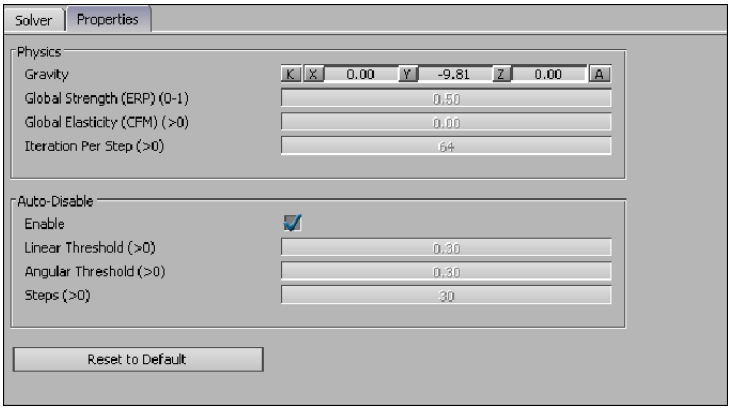
NOTE If you select an object in the Navigator window or Schematic view that has the Selection Adds a Force setting active, force is applied and the object moves.

Record to Story

Record the solve to the story window as an animation track.

Properties pane

The Physics solver Properties pane lets you specify basic constraints or default conventions that govern the solving behavior.



NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.

Physics area

The following options are in the Physics area.

Gravity

This is Global gravity force vector for the X, Y, Z axes. The default setting is -9.8 meters squared along the Y-axis.

Global strength/elasticity fields

Lets you enter a value to specify how globally flexible or rigid you want the solve be.

Iterations per Step

Lets you set the number of iterations per one simulation step. The more iterations per step you use, the better the result.

Autodisable area

The Autodisable area contains settings for creation of thresholds beyond which the Physics solver will cease to solve. This lets you save system resources by disallowing solving behavior that is no longer visible.

Enable

You can activate or disable every simulated object. When you disable an object, it does no longer participates in the simulation, and is not updated. You can only perform Collision detection with two enabled objects, or an enabled object and a disabled object.

NOTE When you activate auto-disabling, any object that comes to rest is then disabled. This is also used manage key amounts; when you disable an object, keys are no longer added to FCurves.

Linear Threshold

Lets you set a linear velocity limit for disabling an object. When you specify a Linear Threshold value, you create a limit so that when the Linear Velocity goes below this clamp, it is disabled.

Angular Threshold

Let you sets angular velocity limit for disabling an object. Once the Angular velocity goes below a specific value, it clamps and disables the object.

Steps

Let you set the number of simulation steps that an object requires to be idle before it is disabled. Set a value for how many steps the action performs before the object is considered dropped. The lower the number, the faster it becomes inactive.

Overwriting animation data

When you use the Physics solver to write animation data to an object, it writes the data into the Translation and Rotation channels of the object. For a Character it writes the data on the Control rig effectors.

If you do not want this to happen, store the animation you want to use in the solve in another Take. Then, use this take as an input and record onto yet another Take. (You can also copy the take and record over it.)

The overwrite occurs when you plot or record, and a dialog box appears to ask if you want to overwrite the current take. If you choose yes, and you are on the same track, your animation data is overwritten.

HumanIK (HIK) character solving

MotionBuilder uses the HumanIK 4.0 and HumanIK 3.6 middleware libraries as plug-ins to perform Character solving. This way, users can benefit from the latest HumanIK technology.

The Character Solver Selector menu, located in the Character Settings pane lets you select between HumanIk libraries (if applicable). See Character Solver selector on page 1535 for more on switching solver libraries.

NOTE You must have an additional HumanIK library to view anything other than the MotionBuilder default Character Solver.

What is HumanIK?

Autodesk® HumanIK® animation middleware is a run-time full-body inverse kinematics (IK) solver. It is also a run-time retargeting engine for characters of differing size, proportions and skeletal hierarchy.

HumanIK offers developers a modular component for the development of their animation tool-chain and run-time game engine. HumanIK is a highly modular, multi-threaded library, optimized for use with the following platforms:

- Microsoft Windows (32-bit and 64-bit)
- XBox®, XBox 360™
- Sony PlayStation® 2 and PlayStation 3
- Nintendo Wii
- Apple Mac (PowerPC® and Intel)

Designed for integration into animation engines, HumanIK works in unison with third-party solvers and middleware components, such as physics and simulation engines. See Switching to HIK solving on page 1544.

What is new in HumanIK 4.0 release

The following provides an overview of the HumanIK 3.6 changes:

- Improved finger retargeting
- Improved knee response to ankle rotations
- New sample framework
- Character State internal pointers removed
- New licensing mechanism
- New logging information

What is new in HumanIK 3.6 release

The following provides an overview of the HumanIK 3.6 changes:

- Low-level of Detail solvers
- Degrees of Freedom (DoF)
- Oriented floor contact
- Inverse joint support
- Squash 'n' stretch
- New Collar node
- Collar Node stiffness control
- Additional chest effector offsets
- Maximum extension angles for knees and elbows
- Improved data synchronization for Character States and Effector Set States
- Improved data synchronization for Character States and Effector Set States
- Support for local space transforms
- Added platforms
- New samples
- Debugging library
- Modular solving
- Prefetching on XBox 360
- Subordinate topics

MotionBuilder HumanIK limitations

The following are not currently supported by the MotionBuilder HumanIK library:

- No support for Align Control rig
- No support for Double evaluation
- No support for Output Control rig

- Character Poses continues to use internal evaluation
- Story continues to internally retarget on the Character

NOTE Refer to the MotionBuilder readme for the latest updates on HumanIK integration.

The MotionBuilder HumanIK library does not support:

- Old (MotionBuilder 5.5) Limits

Switching to HIK solving

To switch to HIK solving:

1. Drag an HIK solver from the Asset browser Solvers folder on top of a character in the Viewer window or Scene browser.

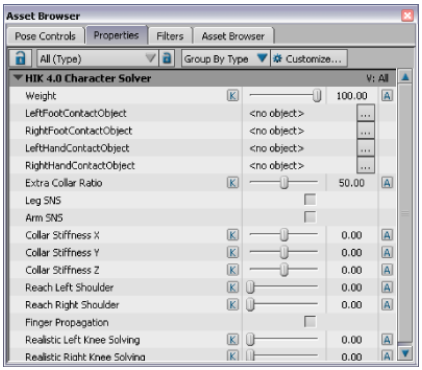
   This adds the HIK constraint to the solver list for this character.

2. In the Navigator window, expand the Characters folder, expand the Character that you applied the solver to, and double-click it.

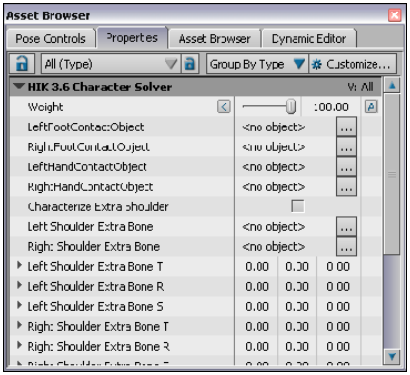
   NOTE You can also expand the Solver folder in the Navigator window and double-click the solver.

3. To view the HIK solver properties, expand the HIK solver in the Properties .

   The solver features displays in the Properties window.



HIK Properties



HIK properties

In Place

When the In Place options are activated, you can lock the overall translation of a character's animation on any axis. This lets you visualize a smooth loop of sequences such as walk cycles without having the character jump from one position to another as the play cursor reaches the end of the timeline.

Lock X

Locks the translation of the character's animation on the X-axis.

Lock Y

Locks the translation of the character's animation on the Y-axis.

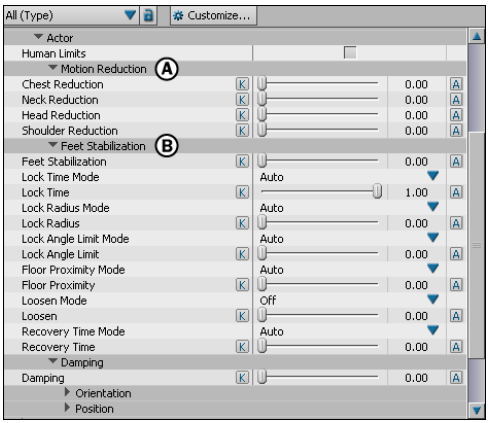
Lock Z

Locks the translation of the character's animation on the Z-axis.

■ Character settings on page 1505

Retargeting - Actor properties

In the Retargeting group of properties within the Character Settings, the Actor properties can adjust a character's Actor input source.



Retargeting > **Actor settings** *A.* **Motion Reduction group** *B.* **Feet Stabilization group**

Human Limits

Human Limits prevent a character from bending a body part in an unrealistic way, while still reaching with its hands and feet.

While the character's movement may change slightly when Human Limits is activated, it is better to have a character that moves correctly than to exactly match your model's movement without considering physical human limits.

Motion Reduction

The Motion Reduction group of settings lets you reduce the amount of motion transferred between the chest, neck, head, and shoulder body parts of your Actor to the corresponding object of your character.

Use Motion Reduction if, for example, the chest, neck, head, or shoulder sensors of your Actor are poorly captured, or when the Actor's Marker set does not provide good capture data.

Increasing the Motion Reduction percentage is similar to applying damping. For each Motion Reduction property, use the following guidelines:

- At 0%, the full movement is transferred between the Actor and character. There is no motion reduction.
- At 50%, half the movement is transferred resulting in damping between Actor and character. For example, setting Head Reduction to 50% results in half the character's head movement coming from the Actor's head. The other half of the movement is based on other objects in the character hierarchy.
- At 100%, no movement is transferred, and the character's movement is based entirely on the other objects in the hierarchy.

Chest Reduction

A reduction percentage between 0% and 100% averages the movement between the chest object and the Hips object. Chest refers to all required and optional Spine objects. This means that Chest Reduction also affects all Spine objects.

Neck Reduction

A reduction percentage between 0% and 100% averages the movement between the Neck object and the chest. When set to 100% the neck moves at a set distance from the chest, and may result in stiff, unnatural movement since no movement is transferred to the Neck object.

Head Reduction

Adjusts the percentage of reduction when transferring motion from the Actor's head to the character's head object.

Shoulder Reduction

A reduction percentage between 0% and 100% averages the shoulder movement between each Shoulder object and the Chest object.

Feet Stabilization

The settings in the Feet Stabilization group of settings let you stabilize the feet of your model. This may be necessary in certain situations, such as when you have data with noise that causes your model's feet to jitter.

Lock Time Mode

When set to Off, Lock Time is disabled. When set to User, you can manually specify the number of frames for the Lock Time. By default, Auto mode is selected, and Lock Time calculates the number of frames automatically.

Lock Time

Sets the feet to stationary after a specified number of frames, where the feet have not moved outside the specified range (Lock Radius and Lock Angle Limit).

Lock Radius Mode

When set to Off, Lock Radius is disabled. User mode lets you change the Lock Radius property manually. Auto mode is selected by default, and automatically calculates the Lock Radius.

Lock Radius

Sets the radius tolerance before foot stabilization is unlocked.

Lock Angle Limit Mode

When set to Off, Lock Angle Limit is disabled. Selecting User mode lets you manually adjust the angle tolerance. Auto mode calculates the angle tolerance for you, and is the default option.

Lock Angle Limit

Sets the angle tolerance before foot stabilization is unlocked.

Loosen Mode

When set to Off, the Loosen property is disabled. The User mode lets you manually adjust the Loosen property. By default, Auto mode is selected, automatically setting the Loosen property.

Loosen

Loosens the effect of stabilization, resulting in a less rigid effect.

Recovery Time Mode

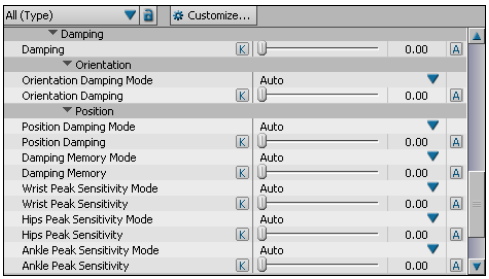
When set to Off, the Recovery Time property is disabled. By default, Auto mode is selected, which automatically calculates the Recovery Time. Select User mode to define a customized Recovery Time.

Recovery Time

Sets the number of frames to move the foot to a new position after unlocking stabilization.

Damping

The Damping group of settings consists of the Orientation and Position Damping settings.



Retargeting > Actor > Damping group of settings

Orientation

There are two properties in the Orientation group.

Property	Description
Orientation Damping Mode	When set to Off, Orientation Damping is disabled. When set to User, you can manually define damping values for

Property	Description
	the hips and ankles. By default, Auto mode is selected, and automatically defines Orientation Damping.
Orientation Damping	Lets you damp the orientation of hips and ankles.

Position

The Position properties for the Damping group include the following options.

Option	Description
Position Damping Mode	If Position Damping Mode is set to Off, Position Damping is disabled. User mode lets you change the Position Damping property manually. Auto mode is selected by default, and automatically calculates the Position Damping.
Position Damping	Clamps positions, prevents sudden changes in movement, and removes peaks and filter noise.
Damping Memory Mode	When set to Off, Damping Memory is disabled. Selecting User mode lets you customize the time across which damping applies. Auto mode calculates the Damping Memory for you, and is selected by default.
Damping Memory	Specifies the time (in frames) across which damping applies to the hips and feet.
Wrist Peak Sensitivity Mode	When set to Off, Wrist Peak Sensitivity is disabled. User mode lets you manually adjust the level of sensitivity for quick wrist movements. By default, Auto mode is selected, and automatically sets Wrist Peak Sensitivity level.
Wrist Peak Sensitivity	Specifies the sensitivity to quick movements of the wrists.
Hips Peak Sensitivity Mode	When set to Off, Hips Peak Sensitivity is disabled. By default, Auto mode is selected, which automatically calculates the level of Hips Peak Sensitivity. Select User mode to define a customized level.
Hips Peak Sensitivity	Specifies the sensitivity of the hips to quick movements.

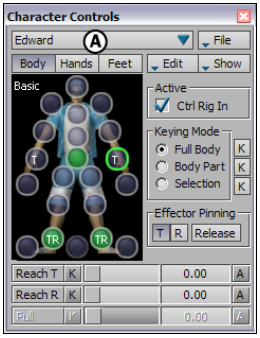
Option	Description
Ankle Peak Sensitivity Mode	When set to Off Angle Peak Sensitivity is disabled. Selecting User mode lets you manually adjust the level of sensitivity. Auto mode calculates the level of Ankle Peak Sensitivity for you, and is the default option.
Ankle Peak Sensitivity	Specifies the sensitivity to quick movements of the ankles.

- Character settings on page 1505

Character Controls

89

The Character Controls window helps you animate a character model using a Control rig, lets you select the motion source for the current character, and lets you plot animation to the character model.



Character Controls window
A. **Current Character menu**

The Character Controls window is made up of the following main options and areas:

- Current Character menu on page 1554
- File menu on page 1554
- Character Representation on page 1554
- Edit Menu on page 1560
- Show menu on page 1566
- Active area on page 1569
- Keying Mode area on page 1569
- Effector Pinning area on page 1574
- Reach and Pull area on page 1575

Current Character menu

The Current Character menu displays the name of the selected character. Use this menu to select a character from your scene. You can also select characters in the Scene browser.

File menu

The File menu contains the following two options, which let you quickly save and load character animation.

Load Character Animation

Lets you automatically retarget, copy, or plot animation to the current character.

When you select this option, an Open File dialog box appears to let you select the animation you want to load. For best results, select an *.fbx* file that contains motion capture or keyframe animation that was saved using the Save Character Animation option. If you select more than one *.fbx* file to load at the same time, the files are loaded in alphabetical order.

When you click Open in the Open File dialog box, the Load Character Animation Options dialog box on page 1581 appears. See Load Character Animation Options dialog box on page 1581.

Save Character Animation

Lets you quickly save the current character's animation. You can choose to save the Control rig with one or multiple takes.

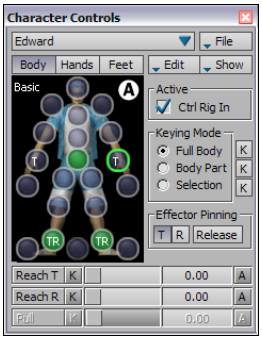
When you select this option, the Save File dialog box opens, which lets you specify the *.fbx* file name and saving location. When you click Save, the Save Character Animation Options dialog box on page 1585 appears.

See Saving character animation on page 257 for more information.

Character Representation

The Character representation displays an image of a biped character and all the effectors you can use to animate its Control rig. Each effector in the Control

rig is represented by a circular cell on the Character representation. These cells provide visual feedback on the pinning, reach, and pull defined for each effector, and also let you create and select Auxiliary effectors and pivots.



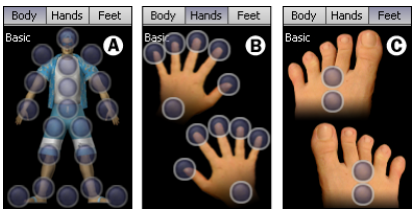
Character Controls window
A. **Character representation**

All effectors in the Character representation work in conjunction with the Control rig, Keying Mode area, Effector Pinning area, and Reach areas.

Before you can use any of the cells in the Character representation, the current Character must be characterized and Active.

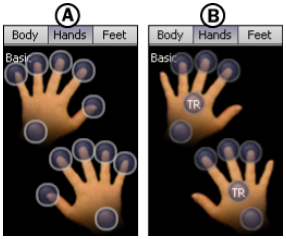
Body, Hands, and Feet

The Body, Hands, and Feet options above the Character representation let you choose to display effectors for the body, hands, or feet.



A. **Body effectors** *B.* **Hand effectors** *C.* **Foot effectors**

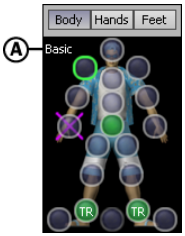
When the source of the current Character is a Control rig, only the character's defined fingers and toes display cells in the Hand and Foot representations. For example, in the following figure B shows the Hand representation for a quadruped with only three fingers.



A. **Default Hand effectors with no active character** *B.* **Hand effectors for a quadruped character with only 3 fingers defined.**

Basic and Expert Modes

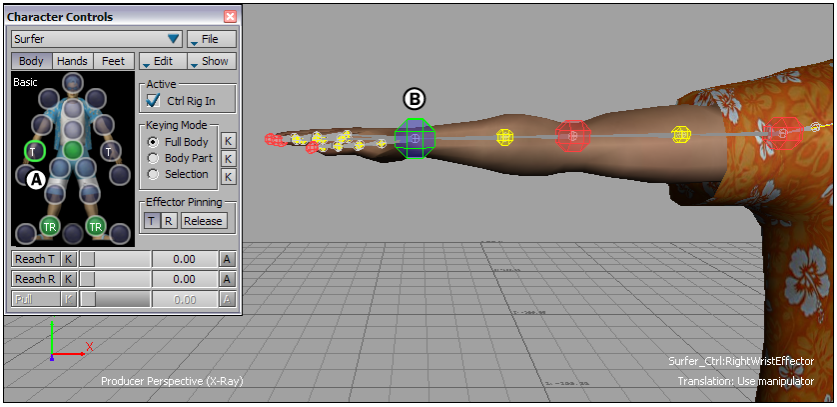
At the top left corner of the Character representation, the Basic or Expert label displays, indicating whether you are in Basic or Expert mode. See Expert Mode on page 1564 for more information.



Character representation *A.* **The Basic mode label**

Effector cell feedback

When you select an effector cell, its corresponding IK rig effector is selected in the Viewer window. In the Character representation, selected effector cells display with a green circle.



Selecting cells *A*. Selected cell for Right Wrist effector in Character representation *B*. Effector shown in the Viewer window

When the source driving your character is a Control rig, cells in the Character representation also indicate whether each effector is pinned in translation or rotation. The following table describes the various visual feedback that can display on Character representation cells:

Feedback	Meaning
T	The corresponding effector has translation pinning.
R	The corresponding effector has rotation pinning.
T and R	The corresponding effector has both translation and rotation pinning.
Empty	An empty cell indicates that the corresponding effector has no translation or rotation pinning.
White circle	The corresponding effector is part of a selected body part. This is most visible when in Body Part Keying mode.
Green circle	The corresponding effector is selected.
Blue X	The corresponding effector has a selected Auxiliary pivot. When you click a cell with a blue X, the Auxiliary pivot is selected, not the effector itself. See Selecting Auxiliary effectors and pivots on page 1474.
Purple X	The corresponding effector has a selected Auxiliary effector. When you click a cell with a purple X, the Auxiliary effector is selected, not

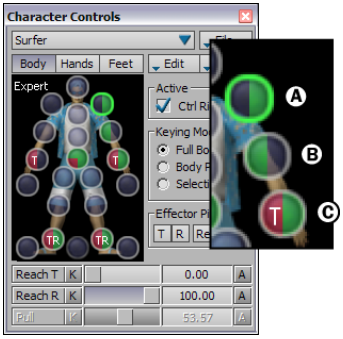
Feedback	Meaning
	the effector itself. See Selecting Auxiliary effectors and pivots on page 1474.
White X	The corresponding effector has Auxiliary objects, but the effector itself gets selected if you click this cell.

Reach and Pull Feedback

Cells in the Character representation can also display the amount of reach between the Control rig's IK and FK effectors, and each effector's amount of pull.

NOTE When you select Control rig as the input source, the pull slider and pull feedback are only available in Expert mode.

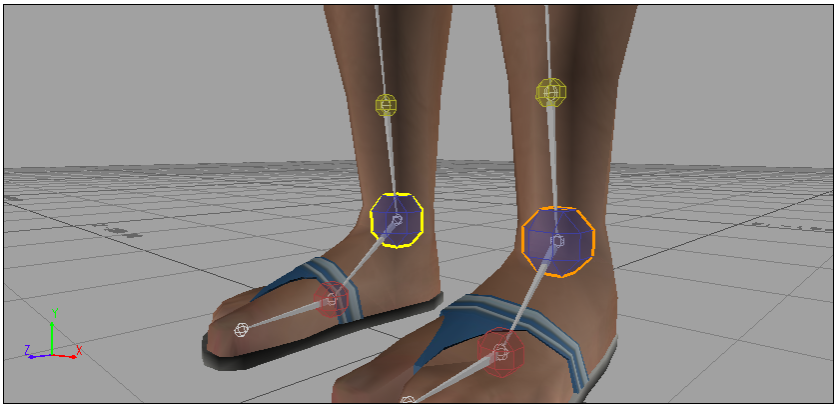
Each cell's left half indicates the amount of translation reach while each cell's right half indicates the amount of rotation reach between the IK rig and the FK rig. For example, the Left Shoulder cell reaches fully towards the FK rig translation (no green) and its rotation reaches fully towards IK (full green). Pull is disabled because shoulder effectors do not have pull.



Reach and Pull feedback *A.* **Rotation reaches fully towards IK rig.** *B.* **Translation reaches fully towards IK rig.** *C.* **Translation and Rotation reach fully towards IK rig, Pull at 100%.**

Each cell's left half indicates the amount of translation reach between the IK rig effector and the FK rig effector. For example, the Left Elbow cell reaches fully towards the IK rig translation (full green), rotation reaches fully towards FK (no green), and the pull is set to zero (no red).

In the Viewer window, a colored outline displays on effectors that have adjusted Reach settings. You can show, hide, or change the visual feedback on Control rigs, including the Reach outlines, using the Properties window.



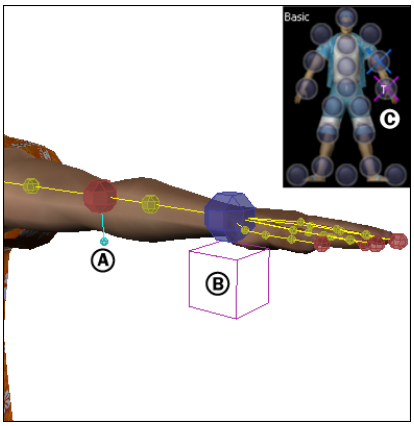
Colored outlines display around objects that have Reach values defined.

Since Pull is applied over IK translation, if the effector does not reach towards the IK rig, then the Pull slider has no affect. For example, the Left Wrist cell reaches fully towards the IK rig translation and rotation (both full green) and pull is set to 100% (full red).

Auxiliary objects

In addition to the cells representing IK effectors, the Character representation displays Auxiliary effectors and pivots, which are Auxiliary objects that provide another level of IK control.

You can create up to fourteen Auxiliary objects for each IK effector on a Control rig. On the cells of the Character representation in the Character Controls window, Auxiliary effectors display as a purple cross, and Auxiliary pivots display as a blue cross.



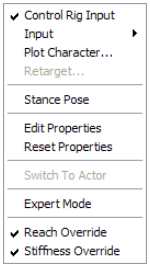
A. **An Auxiliary pivot on the elbow effector.** *B.* **An Auxiliary effector on the wrist effector.** *C.* **A blue cross representing the Auxiliary pivot and a purple cross representing the Auxiliary effector display in the Character Controls.**

In the Viewer window, Auxiliary pivots display as a light blue marker connected to the regular IK effector. Auxiliary effectors display as a purple wireframe cube. You can change the size and appearance of these Auxiliary objects using the Properties window.

Refer to Auxiliary objects on page 1469 for more information.

Edit Menu

This section describes the Edit menu options that let you select a Character's input type and source, override the default Control rig behavior, switch to Expert mode, and so on.



Character Controls Edit menu

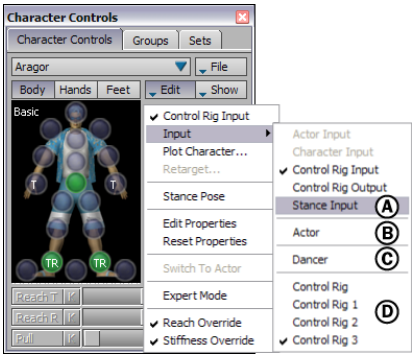
The remainder of this section describes each item in the Edit menu as it appears.

Control Rig Input

Selecting Control Rig Input activates the Control rig as the motion source type that drives the character. You can also select Control Rig Input in the Input menu in the Character Settings. If the current Character does not have any Control rigs, this menu item is disabled.

Input

The options in the Input menu let you choose the motion source that you want to drive your character.



Character Controls Input menu *A.* **Stance Input is selected** *B.* **One Actor is available.** *C.* **A "Disco Dancer" character is available.** *D.* **Four Control rigs are available.**

The type of motion source can be an Actor (Actor Input), another character (Character Input), a selected Control rig (Control Rig Input), an additional Control rig, or a reset to the character's stance position (Stance Input).

Choosing an Actor source in the Input menu automatically switches the input type to Actor Input. Similarly, choosing a character as the source in the Input menu switches the input type to Character Input.

You can also choose Input options in the Character settings on page 1505. For detailed information on each type of motion source, see Motion sources on page 1252.

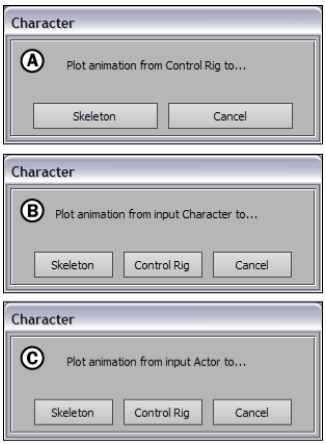
You can select from the following Input options:

Input option	Description
Actor Input	Lets you choose an Actor as the source of mapping data to constrain your character.
Character Input	Lets you select another character as the source of mapping data.
Control Rig Input	Lets you use a Control rig as the source of mapping data to constrain the character.
Control Rig Output	Lets you plot and output the animation on your model's skeleton to a Control rig for editing.
Stance Input	Resets the selected character to a T-stance.

Plot Character

Selecting Plot Character opens a dialog box that lets you transfer the motion data from the Control rig to your model's skeleton, the selected source to the character's Control rig, or from the Input Actor to either a Control rig or the model's skeleton.

When you plot animation to a model's skeleton, the motion data can come from another character (Character Input), or the character's Control rig (Control Rig Input).



A. **Plot Control rig animation to the skeleton.** *B.* **Plot animation from the character to a Control**

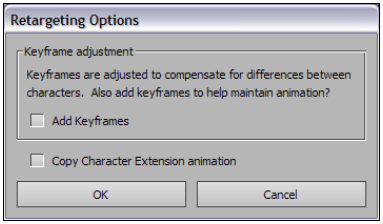
rig. *C.* **Plot data from an Actor source to the character or Control rig (MotionBuilder only.)**

When you plot animation to a Control rig, the animation can come from an Actor, another character, or the model's the skeleton itself (Control Rig Output).

Retarget

Selecting Retarget copies keyframe animation from the Control rig of the character selected as the Input Source to the Control rig of the current character. See Retargeting animation character-to-character on page 1257 for more information.

When you select the Edit > Retarget option, the Retarget Options dialog box appears. This dialog box lets you choose whether you want to allow added keyframes during retargeting, and whether you want to copy Character Extension animation.



Retargeting Options dialog box

Activating the Add Keyframes option is recommended if you are concerned with retargeting your original animation as precisely as possible. While the retargeting process copies animation nearly exactly, slight adjustments to the data are required to compensate for differences between the source and target characters. If you can tolerate these slight changes and you do not want any added keyframes, disable the Add Keyframes option.

Stance Pose

The Stance Pose item is only available when the Character's input is set to Control Rig. Selecting Stance Pose resets the Control rig to the default T-stance position without changing the Input type and source to Stance Pose.

The Stance Pose for biped and quadruped characters are different. See Bipeds and quadrupeds on page 1290 in Models on page 1289.

Stance Pose only resets rotational offsets. These offsets remain if you translate or scale the character.

Edit Properties

Select Edit Properties to display the current character's properties in the Properties window.

The properties shown in the Properties window are the same as the options in the Character Settings. For more information, see Character settings on page 1505.

Reset Properties

Select Reset Properties to reset the current character's definition and/or solving properties back to their default values. Selecting Reset Properties creates the same result as clicking the Reset All Properties button on page 1522 in the Character Settings pane on page 1519.

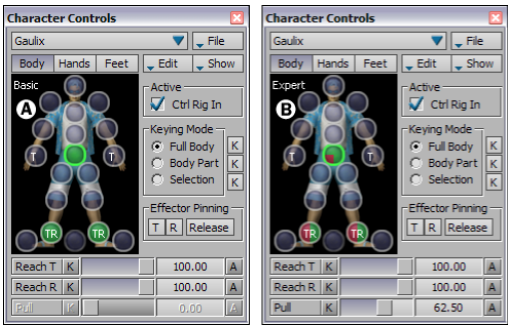
Switch to Actor

Lets you switch between the current character and its Actor. If you select Switch to Actor, the Character Controls window changes to the Actor Controls window.

The Switch to Actor option only appears in the Edit menu when the current character's Input type is set to Actor.

Expert Mode

Lets you switch between Basic mode and Expert mode as you work with characters that are driven by Control rigs. When Expert mode is activated, the Pull and Stiffness options are available and the Pull slider is active (B, C). When Expert Mode is disabled, the Character Controls are in Basic mode, and the Pull and Stiffness settings are disabled.



Character Controls window *A.* **Basic mode** *B.* **Expert mode** *C.* **The Pull slider is available in Expert mode.**

Adjusting the Pull and Stiffness settings while Expert mode is active can have unpredictable results if you are using the Sync button in the Key Controls. You should only use Expert mode if you have a good understanding of how the Sync button works.

If you load animation files created in MotionBuilder version 5.6 or earlier, the Character Controls are automatically placed in Expert mode, since the old animation may include animated Pull settings. Otherwise, the Character Controls are in Basic mode by default.

NOTE The Character representation displays a Basic or Expert label in the top left corner depending on which mode you are in.

Reach Override

The Reach Override option determines the state of the effector pinning and how your character behaves in conjunction with Pull values during manipulation.

Reach Override is active by default, which means that each effector's Pull value is ignored during character manipulation. You can only see your Pull settings when you play your animation.

To view the effects of Pull while applying transformations to your character, disable Reach Override. Effector pinning is also disabled since the character's behavior is based on each effector's Pull values rather than its effector pinning.

Reach Override is only effective in Full Body or Body Part mode.

Stiffness Override

The Stiffness Override option determines how your character behaves when it is manipulated in relation to the Stiffness values.

Stiffness Override is active by default, which means that the character does not use the Stiffness values (see Stiffness properties on page 1528) during character manipulation. Stiffness settings are only applied when you play your animation.

Stiffness Override is only effective when in Full Body or Body Part mode.

Show menu

This section describes the options in the Show menu that let you show and hide interface items associated with the model's skeleton, the character's Control rig, and the character's source. You can also use this menu to lock the translation and selection of the FK rig and the model's skeleton.

Character Controls Show menu for MotionBuilder

Skeleton

Shows or hides the model's skeleton. Use the skeleton to define the nodes used by the character. The Control rig is created based on your model's skeleton. To hide the skeleton, disable Skeleton in the Show menu.

FK

Shows or hides the FK rig of the current character.

The FK rig is one-half of the Control rig. It is based on the original skeleton of your model. To hide the FK rig, disable the FK option in the Show menu.

IK

Shows or hides the IK effectors on the character's Control rig. To hide the effectors, disable the IK option.

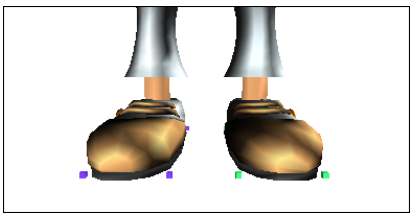
The IK rig is an Inverse Kinematics system that lets you transform your character using IK effectors. Manipulating a character using this system moves the body relative to its hierarchy, similar to the way a human body reacts.

Auxiliary

Shows or hides Auxiliary effectors and pivots. To hide Auxiliary objects, disable the Auxiliary option. Unless you create an Auxiliary object for one of the effectors on the IK rig, no Auxiliary objects display. See Creating Auxiliary effectors and pivots on page 1473.

Floor Contact

Hides or shows the markers that define the floor contact. To hide the floor markers, disable the Floor Contact option. See Floor contact on page 1323 for more information on setting up floor contact for a character.

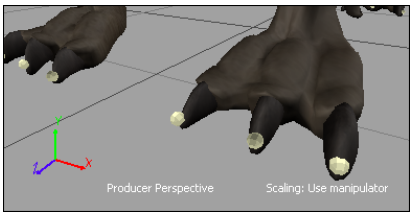


Floor Contact shows green and blue markers around the character's feet.

You can activate Scaling mode on page 696 or use the Floor Contact properties on page 1325 to change the size of the hand and toe contact markers.

Finger Tips

Hides or shows the contact spheres used for the character's finger tips or toes. The finger tips for a quadruped character display in the following image.



Finger Tips option is active, finger tip markers display.

See Hands Contacts Size on page 1333.

Actor Hide and Show Options

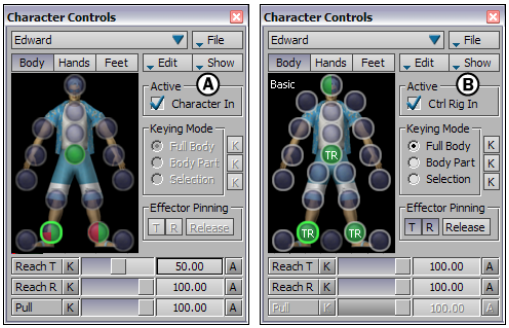
Beneath the Finger Tips option in the Show menu, five additional Actor options let you hide or show interface items related to an Actor.

These options are only available if your character's input type is an Actor. These options are also available in the Actor Controls window.

Option	Description
FK Lock Sel	Lets you lock or unlock FK markers for selection. When activated, you cannot select the FK markers. To select FK markers, disable FK Lock Sel.
FK Lock Trs	Locks or unlocks FK markers for transformation. When FK Lock Trs is active, you cannot transform the FK markers, although you can still select them. To unlock the markers, disable FK Lock Trs. You need to disable FK Lock Trs to use of MotionBuilder's squash and stretch feature. See Squash and Stretch.
Skeleton Lock Sel	Locks or unlocks the skeleton for selection. When Skeleton Lock Sel is active, you cannot select the skeleton. To unlock the skeleton for selection, disable Skeleton Lock Sel.
Skeleton Lock Trs	Lets you select the skeleton, but locks the position and rotation so that you cannot transform it. To unlock the skeleton for transformation, disable Skeleton Lock Trs.

Active area

The Active area corresponds to the input type selected from either the Edit menu or the Input Type field in the Character settings. Enabling this option activates the input source.



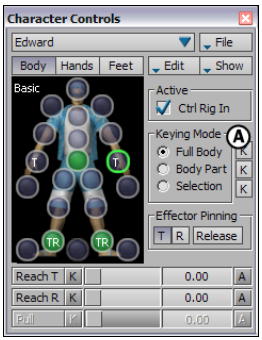
Character Controls Active area *A.* **Character Input as source** *B.* **Control rig Input as source**

For example, if the Input type is set to Character Input, the option in the Active area switches to Character. If the Input type is set to Control Rig In, the option in the Active area switches to Ctrl Rig In.

For more information, see Input Type menu on page 1520 in Character settings on page 1505.

Keying Mode area

The Keying Mode area lets you set manipulation and keyframing modes for setting keyframes on a character's Control rig. You can manipulate and set keyframes on the character's entire body (Full Body on page 1570), a part of the body (Body Part on page 1571), or only on the selected effector (Selection on page 1573). For more general information, see Keying groups on page 837.



Character Controls window
A. **Keying Mode area**

Both IK and FK effectors can be manipulated in any keying mode, giving you quick, precise control over all types of manipulations, including those of the spine, neck, and finger bones.

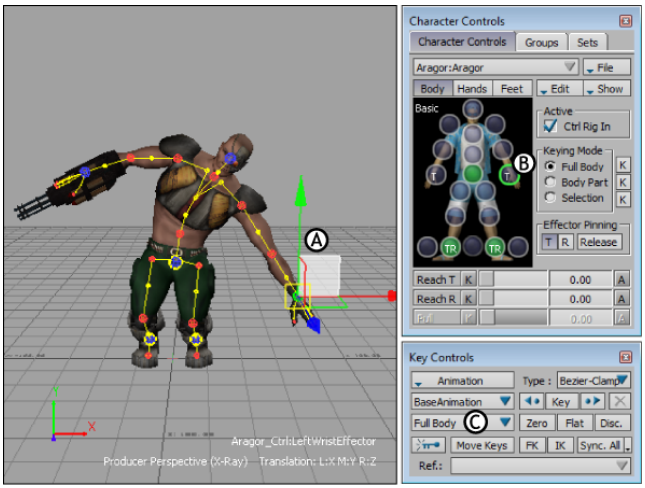
Keyframe (K) buttons next to each of the Keying modes let you set keyframes on any of the modes at any time, regardless of which mode you have currently selected.

For example, if you are working in Body Part keying mode, you can click the Keyframe (K) button next to the Full Body keying mode at any time to set keyframes on a characters entire body without having to switch keyframes.

See Keyframe (K) and Animate (A) buttons on page 822 for more information on the Keyframe buttons.

Full Body

Full Body Keying mode lets you use individual effectors to manipulate the entire body of a character. For example, translating a character's wrist effector in Full Body mode affects the whole body as it moves to reach that effector.



A. **The entire body follows the IK system when manipulated.** *B.* **Full Body keying mode is active in the Character Controls.** *C.* **Full Body keying mode is also indicated in the Key Controls.**

The active Keying Mode also determines what is keyed, so it is also displayed in the Key Controls window. When Full Body is selected in the Key Controls Keying Mode menu, it indicates that keyframes are set on the character's entire body.

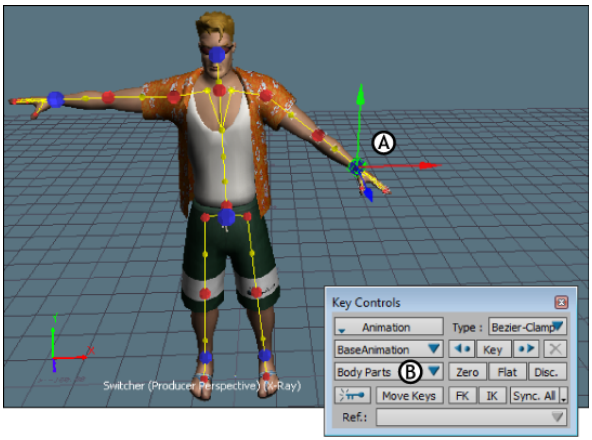
How your character reacts to manipulation when in Full Body mode depends on the pinning of various effectors, and whether Override Reach and Override Stiffness are active. See Effector Pinning area on page 1574, Reach Override on page 1565 and Stiffness Override on page 1566.

When in Full Body mode with Override Reach active, the Pull settings for your character are not shown during manipulation.

Body Part

Body Part Keying mode lets you use individual effectors to manipulate only the selected body part. The effectors on the rest of the body are not affected.

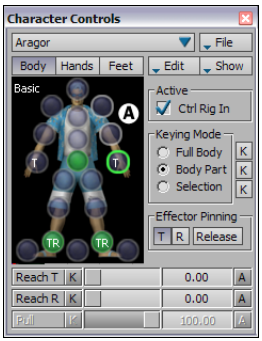
For example, translating a character's left wrist effector in Body Part mode affects only the left arm. The right arm, hips, chest, head, and all other effectors do not move.



Body Part Keying mode is active. *A.* **Selecting the left wrist effector lets you translate all the effectors in the chain for the left arm.** *B.* **The Key Controls window displays Body Parts.**

In Body Part mode, the keying mode in the Key Controls window is set to Body Part, and keyframes are set on the effectors that comprise the selected body part. For example, if you set keyframes with the left wrist effector selected in Body Part Keying mode, you set keyframes on the left wrist, left elbow, and left shoulder.

The effectors of the selected body part are highlighted in the Character representation with white circles. Keyframes are set on the these highlighted effectors.



Character Controls *A.* **The left wrist effector is selected in Body Part mode, so the other effectors for the left arm**

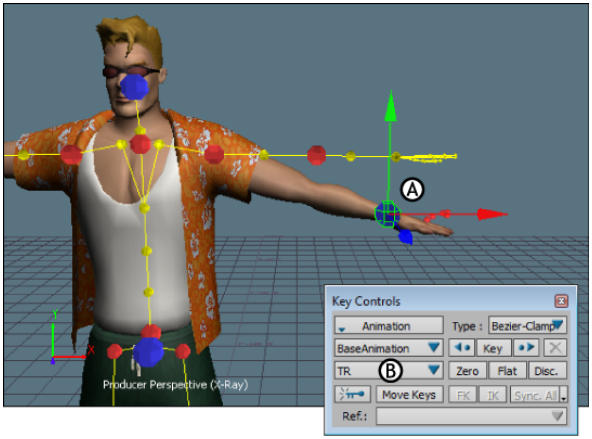
are also highlighted in pale white.

To select more than one body part, Ctrl-click each additional body part in the Character representation.

Selection

When Selection is active, you can manually select what you want to manipulate and keyframe on a character. As you manipulate your character, the Control rig does not synchronize and update in real time as it does in Full Body and Body Part modes.

For example, selecting a character's left wrist effector in Selection mode lets you translate only the selected effector, independent of any pre-defined manipulation mode (Full Body and Body Part), rig setup, or effector pinning.



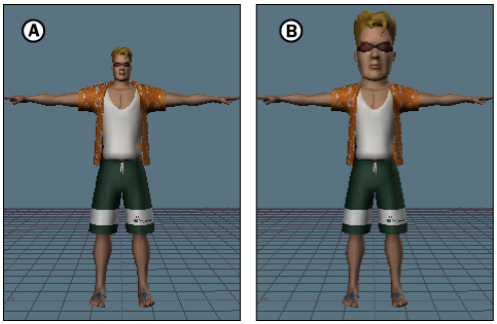
Selection Keying mode is active *A.* Selecting the left wrist effector lets you independently manipulate that effector. *B.* Keying Mode in the Key Controls displays the previous selection (in this case, TRS.)

NOTE When in Selection Keying mode, an effector does not move if its Reach T value is set to zero. An effector also does not rotate if Reach R is set to zero.

In Selection mode, the keying mode in the Key Controls corresponds to the previous selection. For example, if the translation, rotation, and scaling properties were previously selected, TRS displays in the Key Controls.

You can keyframe additional properties by selecting them in the Properties window (see Properties window on page 765).

In Selection mode, you can scale selected body parts using the FK rig. For example, to scale only the head of a character, select the head's corresponding FK node while in Selection mode, and scale it to a larger value.

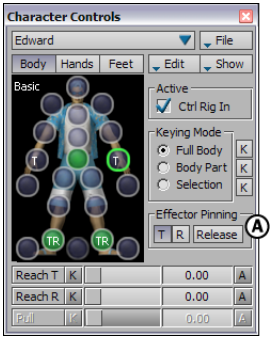


A. **Head is normal size** *B.* **Only the head is scaled**

NOTE FK Lock Sel and FK Lock Trs must be disabled in the Show menu for scale to work.

Effector Pinning area

The Effector Pinning area lets you activate, disable, or temporarily release pinning on effectors.



Character Controls *A.* **Effector Pinning area**

See Pinning on page 1459 for more information.

T and R

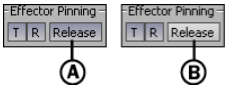
The T (Translation) and R (Rotation) options let you activate and disable translation and rotation pinning on effectors. When T is active, the selected effector has translation pinning. Similarly, when R is active, there is rotation pinning on the corresponding effector.

When multiple effectors are selected, a highlighted T or R indicates that at least one of the selected effectors are pinned in either translation (T) or rotation (R).

Release

The Release option lets you temporarily remove the translation or rotation pinning related to the selected effector and effectors down the chain.

Activate Release to temporarily release pinned effectors. You can also press and hold the Q key. All effector pinning is released while the Q key is pressed.

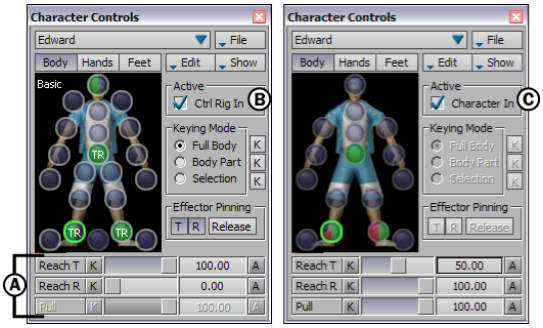


A. **Release is active, releasing the pinning for all selected effectors.** *B.* **Release is disabled.**

Disable Release to return pinning to its previous state.

Reach and Pull area

The Reach and Pull area lets you set the amount of reach between the IK and FK Control rig systems, or between your character and its motion source.



A. **Reach and Pull area** *B.* **Control rig as motion source**
C. **Character as motion source**

The Reach and Pull area is contextual to whatever type of source your character uses. If your character has an Actor or character as its source, the Reach area lets you define the reach between the current character and its source (Actor or character).

This section is split into the following topics:

- Animating Reach and Pull on page 1576
- Reach T and R on page 1577
- Reach Actor/Character on page 1580

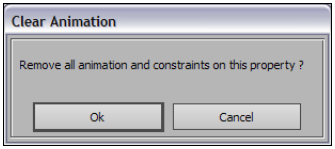
Animating Reach and Pull

Each slider in the Reach area lets you set each reach or pull value for animation or inclusion in a Relations constraint. Each slider also lets you set keyframes for each reach or pull value.

The Animate (A) button lets you set keyframes, use Reach values in constraints, and remove animation from a Reach property. To use a Reach value in a Relations constraint, click the Animate (A) button.

To set a keyframe on a Reach value, click the Keyframe (K) button.

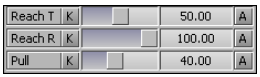
To remove animation from a Reach property, click the Animate (A) button and click Ok in the Clear Animation dialog box that appears.



Clear animation dialog box

Reach T and R

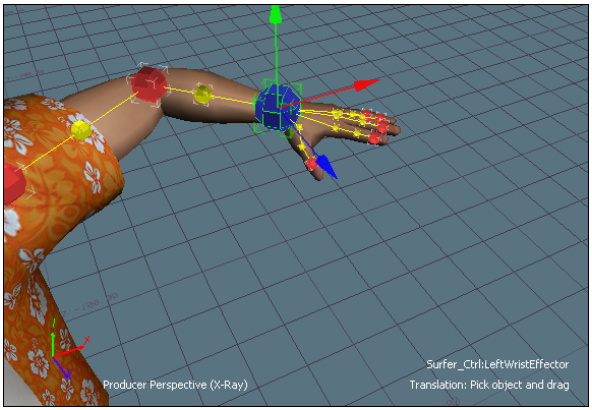
The Reach T and Reach R sliders in the Reach area solve differences between the FK and IK rigs on a character.



Character Controls Reach area

NOTE If the Control rig is IK Only, the Reach options are not available.

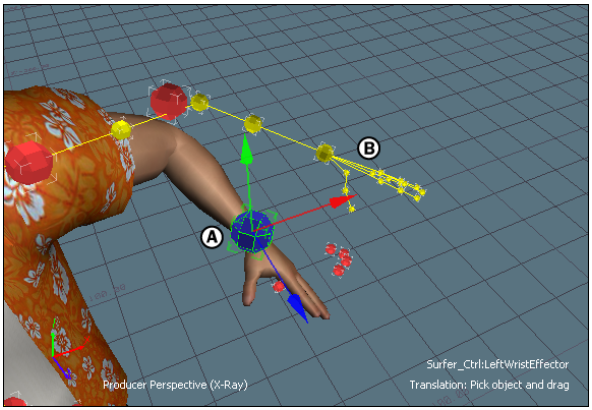
When you set keyframes using the Control rig, both the IK rig and FK rig are synchronized: the IK and FK rigs appear on top of each other in the Viewer window.



The IK rig and FK rig are synchronized at keyframes.

NOTE When the Align Control Rig option is active in the Control rig properties, the IK and FK systems always appear together, even if they interpolate differently between keyframes. Disable this option if you want to view separate interpolation paths for the IK and FK systems.

However, when you play your animation, the interpolation of the IK rig and the interpolation of the FK rig may not match, because each rig solves differently. Between keyframes, the IK rig and FK rig may not occupy the same space.



Between keyframes, the IK rig (A) and the FK rig (B) do not match since each rig uses a different method of solving.

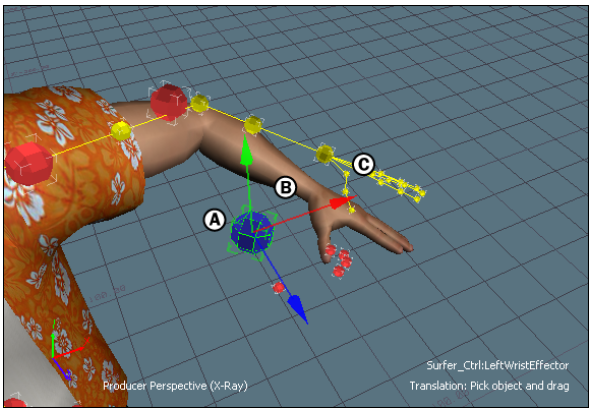
The Reach T and Reach R sliders in the Character Controls let you adjust the amount of influence each system (IK or FK) has on a body part when the two systems get out of sync. This gives you complete control of what happens between keyframes.

To adjust the influence each system has, select an effector in the Character representation, then adjust the percentage of translation and rotation reach between the IK and FK rigs using the Reach T and Reach R sliders.

Use the following guidelines when adjusting reach:

- At 100%, the skeleton follows the IK system.
- At 50%, the skeleton averages between the FK and IK systems.
- At 0%, the skeleton follows the FK system.

For example, in the picture below, a value of 30% is assigned to the Reach T (Translation reach). When the character's wrist effector is translated, the model follows the FK rig more closely (A to B=70%, B to C= 30%).



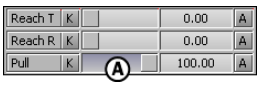
A. **Blue IK wrist effector is selected.** *B.* **Character's arm reaches towards the FK rig since the wrist effector's IK translation reach is set to 30%.** *C.* **Yellow FK rig**

If the Reach T value was set to 50%, the skeleton appears between the FK and IK rigs. The solution of the IK rig and the FK rig is blended together equally to influence the body part.

NOTE The amount of reach also displays in the corresponding cell in the Character representation.

Pull

The Pull slider lets you determine how much pull each effector has on other parts of the body.



A. **Pull slider**

NOTE When a Control rig is selected as the input source, the Pull slider is only available if you are in Expert mode.

To control the amount of pull, select an effector in the Character representation and drag its pull slider, or type a value in the numerical field.

Use the following guidelines when changing an effector's pull:

- At 100%, the effector has full pull. This means that moving other body parts that normally transform the effector has no effect. If all body parts have full pull, translating only moves the selected effector. If the effector

is further up the hierarchy, such as the character's chest or hips, the other effectors down the chain react to the translation.

- At 50%, the effector has half pull. This means that moving other body parts that normally transform the effector have a damping effect.
- At 0%, the effector has no pull. This means that moving other body parts transforms identically.

The effect of each effector's pull value is contingent on the IK Reach T value. For example, if Pull is set to 100%, but Reach T is set to 0%, the Pull value has no effect because Reach is set to the FK rig.

Pull is also based on a virtual hierarchy of your model's skeleton which means that if you re-parent your IK rig, Pull is still based on the original hierarchy. For example, the hips have priority and a stronger effect over chest nodes. The chest has priority over the arms and legs.

Reach Actor/Character

When the input source is an Actor or Character, the Reach area lets you define the translation and rotation reach between the current character and the Actor or character source.

Reach values can be set per effector for the following body parts:

- head (Reach T and Reach R)
- chest (Reach T)
- left and right elbow (Reach T)
- left and right wrist (Reach T and Reach R)
- left and right hand (Reach T and Reach R)
- left and right knee (Reach T)
- left and right ankle (Reach T and Reach R)
- left and right foot (Reach T and Reach R)

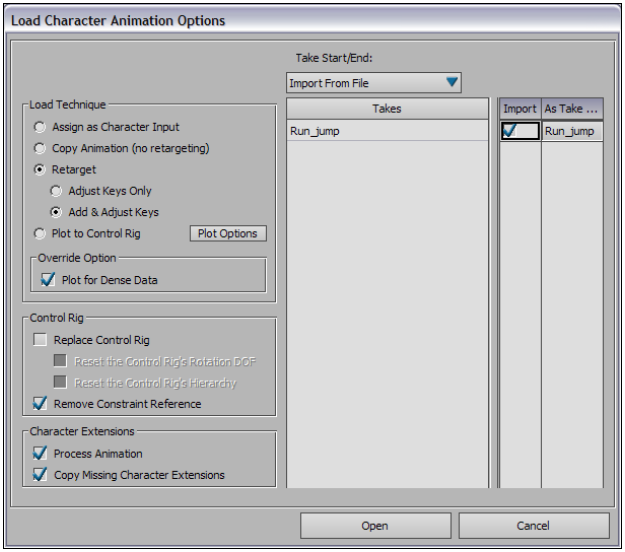
NOTE You can use Finger reach settings for Actor retargeting but Actor toes are not be affected.

To adjust the reach of a body part, select the effector and adjust the Reach T slider in the Character Controls window, or the Reach sliders in the Character settings.

- Animating Characters on page 1251
- Character setup on page 1269
- Load Character Animation Options dialog box on page 1581
- Save Character Animation Options dialog box on page 1585
- Troubleshoot loading character animation on page 1264

Load Character Animation Options dialog box

When you load animation onto a character using the File > Load Character Animation option in the Character Controls, the Load Character Animation Options dialog box appears.



Load Character Animation Options dialog box

The Load Character Animation Options dialog box consists of the following areas:

- Load Technique area on page 1582

- Control Rig area on page 1583
- Character Extensions area on page 1584
- Merge Takes area on page 1584

NOTE If you load animation onto a character with the Load Character Animation option, shoulder FK effectors may be offset If you select the Assign as Character Input option as the Load Technique. To workaround this problem, instead select Retarget as the Load Technique.

Load Technique area

The Load Technique area consists of options that let you load animation in different ways.

Option	Function
Assign as Character Input	The Assign as Character Input option loads the selected .fbx file into your scene, and assigns the loaded character as the Character Input for the current character. A group called Imported Character is created. This group contains all imported assets, so that you can easily find or delete them.
Copy Animation	The Copy Animation option lets you copy animation from one character to another without retargeting or plotting. The copied animation is the same as the original animation only when the characters and their control rigs are exactly the same.
Retarget	The Retarget option lets you retarget character animation to the current character. Use this option to retarget keyframe animation where each keyframe is important.
Add Keyframes	Activate this option if you want to allow extra keyframes to be added during retargeting. Keyframes are adjusted when necessary during retargeting to compensate for differences between the two characters. Allowing added keyframes helps to preserve the original animation as closely as possible.
Plot to Control Rig	Use the Plot to Control Rig option when you want to retarget and plot motion capture data. You can also use this option with keyframe animation when individual keyframes are not

Option	Function
	important. Use the Retarget option instead, if you want to keep individual keyframes the way they are.
Plot Options	Click the Plot Options button to open the Plot Options dialog box and select plotting options. These options are the same as in the Plot Properties window. See Plot Properties window for more information.
Override Option	The Override Option area contains the Plot for Dense Data option, which lets you override retargeting options under specific conditions. When the Plot for Dense Data option is active, if dense data (such as motion capture data or plotted animation) is detected, the animation is automatically plotted to the current character, not only retargeted. This option works with the Retarget option (see Retarget).

Control Rig area

The Control Rig area contains options that affect the characters' control rigs.

Option	Function
Replace Control Rig option	The Replace Control Rig option lets you replace the current character's Control rig with the Control rig in the .fbx file you are loading. The current character's old Control rig is detached from the character, but is not deleted from the scene. Replacing the Control rig lets you retarget the animation with more accuracy. This option is available only if the current character has a Control rig. When Replace Control Rig is activated, the following two options become available: Reset Control Rig's Rotation DOF, which lets you reset the DOF Rotation Properties on the Control rig to default values, and Reset the Control Rig's Hierarchy, which Resets the Control rig to the default hierarchy. See The Control rig hierarchy on page 1479 for more information.
Remove Reference Constraints option	The Remove Reference Constraints option lets you disable the Constrain Reference property for source and target characters. The Constrain References property can affect the result of retargeted character animation when it is active for either the target and source characters.

Character Extensions area

The Character Extensions area contains two options that let you copy Character Extension animation and copy missing Extensions.

Option	Function
Process Animation	The Process Animation option copies Character Extension animation onto the Character Extensions of the current character, but only when the source Character Extension and the Character Extension in the current scene are exactly the same. If they are not exactly the same, the animation is not copied.
Copy Missing Character Extensions	The Copy Missing Character Extensions option copies Character Extensions that do not exist in the current character. For example, if the source file contains a character with two wings and a tail, and the current character has two wings, the tail extension is copied onto the current character. If the current character already has a tail, but it has a different name than the tail in the source file, the character has two tails. If both Character Extensions have the same name but are made differently, they merge. In this case, a dialog box appears listing the parts of the Character Extension that will merge and asking you if you want to continue. Click Continue to merge the Character Extensions or Cancel to abort the operation.

Merge Takes area

The Merge Takes area shows all the takes stored in the *.fbx* file that you are merging.

Use the Take Start/End field to select how the start and end of takes are set when they are merged. Take Start/End gives you the following options:

Option	Description
Leave As Is	Leaves the take start and end times unchanged. If you are creating a take, the take start and end times are imported from the file.
Import From File	Uses the start and end time codes specified by the *.fbx* file being loaded.

Option	Description
Frame Animation	Frames the start and end of the animation for each take.

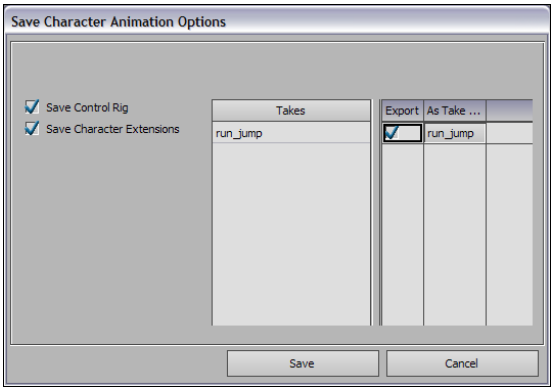
Take List

The Take list is split into the following columns:

Column	Function
Take name	Shows the name of the take as it was saved in the .fbx file. You cannot rename takes using this column.
Import	Marks the take for merging. When active, the corresponding take replaces any takes with the same name. When disabled, the take is not merged.
As Take	Changes the name of the take when merged. This is useful if your scene has a take with the same name and you don't want to replace it with the take being merged.

Save Character Animation Options dialog box

Selecting Save Character Animation opens the Save File dialog box, which lets you specify the *.fbx* file name and saving location. When you click Save in the Save File dialog box, the Save Character Animation Options dialog box appears.



Save Character Animation Options dialog box

Save Control Rig

Lets you save the Control rig with the animation. Disable this option if you only want to save the character animation.

Save Character Extensions

Lets you save any Character Extension with the animation. Disable this option if you want to save Character Extensions without the animation.

Take List

The Take list is split into the following columns:

Take name	Shows the name of the take as it was saved in the *.fbx* file. You cannot rename takes using this column.
Export	Marks the take for saving. When active, the corresponding take is saved to the *.fbx* file.
As Take	Renames the take as it is saved to the *.fbx* file. If the Save One Take Per File option is active, the name of the take in the As Take column is used over the take name in the scene.

■ Character Controls on page 1553

Part 11: Animating Faces

In every day interactions with people, we look to a person's face for visual cues to help us assess what they are thinking or feeling. This is why facial animation is so important.

The intricate movements of the face can make the difference between a character that is believable and a character that does not engage the audience.

Various facial expressions on a bird character face

Creating a face that moves in complex ways can convey realistic, believable emotion. MotionBuilder lets you accomplish this by animating head models with keyframes, voice recognition, and motion data using a combination of the Character Face settings, Actor Face settings, and the Voice device.

To create facial animation, you must create shapes on your character head models, then map those shapes to MotionBuilder's pre-defined expressions.

Once you have a head model with shapes set up, there are three main workflows possible when animating character faces:

- Facial keyframing workflow on page 1588
- Facial motion capture workflow on page 1589
- Audio-driven facial animation workflow on page 1590
- Creating shapes on page 1605
- Creating cluster shapes on page 1606
- Voice device on page 1657
- Plotting facial animation on page 1891

Facial keyframing workflow

The most basic method of creating facial animation is to define and keyframe a set of custom expressions.

Keyframing facial animation workflow

To create facial animation:

1. Load a head model that has shapes or cluster shapes.
2. Add a Character Face to the scene. See Adding a Character Face on page 1640.
3. In the Character Face Definition pane of the Character Face settings, add and define custom expressions. See Defining a custom expression on page 1642.

   NOTE The custom expressions you define in the Character Face Definition pane are listed as Custom Properties in the Character Face Animation pane.

4. Switch to the Character Face Animation pane, select your custom expressions, change their values, and set keyframes to animate the face model. See Setting keyframes on page 819.

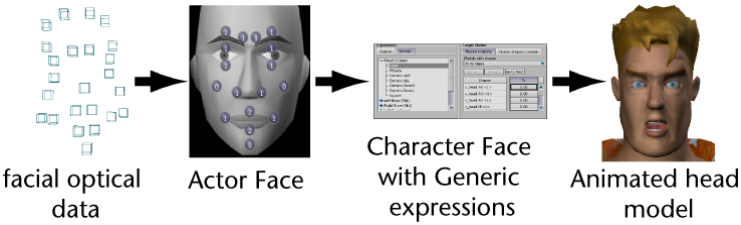
   NOTE It is a good idea to set keyframes on a separate layer using the Animation Layer editor, if you are using keyframes to modify animation. Using multiple layers lets you avoid overwriting the original animation.

- Head models on page 1595
- Shapes on page 1596

■ Clusters and cluster shapes on page 1605

Facial motion capture workflow

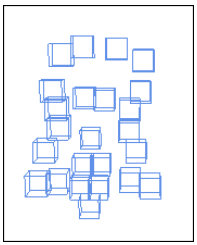
The process of animating a head model with motion capture data is similar to the process of animating a character with motion capture data. While an Actor is used to map motion data to a character, an Actor Face is used to map motion data to a Character Face.



Character face animation using motion capture data workflow

To animate a face with motion capture data:

1 Load a motion data file containing optical markers or magnetic sensors with animation, and ensure that the motion data markers are facing the positive Z-axis.



Facial motion data markers

NOTE Compatible motion file formats include **.aoa**, **.mcd**, **.trc**, and **.c3d**.

2 Add an Actor Face to the scene. See Adding an Actor Face to the scene on page 1611.

3 Connect the motion capture data to the Actor Face. See Connecting an Actor Face to motion capture data on page 1612.

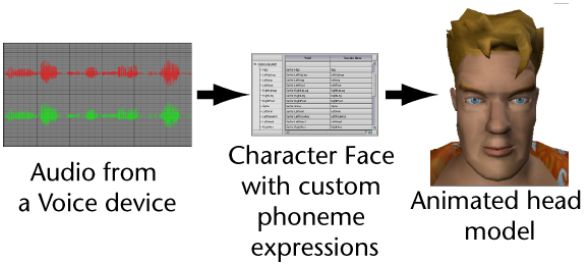
4 Add a Character Face to the scene and define the generic expressions in the Character Face settings. See Adding a Character Face on page 1640 and Defining a generic expression on page 1643.

5 Connect the Actor Face to the Character Face. See Connecting an Actor Face to a Character Face on page 1592.

The optical marker data is now set up to drive the expressions on your character's face.

Audio-driven facial animation workflow

Using a Character Face and the Voice device, you can set up a character to "talk" with an audio file or live audio input as its voice. Through the Voice device, the phonemes in the audio input drive the expressions on the character's face.



Audio-driven facial animation workflow

To drive facial expressions using audio data:

1 Load a head model with shapes or cluster shapes.

The shapes on your head model should be appropriate for the number of phonemes you need to make the character convey your audio input, and they should correspond with the sound parameters of the Voice device. See also Phoneme shapes on page 1600.

2 Add a Character Face to the scene. See Adding a Character Face on page 1640.

3 In the Character Face Definition pane, add a custom expression for each phoneme, then map the phoneme shapes you created for your head model to these custom expressions.

4 Link the Character Face to a Voice device. See Linking a Character Face to a Voice device on page 1658.

5 Add sound parameters, or phoneme sounds, in the Voice device settings. See Adding sound parameters on page 1663.

When you add additional sound parameters (phoneme sounds) to the Voice device, custom expressions automatically appear in the Expressions pane.

NOTE To fine-tune facial animation driven by the Voice device, change the values of automatically added operators, add additional operators, or add other devices to trigger facial expressions.

See also:

- Phoneme shapes on page 1600
- Voice device on page 1657
- Specifying gender in the Voice device on page 1660
- Activating phonemes and instruments on page 1669
- Refining a model's face movements on page 1661

Expression

The combination of various facial features positioned to create a facial expression.

A generic expressions is a preset facial expression, such as a smile, that you link to your shapes using a Character Face. MotionBuilder uses expressions to drive the various shapes or cluster shapes, creating expressions for your facial models.

Channels

A channel is a preset MotionBuilder facial expression that links the Actor Face with the Character Face.

While it is not absolutely necessary that you use these channels, they are the ones you will mostly likely need. You'll want to have all of these channels mapped to shapes on your model. You can also consult the Character Face

representation in the Preview pane, which demonstrates the expression you want each channel to create.

If Open is set to 100%, you get exactly what you modelled this shape into. MotionBuilder records the rate at which the change takes place when you move the slider. So this one channel can drive multiple shapes: including face shapes, tongue shapes, and teeth shapes. It's driving three different parameters. You set those three parameters for one channel. You set these parameters to percentages that look normal for your model, not necessarily what we recommend in the manual.

There are two types of expression in Character Face settings: Generic and Custom expressions.

Connecting an Actor Face to a Character Face

To connect an Actor Face to a Character Face:

1. Double-click a Character Face in the Scene browser to display the Character Face Settings.
2. Switch to the Character Face Animation pane.
3. Select an Actor Face from the Actor Face Source menu, and enable the Active option if it is not automatically enabled.

   Selecting the Actor face in the Actor Face Source menu constrains the Actor face to the Character face, so the defined Character Face can be driven with the animation data on the Actor Face.

   TIP If you want, you can play animation mapped to the Actor Face and watch it play on your character's head model.

■ Facial motion capture workflow on page 1589

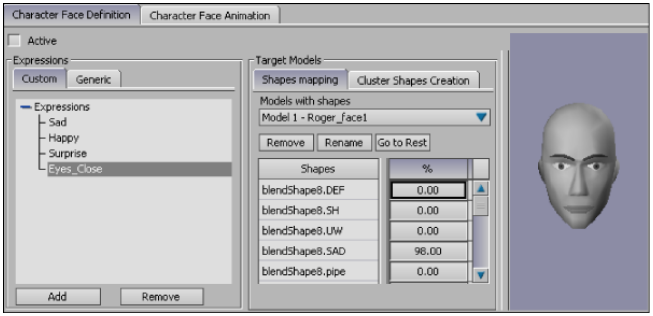
Defining a custom expression

Once you have a Character face loaded, you can define custom expressions to give your character a "vocabulary" of facial movements.

To create a custom expression:

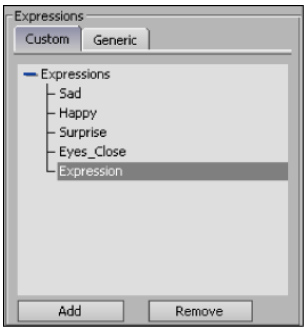
1 Select the character face from the Navigator window. The Character Face Definition pane opens.

2 Disable the Character Face Definition pane Active option.



NOTE When the Character Face Definition pane Active option is enabled, you cannot preview or define facial expressions on the model in the Viewer window.

3 Select the Custom tab in the Expressions area and click Add. A custom expression is added. Rename it for the expression you want to create.



4 In the Target Models area, switch to the Shapes Mapping tab and modify the shape values to make the expression you want to create.

For example, to create the expression “MAD”, the eye, eyebrow, and mouth shape values were increased.

Head models

90

A head model is the model of a face composed of a geometric mesh using shapes or clusters for different facial expressions.

A head model

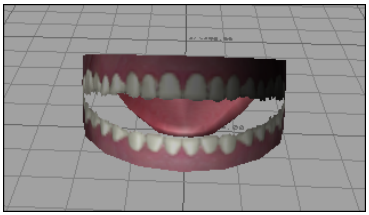
This section covers the following topics:

- Submodels on page 1596
- Shapes on page 1596
- Facial rest pose on page 1597
- Generic shapes on page 1598
- Phoneme shapes on page 1600
- Custom shapes on page 1604
- Choosing shapes to create on page 1604
- Creating shapes on page 1605

- Clusters and cluster shapes on page 1605
- Creating cluster shapes on page 1606
- Changing the rest pose for cluster shapes on page 1608
- Renaming cluster shapes on page 1609

Submodels

Submodels are the smaller parts that make up a character's head model. For example, you might create separate submodels of a character's teeth or tongue.



Sub-models for the upper teeth, lower teeth, and tongue

If your character's head is made up of more than one model, you need different shapes for each submodel affected by each expression.

For example, if you have a head model with separate teeth and tongue submodels, when you create a "Mouth Open" shape, then you need to create separate "Mouth Open" shapes for the teeth, tongue, and any other submodel that is part of the "Mouth Open" expression.

Even if you do not need to modify a submodel for a specific expression, you should still create an independent shape. This allows consistent shape numbering for all of the submodels that compose the face. For example, if the teeth are the same for the default shape and the "AA" phoneme shape, you should duplicate the default teeth shape for the "AA" phoneme.

- Head models on page 1595

Shapes

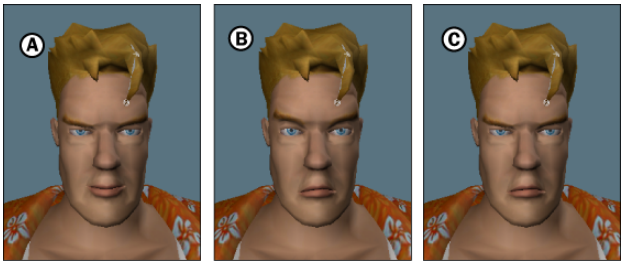
A shape is the position of one or more of the facial features on a head model. Every facial expression is created with a combination of shapes, with the facial

features (such as the eyes, nose, mouth) each positioned in a particular way. By creating different combinations of these shapes, you can create any kind of expression on a head model.

NOTE You cannot create facial animation within MotionBuilder unless you have a head model with shapes or cluster shapes.

Shapes can also be referred to as gizmos or morph targets. Most often, face shapes change the position of the model's mouth, eyebrows, eyes, cheeks, or nostrils. The type and number of shapes you create depends on your project.

For example, you can blend the "Brow Down" shapes with the "Mouth Corner Down" shapes to create an angry facial expression on the model, as shown in the following figure.



A. **Brow Down shapes** *B.* **Mouth Corner Down shapes** *C.* **Resulting angry expression**

- Choosing shapes to create on page 1604
- Creating shapes on page 1605

Facial rest pose

The facial rest pose is the default expression your character's face assumes when there is no specific facial expression applied. The rest pose consists of a closed mouth, open eyes, and eyebrows that are at mid-level.

Whatever shapes you need, the first shape you should create is the rest pose (Shape 0). You can then start with a copy of the rest pose as you create all of the other shapes your project requires. The following figure shows the face in a rest position consisting of a closed mouth, open eyes, and eyebrows at mid-level.

Face in a rest position

- Generic shapes on page 1598
- Creating shapes on page 1605

Generic shapes

Generic shapes correspond to the Generic channels used by the Actor Face settings to animate a head model connected to a motion capture source. See Animating generic channels on page 1624.

If you do not plan to use an Actor Face to connect to a motion capture source, you do not have to create Generic shapes for your head model.

Use and the following descriptions as guidelines when creating Generic shapes.

Generic shapes

Rest Pose

Mouth is closed, eyes are open, eyebrows at mid-level.

Mouth Open

Jaw is dropped, teeth are open or do not show.

Mouth Square

Mouth is open, teeth can be closed.

Mouth Whistle

Mouth is closed, lips are pursed.

Mouth Corners (four shapes)

Left and right corners of the mouth in up and down positions.

Eyes (six shapes)

Both eyes in closed, squint, and wide open positions.

Eyebrows (four shapes)

Both eyebrows in up and down positions.

Cheeks (four shapes)

Left and right cheeks in up and out positions.

Nostrils (two shapes)

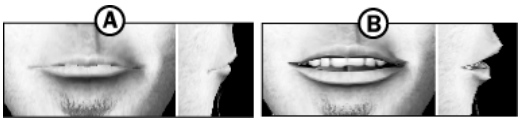
Both nostrils in up positions.

- Choosing shapes to create on page 1604
- Creating shapes on page 1605
- Choosing shapes to create on page 1604
- Animating Faces on page 1587
- Actor Face asset on page 1611

Phoneme shapes

Phonemes are the smallest individual units of sound that are combined to form speech. A phoneme shape refers to the position of the lips, teeth, tongue, and jaw required to utter a phoneme, or a specific sound of speech.

For example, the phoneme shape for the phoneme /m/ consists of lips that are pressed together, whereas the phoneme shape for /l/ consists of lips that are not round and that are slightly apart, with the tip of the tongue pressed lightly to the gums behind the upper teeth.



A. **/m/ phoneme shape** *B.* **/l/ phoneme shape**

Phoneme shapes are needed when you use the Voice device, in conjunction with the Character Face asset, to drive your facial animation. Refer to the

Various Phoneme shapes on page ? figure as a guide for creating phoneme shapes supported by the Voice device.

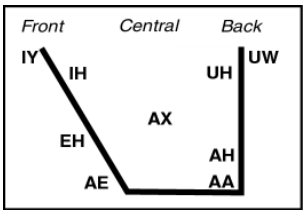
However, you can also drive phoneme shapes as you would custom shapes, using keyframes or devices such as joysticks and keyboards.

Create as many phoneme shapes as you need. If you create only a few phoneme shapes, they can be blended to simulate other shapes. However, the more phoneme shapes you create for a model, the better quality the final animation.

In speech, vowels are particularly important because they comprise the majority of visual cues in spoken language.

How vowels are articulated depends on the different movements of the mouth and tongue, such as the front or back placement of the tongue and the movement of the lips.

The following figure shows the English vowel system (partial) in a scale ranging from front unrounded (IY) to back rounded (UW) vowels. Most other vowels fall in between these two extremes (IY and UW). AX is approximately in the middle, and represents the sound that is made when the tongue and mouth are at complete rest.



Partial English Vowel System

Phonemes are not always pronounced in the same way and may fall between vowels. To compensate for this, or if your model was created without a specific shape, MotionBuilder weights the nearest vowels to generate a mix of shapes that approximates the position of your model's lips.

If your model says a vowel that falls outside the range that your shapes cover, MotionBuilder chooses the closest vowel.

You should select the vowels that correspond to your shapes. Ideally, you should create your model with the shapes for the extreme ends of the vowel range, then uniformly space more vowels in between. See the following figure for a visual example of phonemes and their shapes.

Various phoneme shapes

For example, if you want your character to slightly open and close its mouth, you could use only one vowel such as AX (as in “the”). If you want more subtle movement to represent the sound between different vowels, use more than one. Accordingly, if your model has three shapes that say “beat”, “bat”, and “boot”, use IY, AE, and UW. If your model has six shapes saying “bit”, “bet”, “bob”, “boat”, “book”, and “seat”, use IH, EH, AA, OW, UH, and S respectively.

The following table lists the phoneme shapes available in MotionBuilder and gives an example illustrating their pronunciation.

Phoneme	Example
AE	cat
AO	fought
AX	alas

Phoneme	Example
B	bike
D	dam
F	fox
G	gate
H	hat
IY	heat
K	cake
KG	concur
L	lock
M	moon
N	new
OW	goat
P	point
S	site
SH	shape
T	tap
UH	look
UW	loot
V	veer
Z	zoo
ZH	pleasure

Custom shapes

You can create custom shapes for additional facial expressions and animation that do not match the Generic and Voice shapes. For example, you can create custom shapes for additional eyebrow, nostril, and cheek movements.

Custom shapes should be independent from the supported Generic and Phoneme shapes so that you can blend them to other shapes.

For example, a custom forehead expression should have its own shape. This lets you blend it with other facial expressions and phonemes, instead of only applying it to a specific movement.

Refer to Choosing shapes to create on page 1604 for a guide to creating phoneme shapes supported by the Voice device.

- Smoothing phoneme transitions on page 1666
- Animating Faces on page 1587
- Choosing shapes to create on page 1604

Choosing shapes to create

The shapes you need to create depend on the method you plan to use to animate your head model.

For example, if you want your head model to be connected to a live performer, you must create shapes that match the Generic expressions in the Actor face. If you want your head model to be connected to the Voice device, you need to create shapes that match phonemes. These shapes are referred to as voice shapes.

The types of shapes that you can create are divided into the following categories:

- Rest Pose, which is the expression of your model at rest.
- Generic shapes, which are basic facial expressions that let you use motion capture data to drive facial animation.
- Phoneme shapes, which are basic mouth shapes that let you use audio files and the Voice device to drive facial animation.
- Cluster shapes, which let you create shapes for models with clusters.

You are not restricted to creating shapes that match only the generic and voice shapes, you can create any shape that you want.

Once you create all your shapes, you are ready to export your model(s) to MotionBuilder.

- Creating shapes on page 1605
- Clusters and cluster shapes on page 1605

Creating shapes

Shapes for head models are created using software external to MotionBuilder, then imported using the File > Import function.

Techniques for creating shapes may differ between software. For example, some 3D software may require that you save each shape on the head model at different frames. In others, you create duplicates of your head model with different shapes.

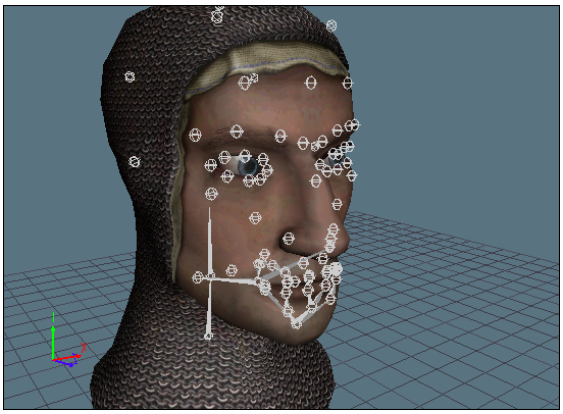
In general, when creating a shape, start with a copy of the facial rest pose so that each shape starts from the same rest position. Then when you create transitions between facial expressions, the shapes blend together smoothly because they are all created from the same basic template.

- Choosing shapes to create on page 1604
- Head models on page 1595
- Choosing shapes to create on page 1604

Clusters and cluster shapes

Clusters are moveable sections of geometry on a face model that are set up to mimic the movement of muscle under skin and define the appearance of the face.

Cluster shapes are simply groups of clusters. When blended together, they create realistic facial expressions.



Clusters appear on a head model

NOTE If your model has clusters instead of shapes, you can use MotionBuilder to create cluster shapes from groups of clusters. See Creating cluster shapes on page 1606.

You create clusters on a head model using MotionBuilder-compatible modeling software. Using a Character Face asset in MotionBuilder, you then group clusters together to create cluster shapes which can be mapped to custom or generic expressions. Model your cluster shapes to correspond with Generic and Voice channels, as you would ordinary generic and phoneme shapes.

NOTE You can only make cluster shapes with a model that has clusters.

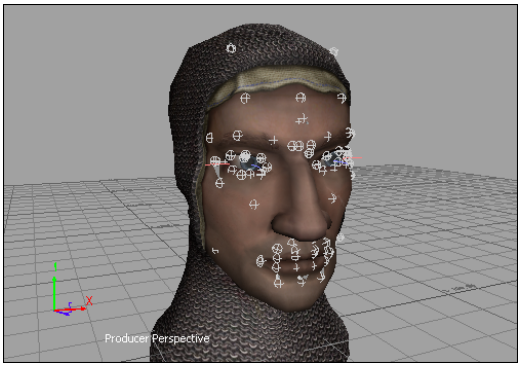
- Creating cluster shapes on page 1606
- Changing the rest pose for cluster shapes on page 1608
- Renaming cluster shapes on page 1609

Creating cluster shapes

These are general guidelines for creating shapes from groups of clusters. Once clusters are grouped, they can be mapped to expressions from the Shapes Mapping pane, just like regular shapes.

To create cluster groups and cluster shapes:

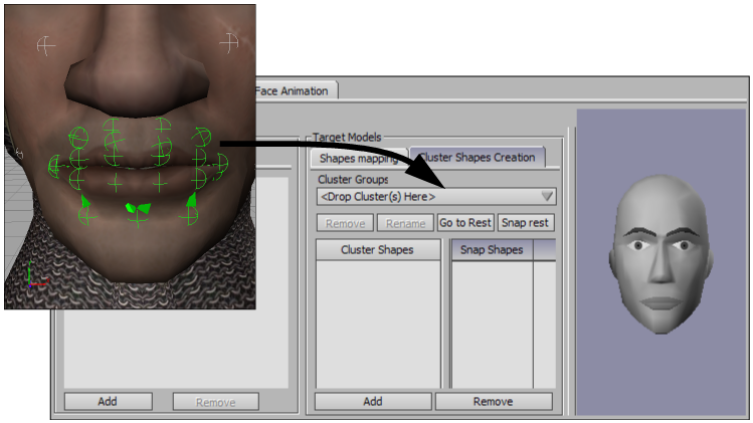
1 Load a head model with clusters into the scene.



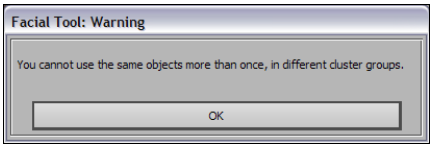
Head model with cluster shapes

2 Create cluster groups by doing the following:

- Select any number of unused clusters, such as all the clusters for the mouth.
- *Alt*-drag the selected clusters into the Cluster Groups menu of the Cluster Shapes Creation pane, as shown in the following figure.



A cluster group is created. If you attempt to create a cluster group with a cluster already added to another cluster group, a dialog box appears. Each cluster can only belong to one cluster group.



Facial Tool: Warning dialog box

3 Rename the cluster group and click Add to add a shape to the Cluster Shapes list.

4 Translate, rotate, and scale the clusters belonging to the cluster group to define the Cluster Shape.

NOTE Make sure that the Active option is disabled to be to transform clusters.

5 Click Snap for each shape. Only clusters belonging to the selected Cluster Group are defined as the shape.

To see the shapes you have created, click on their names in the Cluster Shapes list.

- Clusters and cluster shapes on page 1605
- Changing the rest pose for cluster shapes on page 1608
- Renaming cluster shapes on page 1609

Changing the rest pose for cluster shapes

To change the rest pose:

- Click Rest Pose to work from the current rest pose, move the clusters to a position, and click Snap Rest.
  The model's rest pose is the position in which the face is at rest. By default, a cluster shape's rest pose is the position of the clusters when you drag them into the Cluster Groups menu.

You can use the cluster shapes in the Shapes Mapping pane of the Character Face settings. See Shapes Mapping pane on page 1648 for more information.

- Clusters and cluster shapes on page 1605

- Choosing shapes to create on page 1604

Renaming cluster shapes

To rename cluster shapes:

1. Double-click on the default name.
2. Type in a name.
3. Type Enter to confirm the change.

- Clusters and cluster shapes on page 1605

Part 1: Actor Face asset

The Actor Face asset lets you animate a character's face by transferring animation data from a motion source to a Character Face.

You can use an Actor Face to define a facial Marker set for a motion capture device or for facial motion capture data, then connect the Actor Face as the motion source of a Character Face.

An Actor Face is mapped to motion data using a set of markers called a facial Marker set. This facial Marker set maps markers or sensors of motion data to the specific locations on the Actor Face that they control. You can manipulate and plot the marker or sensor data to the Generic channels of the Actor Face, then clean-up the data by keyframing directly on the Generic channels before plotting the animation to your character head model.

- Attaching an Actor Face to a head model on page 1612
- Actor Face Settings on page 1627
- Character Face asset on page 1639

Adding an Actor Face to the scene

To add an Actor Face to the scene:

➤ In the Asset browser, open the Characters folder and drag an Actor Face asset into the Viewer window.

Nothing appears in the Viewer window, but a new Actor Face is added to the Scene browser.

When you drag an Actor Face over a head model with shapes, a contextual menu appears letting you select the Attach Facial option. Selecting Attach Facial also adds a Character Face to your scene and connects it to the Actor Face.

- Actor Face asset on page 1611
- Attaching an Actor Face to a head model on page 1612

Attaching an Actor Face to a head model

To attach an Actor Face to a head model with shapes:

1. Drag an Actor Face from the Characters folder of the Asset browser onto a head model with shapes.
2. Select Attach Facial from the contextual menu that appears.

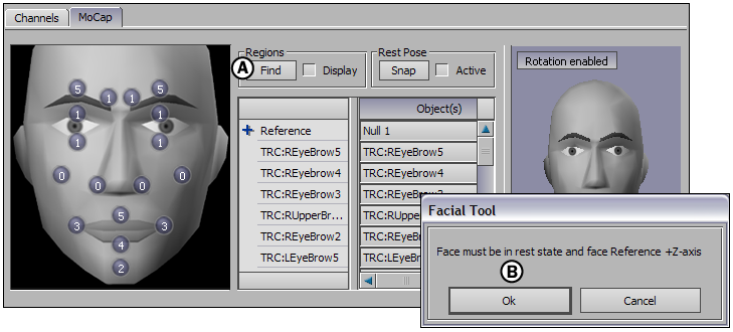
- Actor Face asset on page 1611
- Voice device on page 1657

Connecting an Actor Face to motion capture data

Once you have imported some facial motion capture data and added an Actor Face to the scene, you can set up the motion data to drive the Actor face.

To connect an Actor Face to motion capture data:

1. Drag a null into the scene and set it up as the Reference object for the face. See Creating a face reference on page 1615.
2. Create a facial Marker set. See Creating a facial Marker set on page 1617.
3. In the Regions area of the MoCap pane, click the Find button, then click Ok in the dialog box that appears reminding you that the face must be in the rest pose and facing the Z-axis.



Defining facial regions. *A.* **Click Find.** *B.* **Click Ok.**

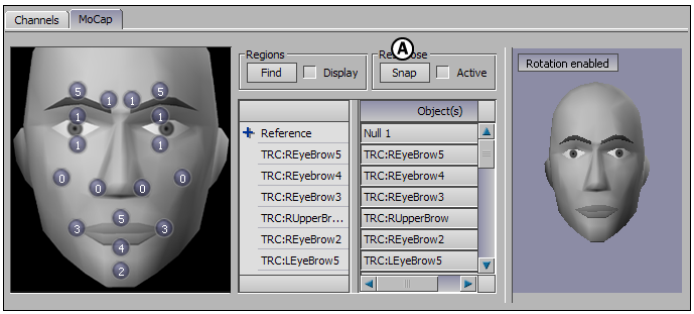
MotionBuilder automatically defines the zone of movement for the facial markers.

You can scale the global movement using the bounding boxes that define specific zones for the mouth, eyes, and eyebrows. For example, you can scale up the bounding box for the mouth to decrease the range of movement.

TIP To view the bounding boxes in the Viewer window, activate Display in the Regions area.

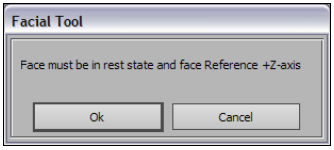
---

4 With the motion data in a neutral pose, click Snap in the Rest Pose area.



Actor Face settings *A.* **Snap option**

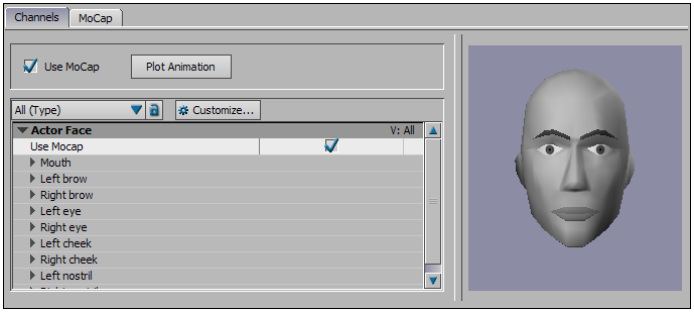
5 Click Ok in the dialog box that appears.



Facial Tool dialog box

The starting pose of the face is set, and the mapping is activated. The Active option is automatically enabled, and the other options in the Regions and Rest Pose areas are disabled. To make any changes to the mapping, you must disable Active.

6 Switch to the Channels pane to verify that the Use MoCap option is be active.



The Use MoCap option is activated in the Channels pane.

The motion capture source can now drive the channels. When you play the animation, the channel sliders move and show their active values, and the Preview pane shows the effect of the motion capture data.

When you have completed these steps, you can continue setting up your Actor Face to drive a Character Face. See Facial motion capture workflow on page 1589.

NOTE You can use multiple motion files on different takes by creating a new take, selecting the optical root of the motion data, and loading another file from File > Import.

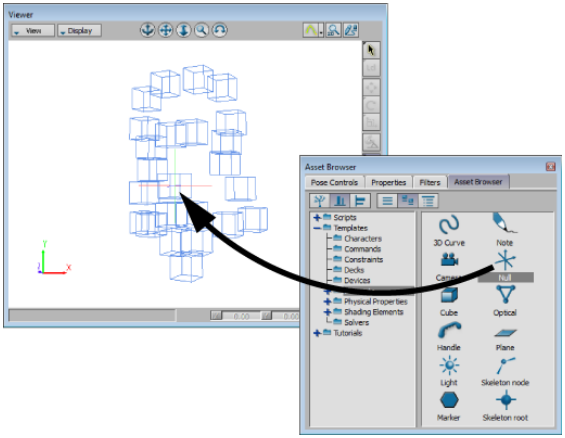
Creating a face reference

Once you have loaded the facial motion data you want to work with, you need to create a Reference object for the face.

To create a face reference:

1 From the Elements folder in the Asset browser, drag a null into the scene.

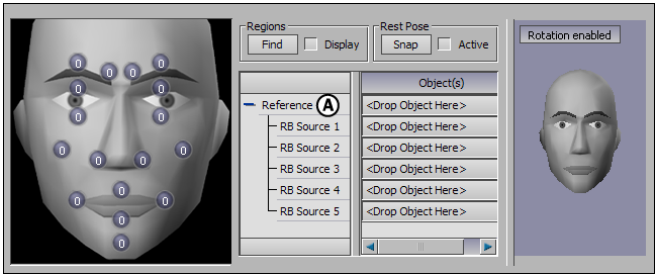
Since the null will be the Reference object, make sure it faces the same direction as the motion data markers.



Drag a null into the scene to act as the Reference object for the face.

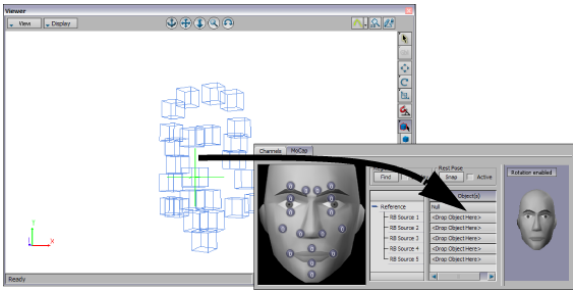
2 If you have not already done so, drag an Actor Face into the scene. See Adding an Actor Face to the scene on page 1611.

3 In the Actor Face settings, switch to the MoCap pane and expand the Reference group.



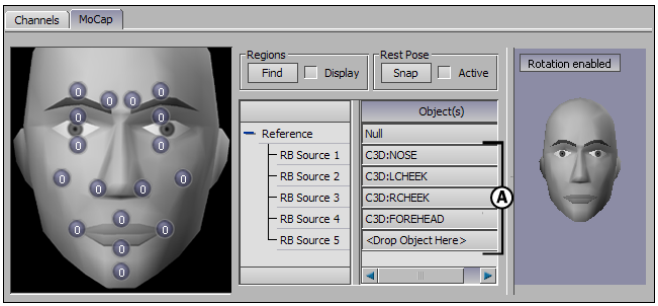
MoCap pane in the Actor Face settings *A.* **Expand the Reference group.**

4 *Alt*-drag the null from the Viewer window into the Reference slot.



***Alt*-drag the null into the Reference slot in the Actor settings.**

5 Identify a group of markers that do not move relative to each other, such as the forehead markers, and drag them into the series of Rigid body slots (RB Source 1, RB Source 2, and so on) in the Reference group.



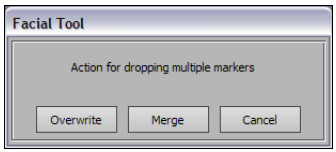
Actor Face settings *A.* **Rigid body sources**

After you set up the face reference, you can go on to define the rest of the facial Marker set. See Creating a facial Marker set on page 1617.

When you play the motion data after setting up the Marker Set list and defining regions, the reference moves with the markers.

To add multiple Rigid body markers simultaneously:

1. Select multiple markers and *Alt*-drag them into a Rigid body slot.
2. A dialog box appears giving you the choice to Overwrite, Merge, or Cancel.
   - Select Overwrite to replace any existing sources in the Rigid body fields with new markers. For example, if you *Alt*-drag three markers at the same time, the first three Rigid body fields are replaced in the Marker Set list.
   - Select Merge to append the markers to existing markers in the list. No Rigid body sources are replaced, so only the remaining empty fields are defined.
   - Select Cancel to abort the operation.



Overwrite, Merge, or Cancel the Rigid body sources.

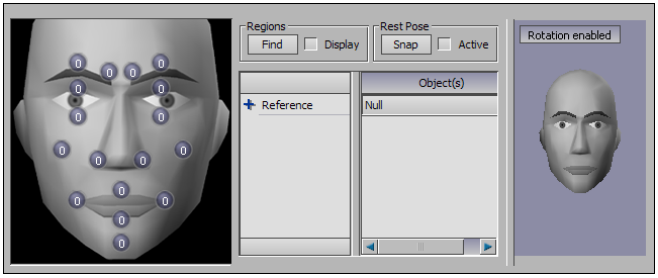
- Connecting an Actor Face to motion capture data on page 1612

Creating a facial Marker set

After you have loaded facial motion data in the scene, added an Actor face, and defined a Reference object, you can create a facial Marker set.

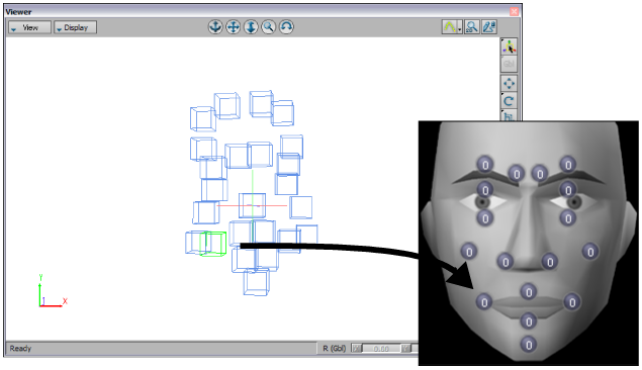
To create a facial Marker set:

1. In the Actor Face settings, switch to the MoCap pane.



MoCap pane of the Actor Face settings

2 *Alt*-drag one or more selected objects containing motion data from the Viewer window into the corresponding cell of the Mapping model in the Actor Face settings.

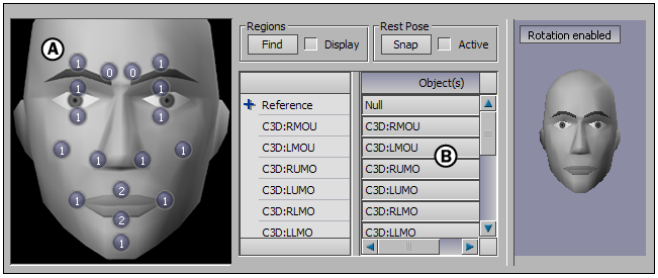


***Alt*-drag markers into the Mapping model.**

NOTE Be sure to deselect each marker before going on to select the next one.

As you add markers, the cells of the Mapping model display the number of markers that affect each part of the face. Each cell can have up to five markers.

The objects are also added to the Marker set list in the MoCap pane.



A. **Mapping model displays numbers of markers** *B.* **Mapping Set list displays list of marker names.**

To view a list of the markers that affect each part of the face:

Select a cell in the Mapping model.

A green outline displays around the cell and the list of markers influencing that part of the face displays in the Mapping Set list.

To view all markers in the Marker Set list:

Click the background of the Mapping model to deselect all cells.

To delete markers from a cell:

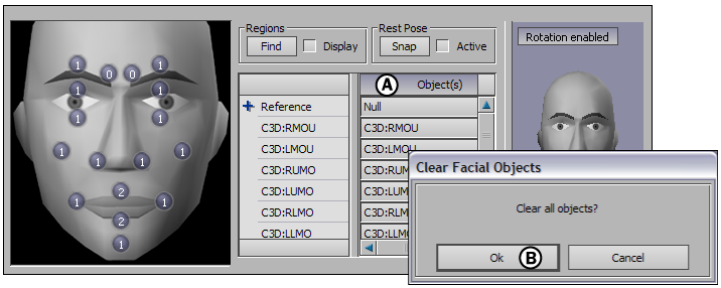
Select the marker in the Marker Set list and press Delete. For information on clearing all markers from the Marker Set, see Creating a face reference on page 1615.

See Connecting an Actor Face to motion capture data on page 1612.

Clearing all markers in a facial Marker set

To clear all markers in a facial Marker set:

Click the heading “Object(s)” at the top of the Marker Set list, then click Ok in the dialog box that appears.



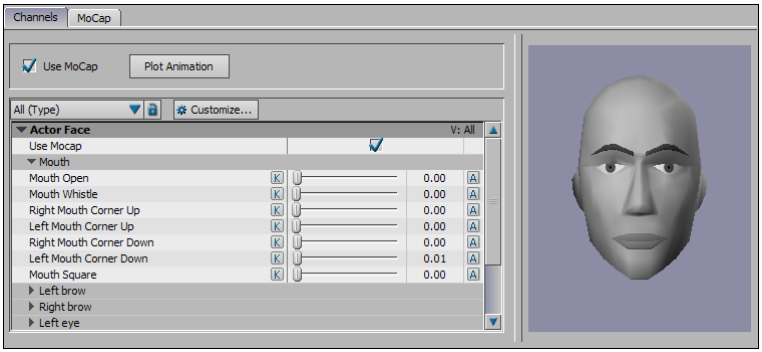
Clearing the facial Marker set *A.* **Click the Object(s) heading** *B.* **Click Ok.**

Editing facial motion capture data

To edit facial motion capture data, you first have to plot the data to the Actor face channels.

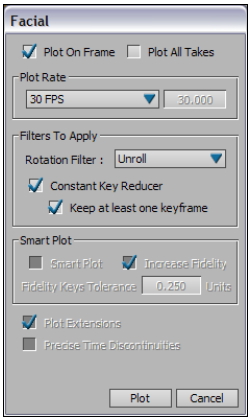
To edit facial motion capture:

1 Transfer the motion capture to the Actor Face channels by clicking Plot Animation in the Channels pane.



Click Plot Animation.

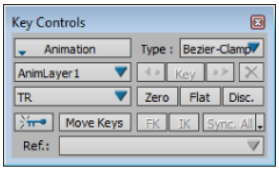
2 Click Plot in the Facial dialog box that appears.



Click Plot in the Facial dialog box.

In the Channels pane, the Animate (A) option is activated for all generic channels, making each channel available for editing.

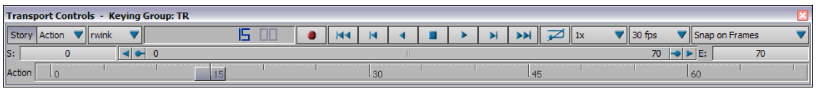
3 In the Key Controls window, select AnimLayer1 from the Layer menu.



Select AnimLayer1.

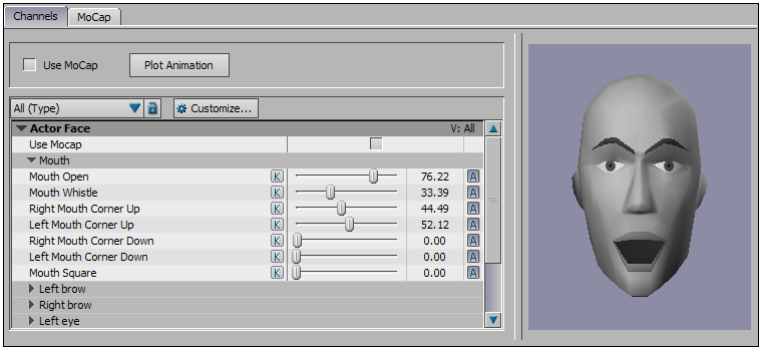
By animating on a new layer, you can modify the animation without changing the plotted animation. Use the Animation Layer editor to view and manage all animation layers. When your satisfied with your changes, you can merge the layers.

4 Move the Timeline indicator to where you want to change the animation.



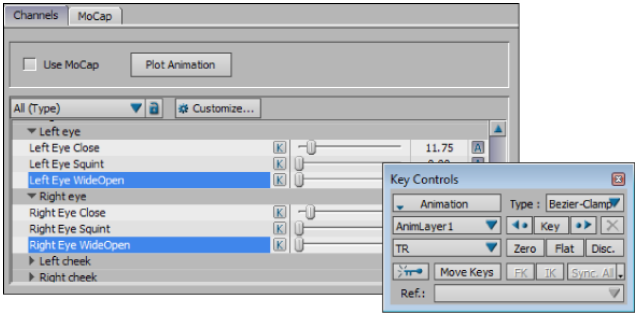
Move the Timeline indicator.

5 Modify the animation by adjusting the channel sliders.



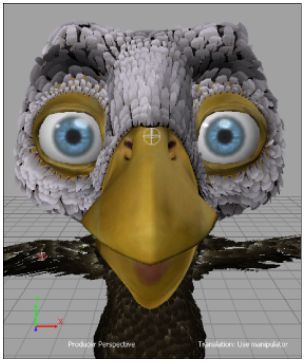
Adjust the Channel sliders.

6 Select the channels you want to keyframe, then click Key.



Select the channels you have changed, then click Key to set a keyframe.

7 Play your animation to see the changes.

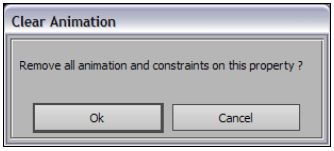


Review the changes you have made.

Removing animation from a channel

To remove animation from a channel:

1. In the Channels pane of the Actor Settings, disable the Animate (A) option next to the channel.
2. Click Ok in the Clear Animation dialog box that appears to confirm that you want to delete all of the animation and remove the channel from any related constraints.



Clear Animation dialog box

This removes the channel from constraints and deletes all animation associated with the channel.

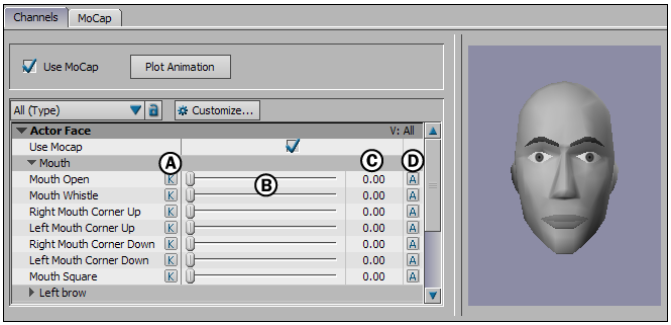
- Channels pane on page 1628
- Animating generic channels on page 1624

Animating generic channels

To animate generic channels:

1 In the Channels pane of the Actor Settings, enable the Animate (A) option next to the channels you want to animate.

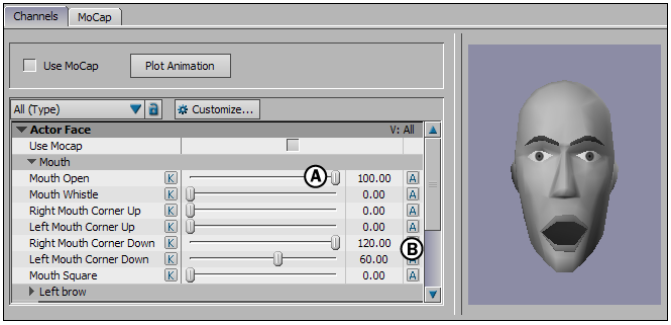
When the Animate (A) option is enabled, the channel can be keyframed and used within a constraint.



Actor Settings, Channels pane *A.* **Keyframe (K) button** *B.* **Channel slider** *C.* **Value field** *D.* **Animate (A) option**

2 Change the value of the channel using the slider or value field. To display the full effect of a channel, drag its channel slider fully to the right.

The maximum value of a channel slider is 100%, but you can use values higher than 100 and lower than 0 in the value field.



A. **Channel at 100%** *B.* **Value field at 120.**

3 Set a keyframe by clicking the Key (K) button next to the selected channel, or clicking Key in the Key Controls window.

- Channels pane on page 1628
- Actor Face Settings on page 1627

Actor Face Settings

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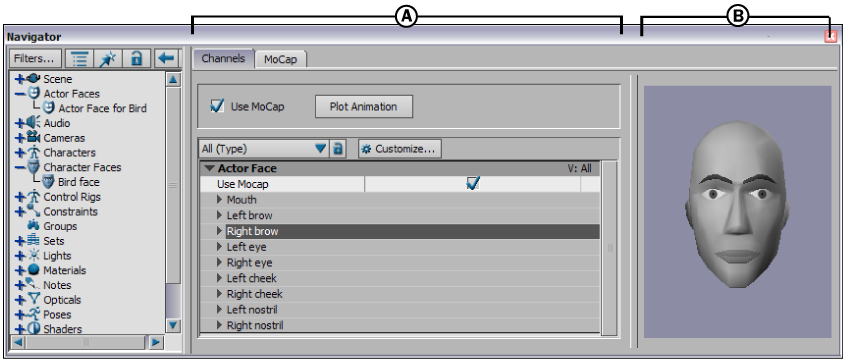
The Actor Face lets you do the following:

- Connect motion capture data from a live or recorded source to an Actor Face.
- Plot motion capture data from a live or recorded source to an Actor Face.
- Animate expressions plotted to an Actor Face using keyframe animation and constraints.
- Use as a motion source for a Character Face to animate the shapes of a head model with live or recorded motion capture data.

The Actor Face settings consist of the following areas:

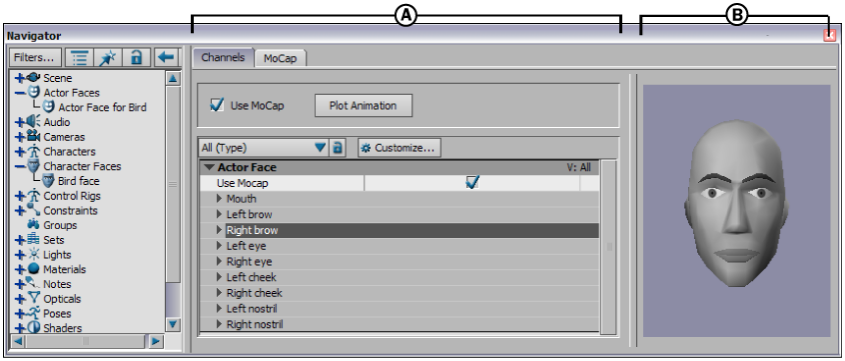
- Channels pane on page 1628
- MoCap pane on page 1630
- Preview pane on page 1636



Actor Face settings *A.* **Channels pane** *B.* **Preview pane**

Channels pane

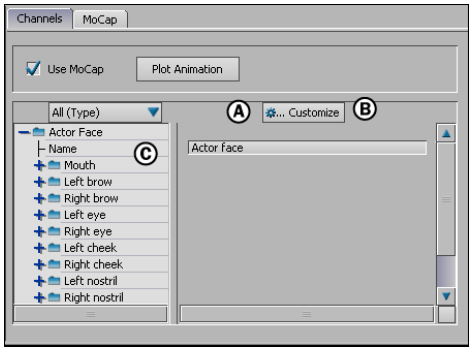
The Channels pane lets you drive and animate channels using keyframes, motion capture, and devices in Relations or Expressions constraints. These channels are defined in the Character Face settings.



Actor Face settings *A.* **Channels pane** *B.* **Preview pane**

The Channels pane consists of the following:

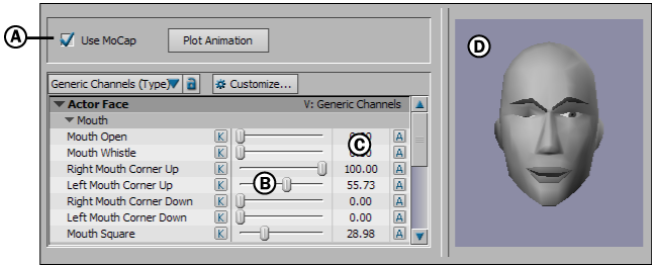
- Use MoCap option on page 1629
- Plot Animation button on page 1629
- Channels List on page 1629



Channels pane *A.* **Use MoCap option** *B.* **Plot Animation button** *C.* **Channels list**

Use MoCap option

When Use MoCap is enabled, the motion capture source drives the channels. The motion capture source is set up in the MoCap pane. See MoCap pane on page 1630.



A. **Use MoCap is enabled and motion capture data drives the channels.** *B.* **The sliders move.** *C.* **The value fields change.** *D.* **The Preview pane shows the effects of the motion capture.**

As the animation plays, the channel sliders move in conjunction with the motion capture data, and the current values display in the value field. The Preview model also shows the effect of the motion capture data.

NOTE You cannot use the channel sliders in the Channels pane when the Use MoCap option is activated.

Plot Animation button

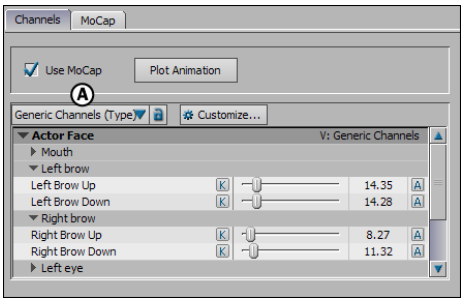
The Plot Animation button plots the motion capture data to the channels of the Actor Face. Plotting activates all Animate (A) options, making the channels available for keyframing and for use in constraints.

After you plot, the Use MoCap option is disabled since the Actor Face no longer uses the motion capture data as a source, but instead uses the generic channels.

Channels List

The Actor Face and Character Face use a set of twenty-three generic channels to communicate with each other. The channels in the Actor settings consist of various positions of the mouth, eyebrows, eyes, cheeks, and nostrils, and they correspond to the generic expressions you define in the Character Settings.

In the Actor Face settings, each generic channel in the list has a Key (K) button, Channel slider, Value field, and Animate (A) option.



Channels pane of the Actor Settings *A*. **The Generic Channels view is selected in the View menu.**

- Defining a custom expression on page 1592
- Animating generic channels on page 1624

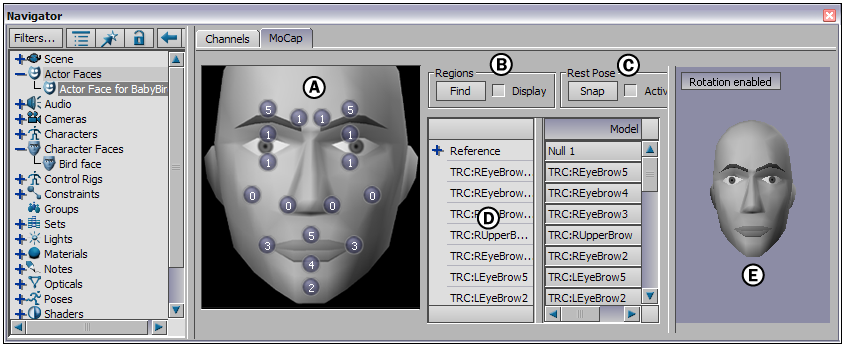
MoCap pane

The MoCap pane lets you map markers to drive the Actor Face. The markers can be, for example, a set of optical markers imported from a Vicon *.c3d* file, or a set of sensors connected to a live device.

The mapping process involves defining nodes that control the movement of certain face regions. In the Actor Face settings, these nodes control areas such as the eyebrows, eyes, cheeks, nose, mouth, and so on.

The MoCap pane consists of the following:

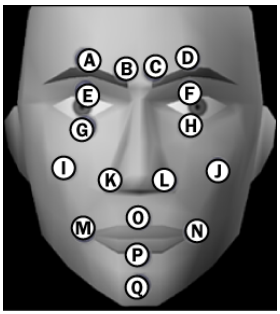
- Mapping model on page 1631
- Marker Set list on page 1632
- Regions area on page 1633
- Rest Pose area on page 1635



MoCap pane *A.* **Mapping model** *B.* **Regions area** *C.* **Rest Pose area** *D.* **Marker Set list** *E.* **Mocap Preview area**

Mapping model

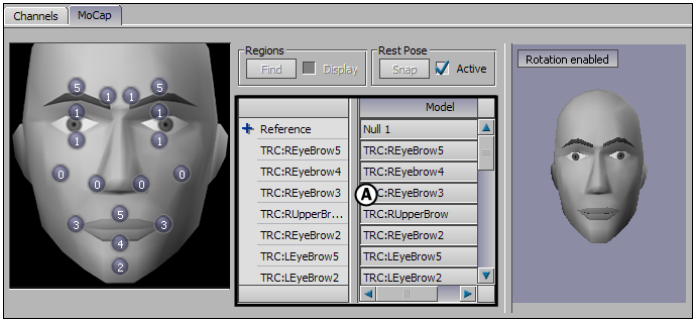
The Mapping model is a visual representation of the Actor Face that shows the number of markers affecting each facial part. The mapped markers are collectively called a Marker set. The following figure identifies the cells in the Mapping model that represent each facial part.



A. **Right outer eyebrow** *B.* **Right inner eyebrow** *C.* **Left inner eyebrow** *D.* **Left outer eyebrow** *E.* **Right upper eye** *F.* **Left upper eye** *G.* **Right lower eye** *H.***Left lower eye** *I.* **Right cheek** *J.* **Left cheek** *K.* **Right nostril** *L.* **Left nostril** *M.* **Right mouth** *N.* **Left mouth** *O.* **Upper mouth** *P.* **Lower mouth** *Q.* **Chin**

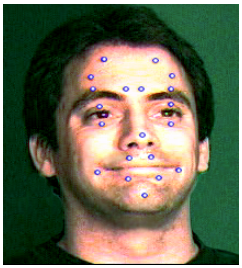
Marker Set list

The Marker set list lets you define a Marker set for mapping motion data to the Actor Face. The mapped areas define the facial parts on your source model that relate to the motion sensors on a performer.



MoCap pane *A.* **Marker set list**

For example, you can see motion sensors on the performer's face in the following image. The marker names in the list indicate where the sensors or markers drive the model, and where they eventually drives the Character's facial shapes.



Performer with facial motion sensors.

The first item in the Marker Set list is the Reference field. Setting a reference with Rigid body sources lets you stabilize the head movement. The reference represents the head bone from which the markers move.

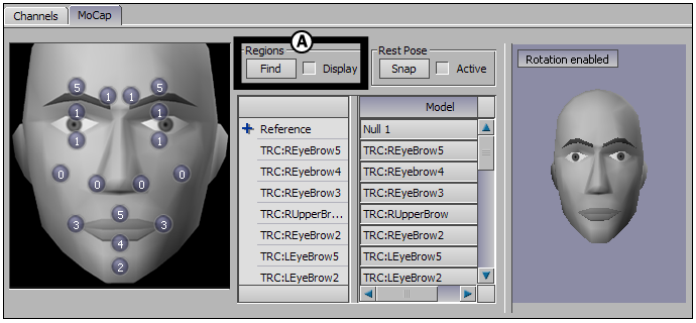
To scroll through the Marker Set list, you can Shift-drag up or down. You can rename a marker in the Marker Set list by double-clicking the marker to select it, typing a new name, and pressing Enter.

To delete a marker, select the marker in the Marker Set list, then press Delete. To delete all models in the Marker Set list, click the Model heading at the top

of the column. In the dialog box that appears, click Ok to delete all models in the list.

Regions area

After setting up the Marker Set list, use the Regions area to define the zone of movement for the model's main facial components. The Regions area is available only when the Active option in the Rest Pose area is disabled, and consists of the Find button and the Display option.



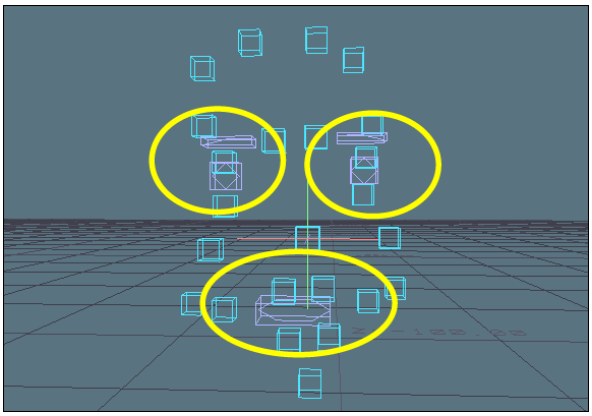
MoCap pane *A.* **Regions area**

Find

The Find button automatically defines the zone of movement for the facial markers using bounding boxes around the mouth, eyes, cheeks, nostrils, and eyebrows. The face must be in the rest pose and be pointed towards the Reference positive Z-axis.

Display

To display the bounding boxes in the Viewer window, activate Display after clicking Find. Bounding boxes appear as purple cubes around the eyes, eyebrows, cheeks, and mouth of your face model.



Bounding boxes display in purple around the eyes, eyebrows, and lips of the optical sensors. Cheeks and nostrils are not defined for this Marker set.

Bounding boxes are Rigid bodies that limit the area in which of your face model can move. If the shapes are set to move outside of a bounding box region, they do not reach to their full values.

You can scale the global movement using the bounding boxes. For example, if there are not enough face markers, you may want to define facial areas so that they fit the boxes more accurately.

When you scale bounding boxes, you affect the volume and shape that the box defines. For example, increasing the size of the bounding box for the mouth decreases the range of movement. Conversely, decreasing the size of the box increases the range.

The data for the bounding boxes comes from the optical sensors that you used to define your Marker set

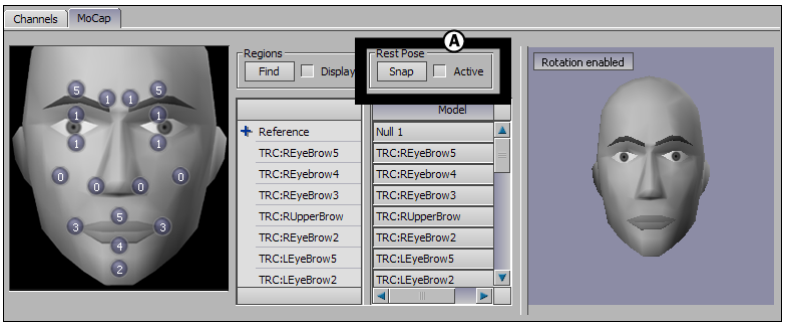
Right Eye	Upper and lower right eye sensors (2)
Left Eye	Upper and lower left eye sensors (2)
Right Eyebrow	Inner and outer right eyebrow sensors (2)
Left Eyebrow	Inner and outer left eyebrow sensors (2)
Mouth	Right, left, upper, and lower mouth sensors (4)
Right Cheek	Right cheek sensor

Left Cheek	Left cheek sensor
Right Nostril	Right nostril sensor
Left Nostril	Left nostril sensor

NOTE Remember that both the size of your optical sensors and of the bounding boxes in the Viewer window are adjustable, so the bounding boxes might not match their corresponding optical sensors exactly.

Rest Pose area

The Rest Pose area consists of the Snap button and the Active option.



MoCap pane. *A.* **Rest Pose area**

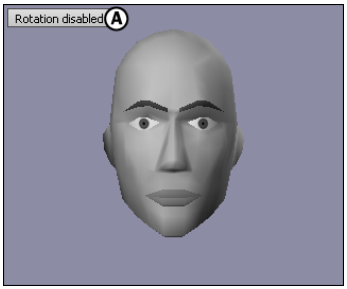
Option	Description
Snap	Use the Snap button after creating the Marker set and setting the regions. Click Snap to compute slight positioning differences between the Marker set and the sensors the Marker set uses, and to set the starting point of the face. The Actor Face settings use the rest pose of the face as the default starting point.
Active	Clicking Snap automatically enables the Active option and activates the mapping. When activated, the remaining options in the Rest Pose and Regions areas are disabled. To make any changes in the Mapping List, you must disable the Active option.

■ Actor Face Settings on page 1627

Preview pane

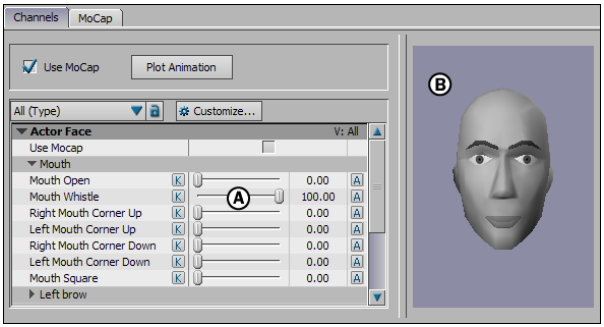
The Preview pane lets you view individual generic channels, as well as the effect of motion capture.

By default, the model in the Preview pane assumes the rest pose, in which the mouth is closed, the eyes are open, and the eyebrows are at mid-level.



Preview pane with model in the rest pose. *A.* **Rotation disabled button appears in the MoCap Preview pane.**

To view the effect of an individual channel on the model in the Channels pane, drag a channel slider fully to the right.



A. **The channel slider for Mouth-Whistle is at 100%.** *B.* **The full value of the channel displays on the Preview model.**

When you blend generic channels, you can see the composite effect on the Preview model. In the Channels pane, drag multiple sliders to see the effect on the Preview model. See Channels List on page 1629 for more on channels.

Shortcuts in the Preview Pane

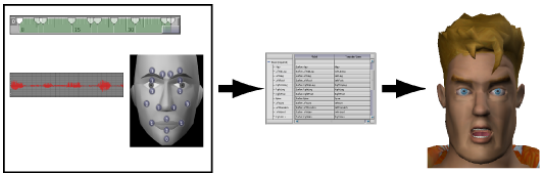
You can use the following shortcuts in the Actor Face Preview pane:

Orbit around Face	*Ctrl*-*Shift*-drag in the Preview pane.
Zoom on Face	*Ctrl*-drag in the Preview pane.
Frame on Face	Click in the Preview pane and press F.
Hide the Preview Model	Double-click in the Preview pane to hide the model and increase the refresh rate. Double-click again in the Preview pane to display the model.

■ Channels List on page 1629

Part 2: Character Face asset

The Character Face receives motion capture, audio data, or keyframe animation and uses the Generic and Custom expressions to animate the appropriate shapes on the head model.



Character Face animation data, generic channels, and model with shapes

With a Character Face, there is no automatic characterization process that lets MotionBuilder recognize the parts of the face. Instead, the shapes that make up a character's head model must be manually mapped to the Character Face to be set up for animation.

To do this, you use the Character Face Definition pane to map your head model's shapes to Generic and Custom expressions.

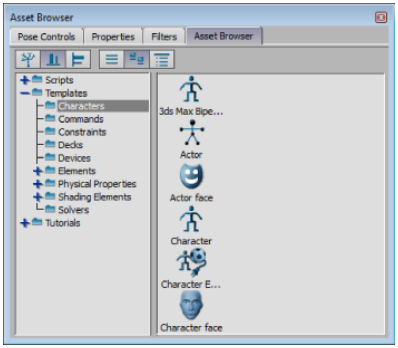
For information on creating head models and their shapes and how to create facial animation within MotionBuilder, see Head models on page 1595 and Animating Faces on page 1587.

- Adding a Character Face on page 1640
- Adding shapes to a Character Face on page 1640
- Defining expressions workflow on page 1641
- Defining a custom expression on page 1642
- Defining a generic expression on page 1643

Adding a Character Face

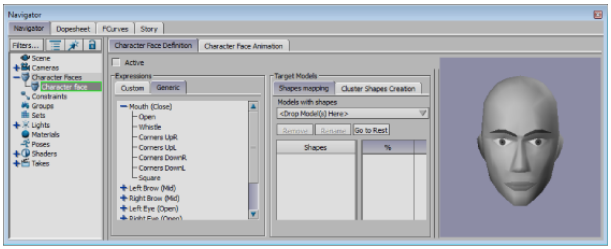
To add a Character Face to the scene:

1 Click the Characters folder in the Asset browser.



2 Drag a Character Face asset into the Viewer window.

The Character Face settings display in the Navigator window.



After you have added a Character Face to the scene, you can begin to define the expressions for your character's face. See Defining expressions workflow on page 1641.

Character Face asset on page 1639

Adding shapes to a Character Face on page 1640

Adding shapes to a Character Face

To add shapes to the Character face Shapes list:

1 Load a head model with shapes or cluster shapes.

2 Add a Character Asset to the scene. See Adding a Character Face on page 1640.

3 In the Target Models area of the Character Face settings, switch to the Shapes Mapping pane.

4 Select the head model and Alt-drag it from the Viewer window into the Models With Shapes menu.

   All of the model's shapes display in the Shapes list.

5 Click Go to Rest to switch the selected model to its rest pose.

To remove a model:

➤ Select the model to remove from the Models With Shapes menu and click the Remove button.

To rename models:

➤ Select the model in the Models With Shapes menu and click the Rename button. Type the new name and press Enter.

Defining expressions workflow

Once you have a head model with shapes in your scene, you can define facial expressions using the Character Face asset. Whether you need to define Generic expressions, Custom expressions, or both, depends on whether you are using motion data (and an Actor Face) or voice recognition data (Voice device).

The workflow for defining expressions can be summarized in the following steps:

1 Add the shapes of the head model to the Character Face. Adding shapes to a Character Face on page 1640.

2 Depending on how you plan to animate your character's face, do one of the following:

   - If you are planning to animate the head model with an audio source such as voice recognition, define custom expressions. See Defining a custom expression on page 1642. You will need to create custom expressions for each phoneme using the shapes on your head model.

- If you plan to animate the head model with motion capture, define the Generic expressions using the shapes on your head model. See Defining a generic expression on page 1643.

Character Face asset on page 1639

Phoneme shapes on page 1600

Defining a custom expression

To define a custom expression:

1. Load a head model with shapes or cluster shapes and add a Character Face asset to the scene.
2. In the Expressions area of the Character Face settings, switch to the Custom pane and click Add to add a new expression.

   The new expression is named "Expression" by default.
3. Scroll through the list of shapes in the Target Models area on page 1648 to find the appropriate shapes to create the expression you want.
4. With the new expression selected, modify the values in the Shapes Value fields until you achieve the expression you want.

   Since this is a custom expression, the results of changing the shapes is shown in the Viewer window, on the model itself .

To rename an expression:

Double-click the expression, type a new name, and press Enter.

Character Face asset on page 1639

Removing a custom expression

To remove a custom expression:

Select the expression in the list, then click Remove.

To remove all custom expressions:

1. Select the heading for a group of expressions and click Remove.

2 Click OK in the dialog box that appears.

NOTE Deleting all expressions cannot be undone.

Defining a custom expression on page 1642

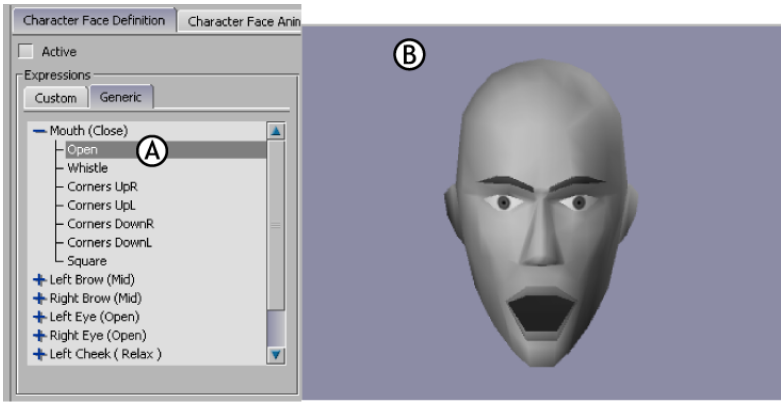
Defining a generic expression

To define a generic expression:

1 In the Character Face Settings, switch to the Character Face Definition tab.

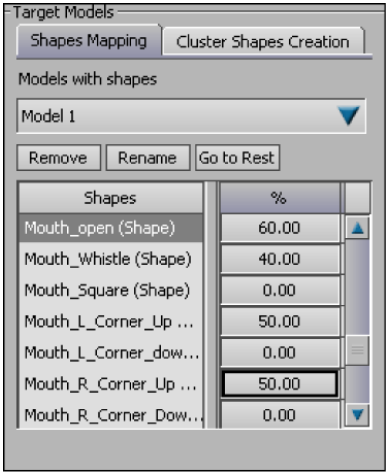
2 In the Expressions area, select the Generic tab, and expand any of the Generic expressions listed there.

3 Select a generic expression. When you select the expression, it is shown in the Preview pane.



Generic expression A Mouth Open generic expression B Expression displayed in the Preview pane

4 Scroll through the list of shapes in the Target Models area to find the appropriate shapes that replicate the Generic expression shown in the Preview pane.



5 With the generic expression still selected, modify the values in the Shapes Value fields until the expression on your model in the Viewer window matches the expression in the Preview pane.

You can continue defining other generic expressions by selecting them and setting values for the shapes involved. Shape values are saved automatically as you change them.

Once you have defined these generic expressions, you can animate them in the Actor Face.

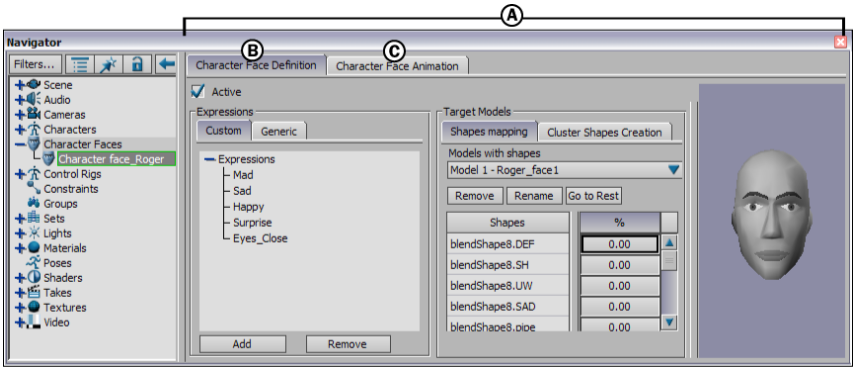
Character Face settings

92

When you add a Character Face asset to the scene, the Character Face settings display in the Navigator window. These settings let you create facial expressions, rename shapes, and use the Voice device for real-time lip synchronization with facial animation.

The Character Face settings consist of the following main areas:

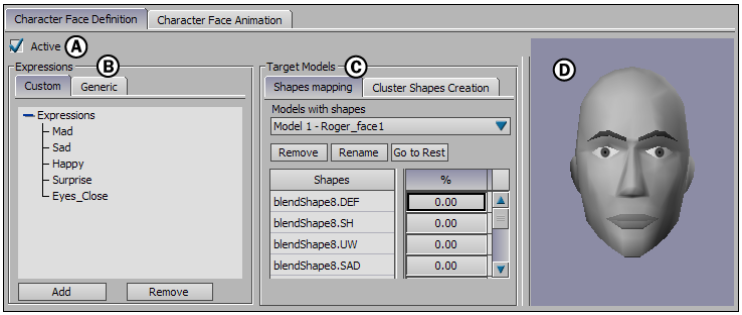
- Character Face Definition pane on page 1645
- Character Face Animation pane on page 1654



Navigator window *A*. **Character Face settings** *B*. **Character Face Definition pane** *C*. **Character Face Animation pane**

Character Face Definition pane

The Character Face Definition pane lets you create a set of facial expressions for your character by blending together shapes or clusters.



Character Face Definition pane *A.* **Active option** *B.* **Expressions area** *C.* **Target Models area** *D.* **Preview pane**

You can create your own custom expressions using the Custom pane, or use the Generic pane to define preset generic expressions for connecting to an Actor Face.

Regardless of which expressions you are defining, you must first Alt-drag models with shapes or clusters into the Target Models area. You cannot define expressions until a head model with shapes or clusters displays in the Target Models area.

Active option

Enable the Active option to activate and constrain the Character Face to its animation source.

When Active is enabled, you cannot define or preview expressions on the model in the Viewer window since the Character Face is constrained to its animation source.

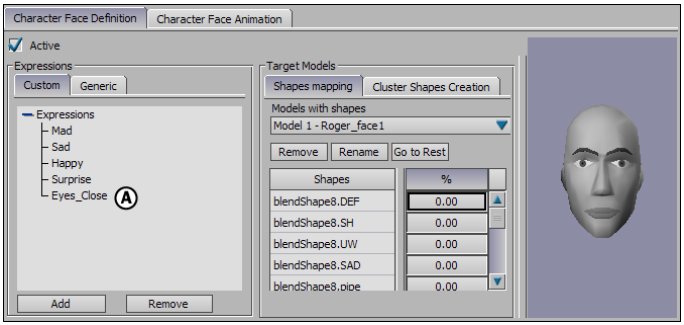
Expressions area

The Expressions area lets you define custom or generic expressions for your Character Face.

Once you define expressions, you animate them in the Character Face Animation pane using either an Actor Face asset, keyframe animation, or a Relations constraint connected to the Voice device.

Custom pane

Use the Custom pane in the Expressions area to define your own custom expressions. Custom expressions can be whatever facial expressions your project requires, including expressions that represent phonemes and are linked to the Voice device.

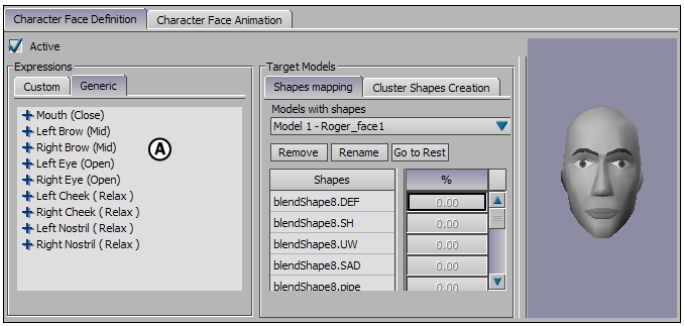


Character Face Settings *A.* **Custom Expressions pane**

For example, you can create an expression, such as a surprised face, from a blend of shapes for the eyes, mouth, eyebrows, and other shapes.

Generic pane

The Generic pane in the Expressions area displays a basic set of facial expressions used to connect the Character Face with an Actor Face.



Character Face Settings *A.* **Generic pane**

An Actor Face lets you connect the Character Face to motion capture data from either a live source or imported file.

TIP If you are not using an Actor Face in conjunction with motion capture data, you can create facial animation using only a Character Face.

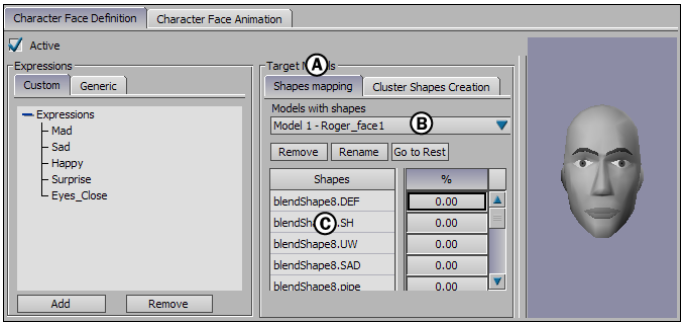
Target Models area

The Target Models area lists all the shapes for the model selected in the Models with Shapes menu. It consists of the following panes:

- Shapes Mapping pane on page 1648
- Cluster Shapes Creation pane on page 1651

Shapes Mapping pane

The Shapes Mapping pane lets you define the values for the shapes of your Character Face. It also lets you rename shapes and remove models from the Models with shapes menu.



Character Face Settings *A.* **Shapes Mapping pane** *B.* **Models with shapes menu** *C.* **Shapes list**

Models With Shapes menu

The Models With Shapes menu lets you select which shapes display in the Shapes list. By default, the Models With Shapes menu is empty. Before you can define your expressions, you must add at least one model with shapes.

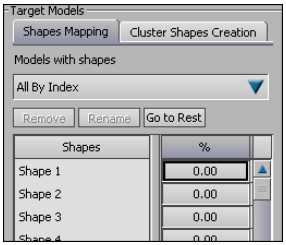
You can choose from the following views in the Models With Shapes menu:

Model Name

Displays individual model shapes. For example, in the previous figure, “Model 1 Roger_face1” is selected and displays all of its shapes in the Shapes list.

All by Index

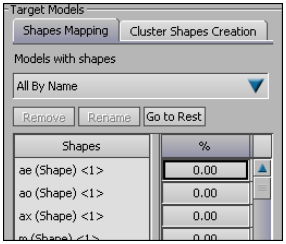
Displays all shapes numerically. Shape numbers are set when you originally create the shapes for your model in your 3D modeling software.



The All by Index display

All by Name

Displays shapes by name and part number. Using All by Name affects shapes with the same name for all models in the Models With Shapes menu.



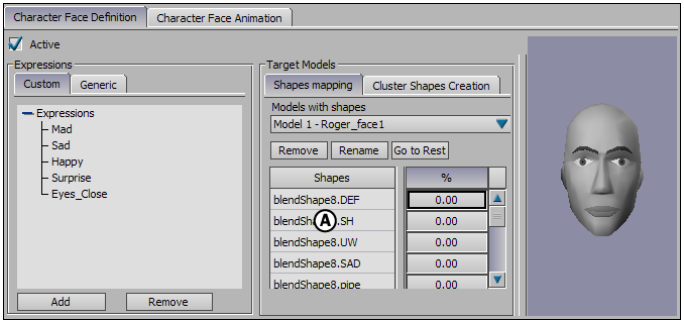
The All By Name display lists shapes by name and part number

A number in brackets <x> next to the entry in the Shapes list indicates how many models in the Models With Shapes menu use the same shape name.

NOTE When adjustments are made to values of shape names with more than one occurrence, every shape with the same shape name in the scene is affected.

Shapes List

The Shapes list displays the shapes for the model(s) selected in the Model With Shapes menu.



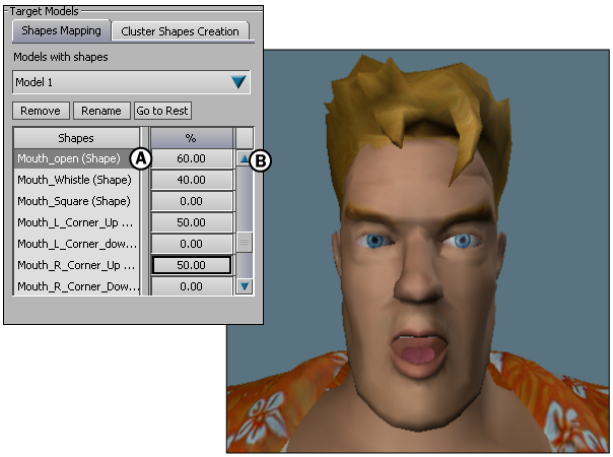
Character Face Settings *A.* **Shapes list**

You use the shapes listed in the Shapes list by associating them with Expressions in the Custom and Generic panes. By selecting a shape in the Shapes list and changing its percentage, you assign a percentage of that shape to help create the selected Expression.

Every expression has a memory, and retains the value you define for each shape in the Shapes list. By default, the value of all shapes is set to 0.

When you select an expression in the Expression pane and then select the corresponding shape in the Shapes list, you define the expression for model shapes or cluster shapes.

If you are associating shapes with a Generic Expression, you can view the configuration for Generic Expressions on the Preview model, and the results of changing the shape percentage on the model in the Viewer window.

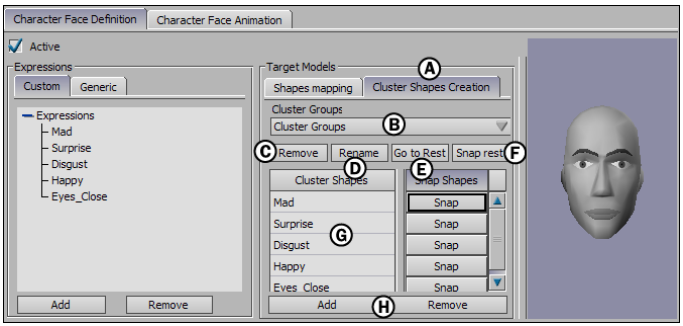


A. **Shape selected in the Shapes list** *B.* **Selected shape displayed on the model**

To match the shapes on your model to the generic expression more precisely, drag in the shape's value field until the head model in the Viewer window resembles that of the Preview model with the selected expression. You can change values in other fields in the Shapes list to create a blend for the expression you want.

Cluster Shapes Creation pane

The Cluster Shapes Creation pane lets you create shapes using clusters. You can then use these cluster shapes in the Shapes Mapping pane. For more information on creating cluster shapes, see Creating cluster shapes on page 1606.



Character Face Settings *A.* **Cluster Shapes Creation pane** *B.* **Cluster Groups menu** *C.* **Remove button** *D.* **Rename button** *E.* **Go to Rest**

button *F.* **Snap rest button** *G.* **Cluster Shapes list** *H.* **Add and Remove buttons**

Cluster Groups Menu

Lets you select which shapes display in the Shapes list. You can select the model's shapes in different views, or you can select generic when defining custom expressions.

By default, the Cluster Groups menu is empty. Before you can select anything in the menu, you must drag groups of selected clusters into the Cluster Groups menu.

Remove

Deletes cluster groups from the Cluster Groups menu.

Rename

Lets you rename cluster groups.

Go to Rest

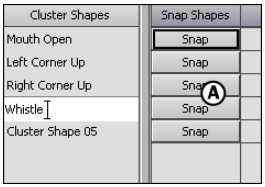
Displays the selected cluster group in its rest pose. By default, the rest pose is the position of selected clusters when you drag them into the Cluster Groups menu.

Snap Rest

Lets you redefine your model's rest pose. To change the default rest pose, move the clusters and click Snap Rest. A dialog box asks you to confirm changing the default rest pose.

Cluster Shapes list

Displays the new shapes of the selected cluster group and each shape's Snap button. The Cluster Shapes list lets you create shapes using selected groups of clusters.



Cluster Shapes list *A.* **Snap buttons**

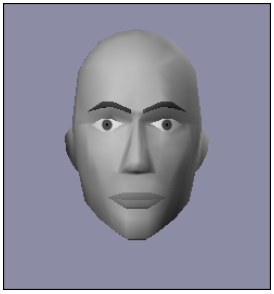
Add and Remove

Let you add and delete shapes to the selected cluster groups.

Preview pane

The Preview pane lets you view individual generic and custom expressions, as well as the effect of motion capture.

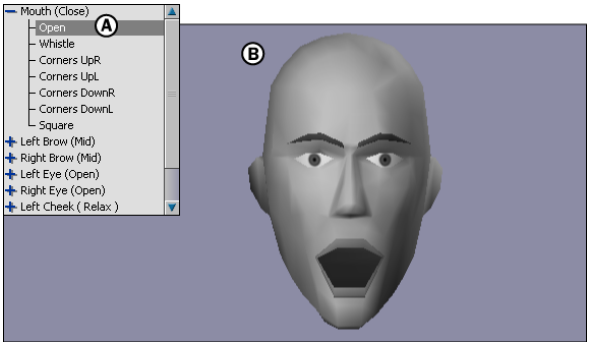
By default, the model in the Preview pane assumes the rest pose in which the mouth is closed, the eyes are open, and the eyebrows are at mid-level.



Preview pane with model in the rest pose

To preview the effect of a generic expression in the Character Face settings, select the expression in the Source list.

For example, the following figure shows the expression "Open" selected in the Character Face settings, and the corresponding facial expression displays on the model.



A. **Generic expression for Mouth-Open** *B.* **Expression displayed on the Preview model**

You can use the following shortcuts in the Character Face settings Preview pane:

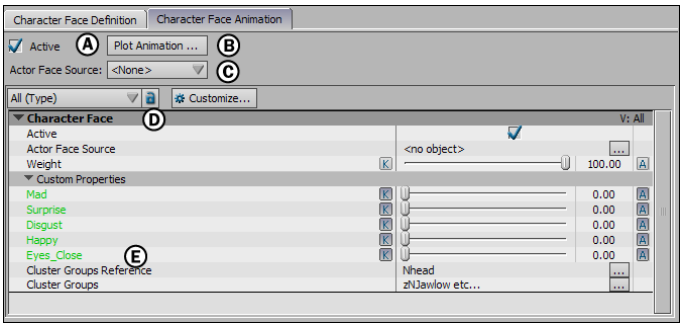
Action	Shortcut
Orbit around Face	Ctrl-Shift-drag in the Preview pane.
Zoom on Face	Ctrl-drag in the Preview pane.
Frame on Face	Click in the Preview pane and press F.
Hide the Preview Model	Double-click in the Preview pane to hide the model and increase the refresh rate. Double-click again to display the model.

■ Character Face Animation pane on page 1654

Character Face Animation pane

Use the Character Face Animation pane to animate the generic and custom expressions defined in the Character Face Definition pane.

The Character Face Animation pane lets you animate using keyframes, motion capture, and constraints.



Character Face Animation pane *A.* **Active option** *B.* **Plot Animation button** *C.* **Actor Face Source** *D.* **Character Face Properties** *E.* **Actor Face Properties**

The Character Face Animation pane consists of the following:

■ Active option on page 1655

- Plot Animation button on page 1655
- Actor Face Source menu on page 1655
- Character Face properties on page 1656
- Actor Face properties on page 1656

Active option

To activate and constrain the Character Face to either an Actor Face or plotted animation, enable the Active option. You can also enable the Active option in the Character Face Definition pane.

When Active is enabled, you cannot preview facial expressions on the model in the Viewer window. You are also unable to define shapes.

Plot Animation button

The Plot Animation button lets you transfer the animation from the selected source to the shapes of the Character Face model. See Plotting facial animation on page 1891.

Actor Face Source menu

The Actor Face Source menu, lets you select an Actor Face as the animation source.

An Actor Face lets you use motion capture data as a source for your Character Face. The motion capture data can be from live sensors connected to a performer or an imported motion data file. See Connecting an Actor Face to motion capture data on page 1612.

View menu

The View menu gives two methods of viewing generic channels:

- Select which channels to display from the View menu. The All (Type) view displays both generic and Actor Face properties. The Generic Channels (Type) view displays only generic channels.
- Click the Customize button to create a view. This is the same window accessible from the Properties window. See View Editor pane on page 775

Character Face properties

All custom expressions display as properties that you can keyframe and animate in the Character Face Properties area.

Once all the animation is plotted to the model, you can save your *.fbx* file and import it into other compatible 3D software, or reuse it in MotionBuilder. You can also see the function curves on the animation in the FCurves window.

Actor Face properties

If the Character Face uses an Actor Face as its source, an additional folder with all the Generic channels appears.

Voice device

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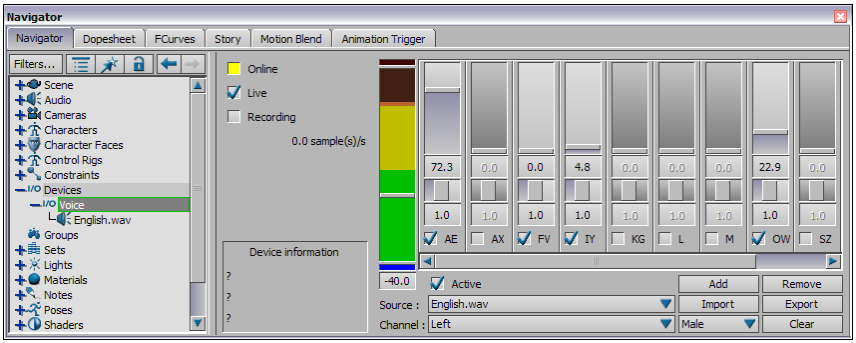
The Voice device provides voice recognition and sound analysis that let you synchronize the lip movements of up to two characters simultaneously in real time, using any language. You can also link audio files or live audio input to models, and extract various sound properties.

The Voice device identifies phonemes in the audio input so that when connected to a Character Face it can drive the shapes of your character's head model, making the character's mouth move with the audio.



Voice device settings in the Navigator window

NOTE Before you can use the Voice device to drive facial animation, you need to load a face model with either shapes or cluster shapes for the appropriate phonemes. See Audio-driven facial animation workflow on page 1590.

- Adding a Voice device to a scene on page 1658
- Voice device settings on page 1670

See also:

- Head models on page 1595

Adding a Voice device to a scene

The purpose of adding a Voice device to a scene is to extend the animation.

To add a Voice device to a scene, do either of the following:

- Drag a Voice device asset from the Devices folder of the Asset browser into the scene.
  The Voice settings appear in the Navigator window.
- Drag an audio file directly onto a head model and select Attach Facial. A Voice device is automatically connected to the Character Face using a Relations constraint.

- Linking a Character Face to a Voice device on page 1658
- Adding sound parameters on page 1663
- Activating phonemes and instruments on page 1669

Linking a Character Face to a Voice device

The purpose of linking a Character's face to a Voice device is to extend the animation of a character's face so the shape of the character's head model is synchronized with the movement of its mouth.

To link a Character Face to a Voice device, do any one of the following:

- Drag an audio file onto a head model and select Attach Facial from the menu that appears.
- Drag an audio file onto a Character Face listed in the Scene browser, then select Attach Facial from the menu that appears.
- Drag a Voice device onto a Character Face listed in the Scene browser, then select Attach Facial from the menu that appears.
  When you select Attach Facial, a Voice device is added and automatically connected to the Character Face through a Relations constraint.

See also:

- Character Face asset on page 1639

Selecting live or recorded audio in the Voice device

You can use either live or recorded audio input to drive the Voice device.

To use recorded .wav files:

- Use the Audio settings to select and adjust a **.wav** file before linking it to your head model.

  NOTE The Voice device uses the audio file with the options you set in the Audio settings.

  By default, the name of your computer's sound card and "New Media" appear in the Source menu.

  See Audio on page 329.

To use live audio input:

1. Select your computer's sound card in the Scene browser's Audio folder.

   NOTE When using live audio input, use a professional quality microphone to avoid introducing noise that may occur if you use your computer's microphone.

   See Recording audio on page 333.

2. Configure your sound options using the Volume Control options provided by your operating system.

See Audio settings on page 338 and Setting an audio threshold on page 1668.

- Adding a Voice device to a scene on page 1658

Tracking two channels

You can track two channels using two Voice devices.

To track two channels:

1 Set up two Voice devices.

2 Assign the first channel to Left and the second channel to Right.

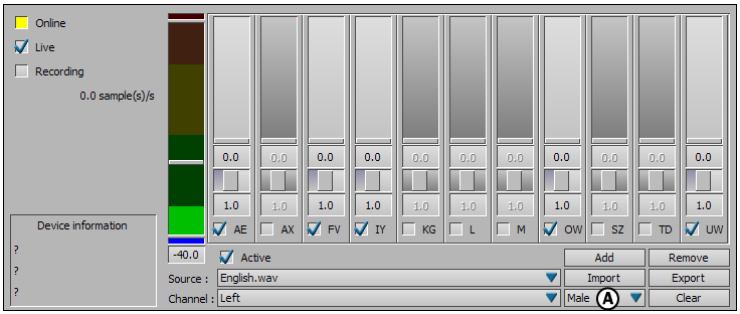
NOTE Channel is disabled if your audio source has only one track (mono).

- Voice device settings on page 1670
- Filtering noise in audio files on page 1669

Specifying gender in the Voice device

You can specify the gender in the Voice device. While speech frequency varies from person to person, women generally have a higher speech frequency than men. Choosing the Female option may produce more accuracy for phoneme values.

NOTE You may also want to use the Female option for children's voices.



Voice device settings *A.* **Gender menu**

To specify gender in the Voice device, select Male or Female in the Gender menu.

This selection can help to precisely analyze spoken vowels.

- Smoothing phoneme transitions on page 1666
- Filtering noise in audio files on page 1669
- Adding sound parameters on page 1663

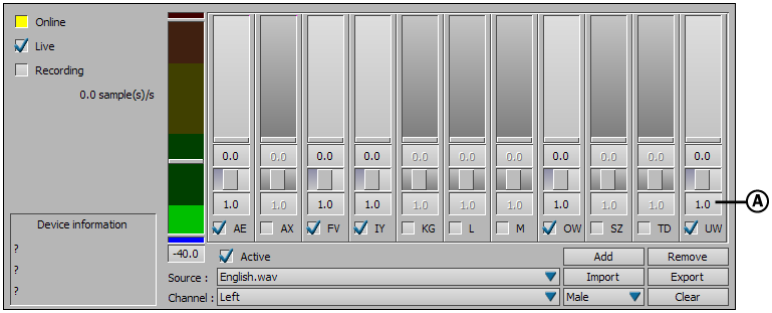
Refining a model's face movements

You can use the Sound parameter settings in the Voice device to refine the movements of your model's face or mouth to produce a closer match between its lips and voice.

To refine a model's face movements, identify which phonemes you want to adjust, then adjust the Weighting value for that phoneme in the Sound parameter settings.

The Weighting number values range from one to ten where ten produces the most emphasis. See Setting an audio threshold on page 1668.

NOTE Before adjusting weighting, make sure the Threshold level is set at an appropriate value. For example, if a model does not pronounce the UW phoneme with enough emphasis, you can boost the shape by increasing the Weighting value for that phoneme.



Voice device settings *A.* **Individual phoneme Weighting value**

NOTE Typing a number in the value field while dragging the slider allows the motion to continue while you make adjustments.

- Specifying gender in the Voice device on page 1660
- Smoothing phoneme transitions on page 1666
- Sound parameter settings on page 1672

Saving and Loading a Voice device setup

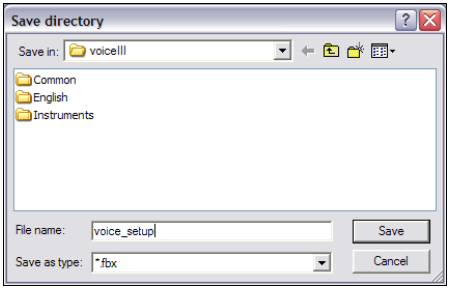
You can save a Voice device setup as an .fbx file that you can use for other projects.

To save a Voice device setup:

1 Click the Export button (A) in the Voice device settings.

Voice device settings *A.* **Export button**

The Save directory dialog box appears.



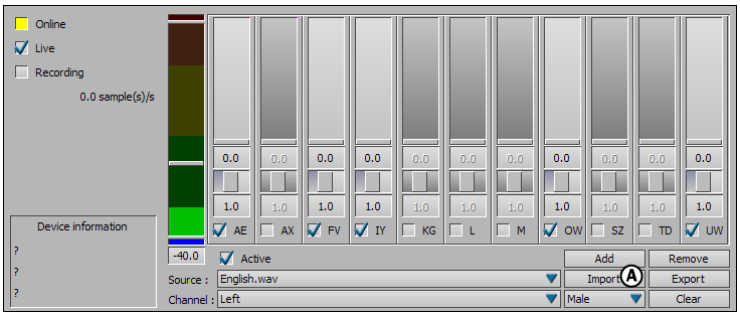
Save directory dialog box

2 Enter a file name, then click Save.

The Voice device setup is saved in the *.fbx* file format.

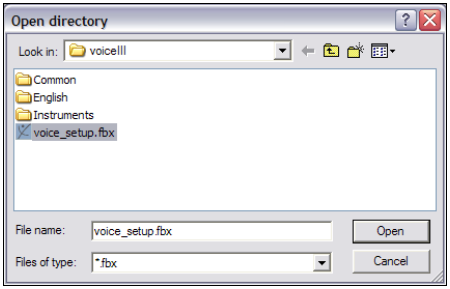
To load a Voice setup:

1 In the Voice device settings, click Import.



Voice device settings *A.* **Import button**

The Open Directory dialog box appears.



Open directory dialog box

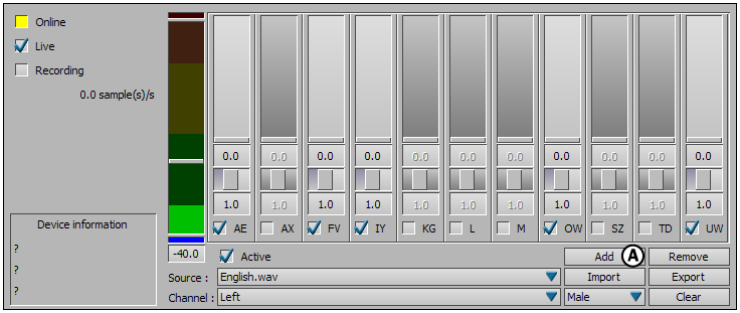
2 Select the **.fbx** file containing the voice setup you want to load into the Voice device and click Open.

Adding sound parameters

You can refine the sound animation by setting the sound parameters.

To add sound parameters:

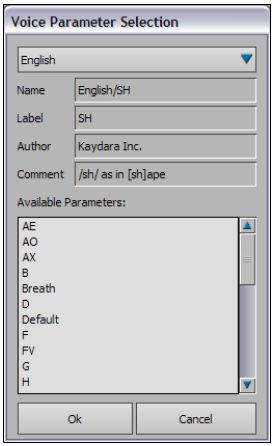
1 In the Voice device settings, click Add to open the Voice Parameter Selection dialog box.



Voice device settings *A.* **Add button**

2 Choose a parameter type from the first menu.

A list of phonemes or instruments appears in the Available Parameters area.



Voice Parameter Selection dialog box

3 Select a phoneme or instrument, then click OK.

- Sound parameter settings on page 1672
- Activating and disabling sound parameters on page 1665
- Removing sound parameters on page 1665

Removing sound parameters

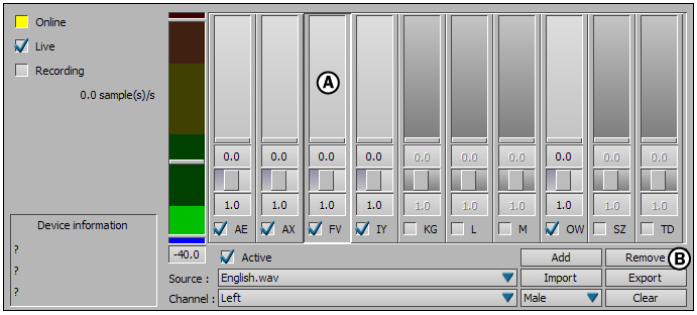
You can can remove sound parameters or clear all sound parameters from the Voice device.

To remove sound parameters from the Voice device:

1 Select the sound parameter you want to remove.

In the following figure, the FV sound parameter is selected (see A).

2 Click Remove (see B).

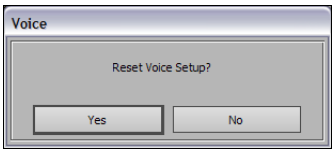


Voice device settings

To clear all sound parameters:

1 In the Voice device settings, click Clear.

2 In the Voice dialog box that appears, click Yes to confirm you want to clear all the sound parameters.



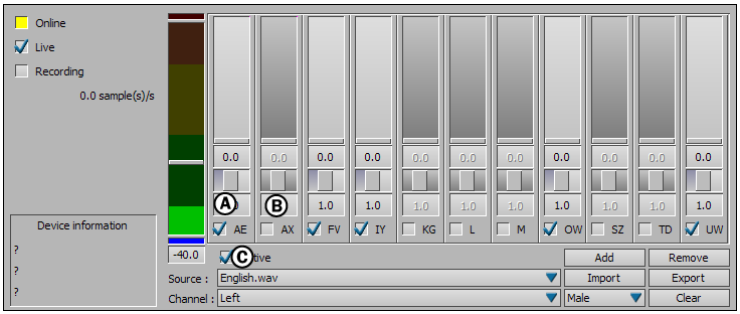
Voice dialog box

Activating and disabling sound parameters

When you add a sound parameter to the Voice device, it is active by default. See Adding sound parameters on page 1663.

To disable a parameter, disable the sound parameter's Active option.

To disable all paramaters, disable the main Active option in the Voice device settings.



Voice device settings *A.* **Sound parameter activated***B.* **Sound parameter disabled***C.* **Active option**

NOTE When a sound parameter is disabled, you cannot change its settings.

- Sound parameter settings on page 1672
- Adding sound parameters on page 1663
- Removing sound parameters on page 1665

Default phoneme

When the Voice device does not detect any speech, the sound information is sent to the default field. The default field represents the neutral shape.

- Choosing shapes to create on page 1604
- Threshold level on page 1667
- Adding a Voice device to a scene on page 1658
- Setting an audio threshold on page 1668

Smoothing phoneme transitions

Use the filter slider for each sound parameter to smooth transitions between phonemes that have lip jittering and other unwanted movement.

When the filter effect is increased, the differences between the facial shapes for that phoneme and others is reduced.

To increase the filtering effect, slide the filter to the right.

To reduce the filtering effect, slide the filter to the left.

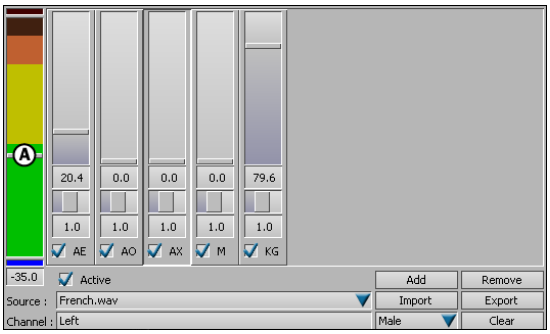
Sound parameter
A. **Filter slider**

- Setting an audio threshold on page 1668
- Filtering noise in audio files on page 1669

Threshold level

Both live input and pre-recorded audio files usually contain some level of ambient noise caused by background noise or other problems during recording. This noise can produce unwanted movement when the audio is used to drive a character's face, such as mouth jittering when there is no actual speech.

The Threshold slider in the Voice device settings lets you define a Threshold level to compensate for this ambient noise in your audio files, and eliminate that unwanted mouth movement.



A. **Threshold slider**

- Setting an audio threshold on page 1668
- Audio-driven facial animation workflow on page 1590

Setting an audio threshold

For the Voice device to recognize and register silence, you need to set the Threshold slider to the minimum sound level that is considered speech. This can also help to filter out any background noise affecting your live input or pre-recorded audio files.

To set a threshold:

1. Listen to the audio file or have the voice input begin speaking, and watch the Threshold meter in the Voice device settings.

   During speech, the Threshold meter rises to a peak value and returns to a lower value when speech stops. It registers at zero when there is no sound. At zero, the model's mouth is closed.

2. Determine the minimum noise level during silent periods and drag the Threshold slider up to that level on the Threshold meter.

   Generally, the higher the ambient noise level in your audio input, the higher you need to set the Threshold level. However setting the Threshold slider too high causes the Voice device to ignore all but the loudest speech.

A. **Threshold meter** *B.* **Threshold slider**

3 Play the audio again and observe the effect this Threshold slider placement has on your character's mouth movement. Continue adjusting the Threshold slider as necessary.

- Smoothing phoneme transitions on page 1666
- Voice device settings on page 1670

Filtering noise in audio files

To filter out ambient noise affecting live input or pre-recorded audio files, you can adjust the Threshold slider in the Voice device settings. See Setting an audio threshold on page 1668.

See also:

- Smoothing phoneme transitions on page 1666

Activating phonemes and instruments

You can choose to either activate or disable individual phonemes, or to activate all phonemes and instruments.

To activate phonemes and instruments, enable the Active option in the Voice device settings.

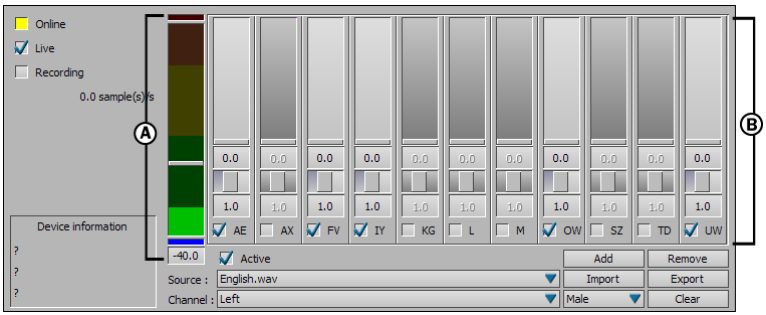
All phonemes and instruments added to your device are activated.

To activate or disable a phoneme, activate or disable the sound parameter's Activate option.

- Voice device settings on page 1670
- Adding sound parameters on page 1663
- Removing sound parameters on page 1665

Voice device settings

The Voice device settings contain controls to let you set thresholds, specify voice parameters, and set gender for your voice, as well as save and remove voice setups.



Voice device settings *A.* **Threshold meter** *B.* **Sound parameter**

Threshold meter and Threshold slider

The Threshold meter shows a graphical representation of the audio input in the Voice device. It rises as the audio input gets louder, and registers at zero when there is no sound.

The Threshold slider lets you set a Threshold level to compensate for noise in your audio. See Setting an audio threshold on page 1668.

A. **Threshold meter** *B.* **Threshold slider**

When the sound level falls lower than the Threshold slider, the Voice device does not consider the signal to be speech and sets all phoneme values to zero.

Active

When Active is enabled, all phonemes and instruments added to your device are active.

Source menu

Lets you specify your audio source. You can use the Voice device with live audio input and recorded *.wav* files.

Source menu

Channel menu

Lets you specify which channel to display when working with stereo files.

NOTE Channel is disabled if your audio source has only one track (mono).

Add button

Opens the Voice Parameter Selection dialog box, letting you add sound parameters to the Voice device. See Voice Parameter Selection dialog box on page 1674.

Remove button

Removes the selected sound parameter from the Voice device. See Removing sound parameters on page 1665.

Import button

Click to open a Voice setup.

See Saving and Loading a Voice device setup on page 1662.

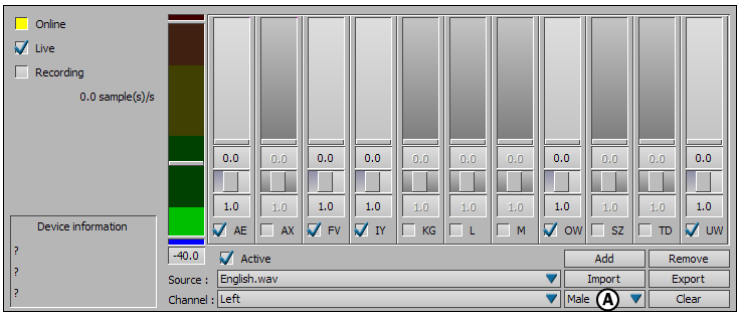
Export button

Click to save the current Voice device setup in *.fbx* format.

See Saving and Loading a Voice device setup on page 1662.

Gender menu

Use the Gender menu to precisely analyze spoken vowels. See Specifying gender in the Voice device on page 1660.



Voice device settings *A.* **Gender menu**

Clear button

Click to remove all sound parameters from the Voice device settings.

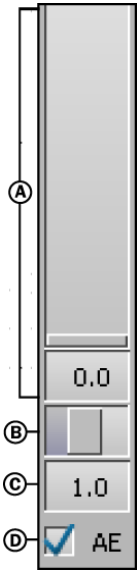
See Removing sound parameters on page 1665.

Sound parameter settings

The Voice device's sound parameters include phonemes and various instruments that measure sound properties.

Each sound parameter has a value representation, Filter slider, Weighting value, and Active button. By adjusting values in the sound parameters, you can do the following:

- Measure the value of various sound parameters
- Filter noise
- Control phoneme sensitivity by adjusting the phoneme's Weighting value
- Activate or disable individual sound parameters



Sound parameter *A.* **Phoneme value representation** *B.* **Filter slider** *C.* **Weighting value** *D.* **Active option**

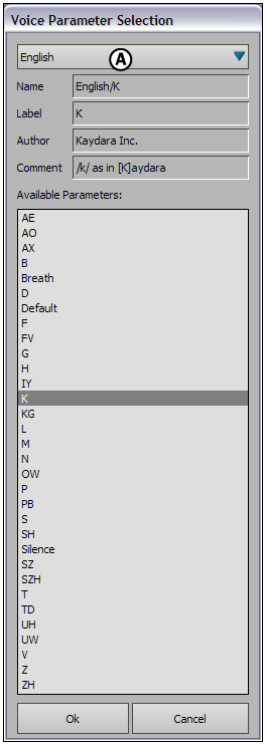
Option	Description
Phoneme value	The phoneme values display in two forms on each sound parameter: as sliders, and as numerical values. Phoneme values display information taken from the audio in-

Option	Description
	put, so you cannot modify them in the Voice device.
Filter slider	Adjust the Filter sliders to smooth phoneme transitions. See Smoothing phoneme transitions.
Weighting value	The Weighting value on each sound parameter dictates the amount of emphasis each phoneme reflects in the talking model. See Refining a model's face movements.
Active	Activates the individual sound parameter. **NOTE** When a sound parameter is disabled, you cannot change its settings.

■ Adding sound parameters on page 1663

Voice Parameter Selection dialog box

The Voice Parameter Selection dialog box lets you select the types of sound parameters you want to add to the Voice device, including phonemes and various instruments that measure sound properties.



Voice Parameter Selection dialog box *A.* **Parameter type menu**

The Parameter Type menu lets you select the following groups of sound parameters:

- Instruments parameters on page 1675
- English parameters on page 1677
- Compatibility parameters on page 1678
- Common parameters on page 1678

Instruments parameters

This group of parameters measure sound properties. You can use Instruments in your Voice-Facial Relations constraint to control elements in your scene.

You can use the Instruments parameters to connect with 3D light intensity in a Relations constraint, to control the lighting in a scene from a sound track. You could also make a model such as a cube oscillate as the audio level changes by linking the Level instrument to the cube's scaling. The value that displays in the instrument in Voice also drives the shape.

You could also add a Pitch instrument to track whether a sound is low or high, and connect it to the color of a light in a Relations constraint. The color change according to the current note, and the intensity of the light varies depending on whether the notes are loud or soft.

You can add the following instruments:

Instrument	Description
Level	Average sound level in linear scale (0 to 100%), where silence is 0%.
LeveldB	Average sound level in decibel scale, where 0 is the maximum sound level, and -60 is nearly mute.
Overload	Overload (clipping) indicates when the sound level is too high. Overload operates on a scale of 0 to 100, where 0 is an acceptable sound level, and 100 is too high.VER: Overload corresponds to the overload indicator of the Threshold level. This level displays as a red bar at the top of the Threshold level. When there is no audio, the bar is dark blue. When the bar at the bottom of the Threshold level is light blue, it indicates that there is audio input.
Peak	Sound peak level in linear scale (0 to 100%).
PeakdB	Sound peak level in decibel scale, where 0 is the maximum sound level, and -60 is nearly silent. At -60, the Threshold level is at its lowest level.
Speech	Speech indicator, where 0 indicates no speech during that audio portion. At 100, the speech is very loud.

English parameters

This group of parameters includes phonemes for the English language.

The International Phonetic Alphabet (IPA) is the standard method for representing phonemes. The ARPABET, which the Voice device uses, codes these phonemes as ASCII characters.

The following phonemes are currently available in the Voice device:

Phoneme	Sounds like
AE[a]	As in “bat”
AO[ou]	As in “bought”
AX[e]	As in “the”
B[b]	As in “baritone” or “bet”
D[d]	As in “dolcissimo” or “dog”
F[f]	As in “fortissimo” or “fit”
FV/F/ or /V/	As in “average”
G[g]	As in “glissando” or “get”
H[h]	As in “hip-hop” or “hat”
IY[ea]	As in “beat”
K[k]	As in “cat”
KG/K/ or /G/	As in “coat” or “goat”
L[l]	As in “legato” or “let”
M[m]	As in “moderato” or “met”
N[n]	As in “neo” or “net”
OW[oa]	As in “ago” or “boat”
P[p]	As in “piano” or “pen”

Phoneme	Sounds like
PB/P/ or /B/	As in “pat” or “bat”
S[s]	As in “soprano” or “sat”
SH[ch]	As in “shut”
SZ/S/ or /Z/	As in “sip” or “zip”
SZH/SH/ or /ZH/	As in “explosion”
T[t]	As in “tenor” or “ten”
TD/T/ or /D/	As in “tip” or “dip”
UH[u]	As in “book”
UW[oo]	As in “boot”
V[v]	As in “vibrato” or “vat”
Z[z]	As in “mezzo” or “zoo”
ZH[j]	As in “measure”

Compatibility parameters

This group of parameters emulate phonemes for use with the Voice device.

Common parameters

This group of parameters includes the phonemes that are common to most languages.

These phonemes also appear in the list when you select another language. For example, all the phonemes in the Common category relating to the English language also display in the English category.

- Adding sound parameters on page 1663
- Voice device settings on page 1670

Part 12: Animating with Physical Properties

The Asset browser Physical Properties folder contains Physical Property assets that you can use to simulate complex interactions between 3D objects and their environment. The Physics solver lets you create collision and rigid interaction effects that are difficult to obtain with keyframing and motion capture techniques.

The three physical descriptions, Rigid Body, Ragdoll, and Joint provide a description of the objects in the scene to the Physics Solver. You can use the Rigid body physical description to prevent interpenetration of characters, objects and other scene elements. You can use the Ragdoll physical description to animate the character's Control rig for increased realism to produce a character that waves his arms as he falls. You can use the Joint physical description to create motion behavior that is inherent to objects, such as door hinges, chains, or rope.

NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.

Joint Physical property

The Joint Physical Property lets you create physical links between two objects that are solved by the Physics Solver. These physical links then let you reproduce behaviors such as hinges, a ball and socket joint, and so on.

NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.

Creating a Joint reaction

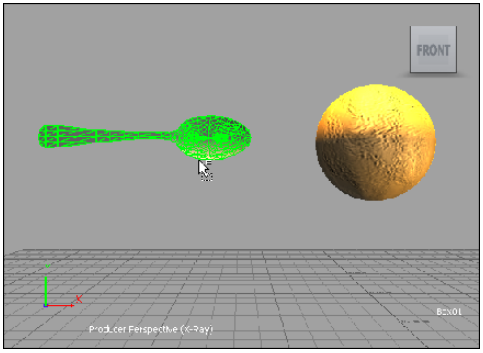
This example shows two models, Orange, and Spoon. This workflow shows a joint applied to the models that is then set so that Orange swings from the end of Spoon.

NOTE Use the polySphere element in the Asset browser when you require a sphere model for Physics solves. The Elements folder Sphere "element" has geometry that may produce unpredictable results.

To connect multiple objects in a chain, see Creating a Joint chain reaction on page 1684.

To create joint behavior between two or more objects:

1. Press Ctrl-A until you are in X-Ray mode.
2. From the Asset browser Solvers folder, drag a Physics solver into an empty area of the Viewer window.
3. Drag a Rigid Body Physical property from the Asset browser Physical Properties folder onto each object you want to join.

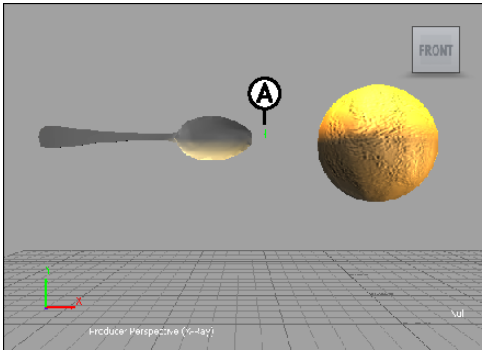


A Rigid Body property is dragged onto the Spoon

In this example, a Rigid Body property is added to the Orange and the Spoon objects.

4 Drag a Null element from the Elements folder into the Viewer window and position it between the objects for which you want joint behavior. This null becomes the pivot from which the joint action is based.

You can use any object as a pivot point, but the joint orientation for physics is read from the local orientation of the pivot object.

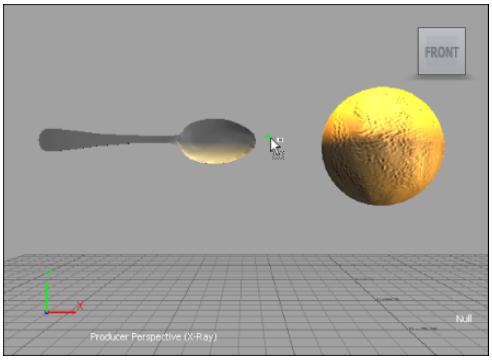


Drag a Null element between the objects.

5 Expand to the Navigator window Physical Properties folder. Click the Rigid Body property for the object that the second object is to swing from and switch to the Setup pane. Select Passive from the Activation menu.

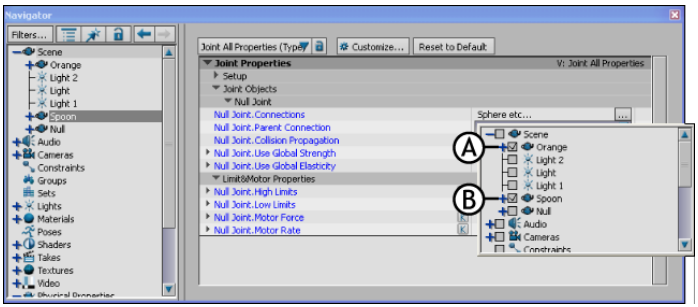
In this example, the spoon remains still and the orange swings from it, so the spoon object is set to Passive.

6 From the Asset browser Physical Properties folder, drag a Joint Physical property onto the null in Viewer window.



Apply the Joint property to the Null to make it the pivot point.

7 Select Joint in the Navigator window Scene browser and expand Setup and ensure that the Joint is set to Active. Then select the affected objects in the Null Joint Connections asset list.



Select the element affected by the Joint behavior. A, (Orange), and B, (Spoon) are the objects in this example.

In this example, the Orange and Spoon are the affected objects.

You can also drag objects to the asset list, which lets you choose the hierarchy order by order in which you selected the objects. In this example, if you select Spoon first, it becomes the parent, and if you select Orange first, it becomes the parent.

8 Select a Joint Type from the Joint pane Type menu. See Joint types on page 1688 for a description of different joints and their behaviors. See Joint settings on page 1689 for more details about what each setting represents.

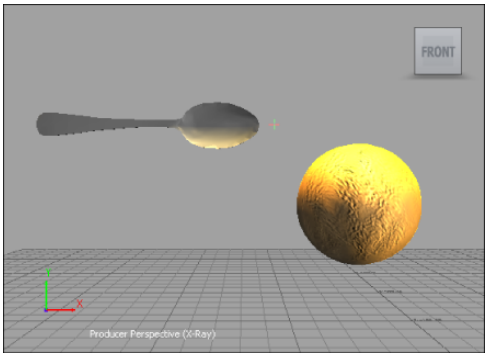
9 Switch to the Scene browser Solvers > Physics Solver folder. Double click Solver to expose the Solver pane, and click Online.

TIP You can also click the Active option in the Physics Solver properties in the Properties window.

10 Click Set Start State to set a position to which the objects can return.

11 Expand the Physical Properties and define specific properties for the object in the Joint settings, as well as in the Solve, and Animation panes.

12 Double-click Solver in the Scene browser Physics Solvers folder to expose the Solver pane and click Live.



Orange swings from Spoon.

NOTE When you set the Physics Solver to Live, if you select an object that has a Physical property, such as Ragdoll, Rigid Body, or Joint attached to it, you must deselect the object otherwise the object will ignore the Physics Solver. This is because selecting the Physical property object when the Physics Solver is Live during recording re-evaluates the FCurves based on the Frame Rate shown in the Transport Controls.

Creating a Joint chain reaction

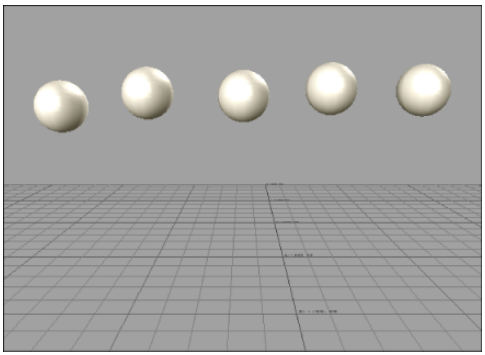
This section explains how to use multiple joints to create a chain or string of objects.

NOTE Use the polySphere element in the Asset browser when you require a sphere model for Physics solves. The Elements folder Sphere "element" has geometry that may produce unpredictable results.

To connect two objects in a simple joint relationship, see Creating a Joint reaction on page 1680.

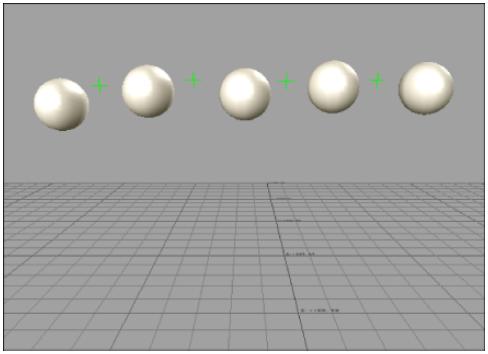
To create a string of beads:

1 Create a group of spheres in a row in the Viewer window.



A row of spheres

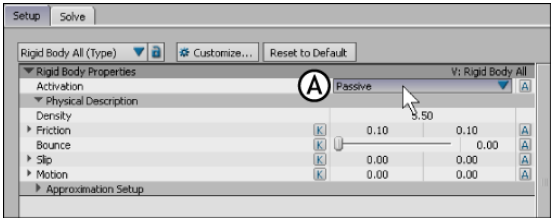
2 From the Asset browser Elements folder, double-click the Null asset, and then click between the beads in the Viewer window. Do this between each bead and press Enter when you finish.



Put Nulls between each sphere.

3 Select the first bead and drag a Rigid body Physical Property on top of it.

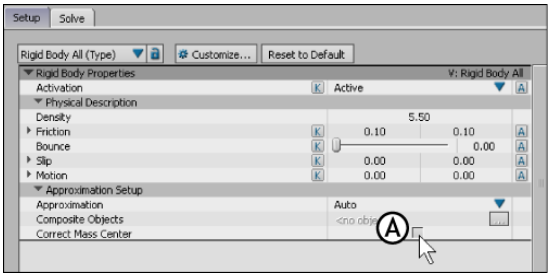
4 In the Physical Properties Setup pane, the Activation type to Passive.



Setup pane A. Passive option.

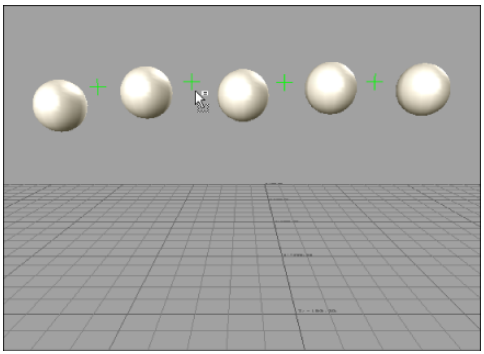
5 Ctrl-click to select the remaining beads and drop a Rigid body Physical Property on them. This applies a rigid body to all the selected beads. Make sure the Activation type of these remaining beads is set to Active.

6 In the Setup pane, expand Approximation Setup and deactivate the Correct Mass Center option.



Setup pane: A. Correct Mass Center option.

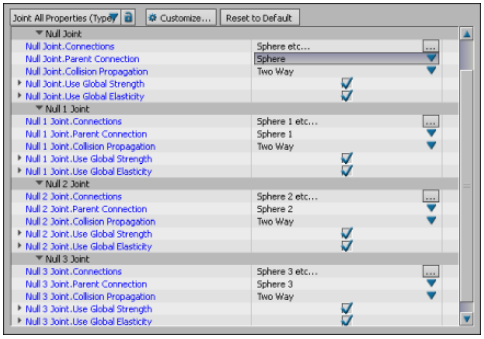
7 Select the nulls between the beads and drag a Joint Physical Property on top of them. Click Joints in the Scene browser to display the Joint properties in the Navigator window.



Drag a Joint Physical Property on top of the selected Nulls.

8 Ctrl-click the top bead and then the second one to select them. Alt-drag them in the Null Joint Connections field.

9 Repeat this for all the other beads, for example bead 2 and bead 3, bead 3 and bead 4, and so on.



The Setup pane Null Joint settings.

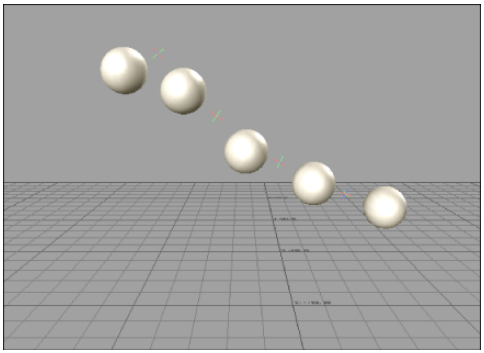
10 You should select the parent first and then, the child nodes.

The Parent/Child order in a joint relationship is important as it defines how much reaction is carried through the chain. The Parent/Child relationships can also define the number of objects connected to the parent. For example, one parent object can have many children that are linked to it by a joint, however you cannot have one child with many parents as this creates solve conflicts.

11 Drag a Physics solver into the scene from the Asset browser Solvers folder.

12 In the Physics solver Solver window, click Online and Live.

Translate the top bead to see the other beads in the chain react. You can tweak the Joint settings on page 1689 to create different effects, such as an elastic or stiffness effect.



The beads swing.

NOTE When you set the Physics Solver to Live, if you select an object that has a Physical property, such as Ragdoll, Rigid Body, or Joint attached to it, you must deselect the object, otherwise the object ignores the Physics Solver.This is because selecting the Physical property object when the Physics Solver is Live during recording re-evaluates the FCurves based on the Frame Rate shown in the Transport Controls.

Joint types

The following table lists the available Joint types and their behaviors.

Joint type	Description
Ball (Default)	A Ball joint works like a "Ball and Socket concept". It has degrees of freedom, and works like a shoulder socket.
Hinge	A Hinge joint swings on one axis and is like a door hinge. You can set limits for the joint rotation.
Hinge-2	The Hinge-2 joint is a series of connected joints. Unlike the Hinge joint, it has two connection points and lets you set a parent with two children so you can have one or two rotation axes.
Slider	The Slider joint is like a piston. There is one free axis, but instead of rotating, the Slider joint moves back and forth in a translation effect.
Universal	The Universal joint is based on two axes or a plane, for example, an XY plane. You can imagine the Universal joint like a cross (+) shape placed at the joint and that the orientation of the cross (+) defines the axis of freedom.
Spring	The Spring joint is like the Slider joint, except that it also has lateral movement. This creates an effect like a child's spring toy.
Motor	The Motor joint lets you connect an object so you can drive the direction of the force. The Motor joint has a single axis of freedom that allows rotation and use force to launch the rotation. This joint behaves like a tire axle with an engine attached.

Joint settings

The following settings are for the Joint asset.

NOTE You cannot make changes to these settings if the Joint Solve is Online. See Physics solving indicators on page 1537 for more on the Online button.

Setup

The Joint Setup options pane is where you configure options that are generic settings, or system overrides.

Creation type

The Creation type menu lets you choose between the default Joint solve behavior or the ability to activate the Joint behavior at a time other than the start of the solve.

Name	Description
At Solver Initialization	Sets the Joint relationship to activate when the solve is set to Live.
At Enable	Sets the joint solve at a specific time other than the start of the simulation. This option lets you lets you activate the joint at a point in the simulation other than the start, for example when you want a character to catch something. **NOTE** This behavior is similar to being able to key and animate the joint behavior, much the same way you can turn a constraint on after a certain time has elapsed.

Disable collision

The Disable collision option lets you deactivate the collision effect, so that you can control whether the Rigid body objects strike or interpenetrate (pass through) each other. When you activate this option, the Rigid body objects affected by the solve collide and react with each other.

When you disable the Disable Collision option, the Rigid Body object reaction to the Joint solve is not affected if it collides with another Rigid body object. This ability to disable the collision behavior of the solve is useful when you want joint behavior from Rigid Body objects but do not want them to collide.

Setup pane properties

The Joint setup properties display along the top of the Joint Setup pane and displays different options for the Joint Properties. The properties options are the Lock option, View menu, Group properties menu, and the Customize button and are described in Property options on page 765.

Active

The Active option lets you turn the Joint solve on and off. Joint behavior for the affected object(s) begins when the session is set to Live or when recorded.

You can key and animate this setting to turn the Joint behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Type

The Type menu lets you specify the Joint behavior, for example a hinge motion or to "drive" objects with a motor. See Joint types on page 1688 for descriptions of Joints types and their behaviors.

Friction

The Friction slider lets you set the level of stiffness in the joint action. The Friction setting calculates Friction values that behave according to the amount of force applied to the object.

Force limit

The Force Limit slider lets you set a "breaking point" or threshold where the joint reaches before it stops functioning and breaks apart. For example, a Force limit is useful if you have a character that kicks a door and you want the door to open and then fall over.

The Force limit setting reads the amount of force applied to the joint, and when it goes over a specified threshold, the Joint connection breaks.

Use the individual strength and elasticity settings for each object to override these settings.

Joint object

This is the area where any objects to which you have applied a joint appear, for example, if you drag a Joint asset onto a null, a Null joint setting appears here. Expand the listing to see the Joint-related settings related to this object. See Joint Objects on page 1691 for descriptions of the settings that appear.

You can also drag objects to the asset list, which lets you choose the hierarchy order by order in which you selected the objects. In this example, if you select Spoon first, it becomes the parent, and if you select Orange first, it becomes the parent.

Global strength

Use the Global strength slider to set the amount of resistance, or force required to keep the joint objects connected.

The Global strength slider sets a Strength/Elasticity for all objects associated with the joint.

There is a local override for each of these.

You can key and animate this setting to turn the Strength behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Global Elasticity

Use the Global Elasticity slider to specify how much give or rigidity the joint has in relation to the connected objects. Like a “Bungee” cord, this setting can create a stretch effect.

You can key and animate this setting to turn the Elasticity behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Joint Objects

Use the Joint Objects asset list to specify the objects used in the solve.

Connections

The Connections menu lists which connected object is considered the parent in the Joint relationship.

NOTE You can have one parent object and many child objects.

Parent connections

Lists the relationships the objects used in the solve can have with one another. See Joint object parenting on page 1693 for examples of the different parent connects and how they affect a Joint solve.

Collision Propagation

The Collision Propagation menu lets you select a relationship between the Joint objects. The Collision propagation menu determines how the motion of one link in the joint connection transfers to the others. Select a direction that the range of joint movement is spread from the Collision Propagation menu.

Collision Propagation	Description
Two way	A collision with to either the parent or child object affects the other.
Parent-to-child	A collision with the parent object affects the child object, but a collision with the child object does not affect the parent object.
Child-to-Parent	A collision with the child object affects the parent object, but a collision with the parent object does not affect the child object.
No Propagation	A collision does not pass from the affected object to any of the joined objects.

Use Global Strength

Activate the Use Global Strength option to sets the amount of resistance, or the amount of force required to keep the joint objects connected. This is a local override for the Global strength on page 1691 settings.

Use Global Elasticity

Activate the Use Global Elasticity to set how much “give” the solve causes in the connected objects. The Use Global Elasticity setting lets you specify how flexible or rigid you want the solve. This is a local override for the Global Elasticity on page 1691 settings.

Limit & Motor properties

The Limit and Motor properties section lets you specify behaviors that drives the motion of the joint.

High/Low limits

The high and low limits act like degrees of freedom that you can set and animate individually for each joint.

Use the limits settings to set joint behavior so that the affected objects only move in specific direction, for example left to right, or no more than 90 degrees.

Motor force/Motor rate

Use these sliders to introduce force or a “Motor” behavior into the solve of the joint so that it has a built-in motion that drives the joint and simulate motor-type joint connections. This applies forces on the joint, as if you are “driving” the objects.

If you apply a positive force on the X-axis of an object, it moves forward. If you apply a negative force, it creates a backward motion. Use the different axes to choose an axis that has more influence over the others.

NOTE The Motor Force settings apply to all joints except Spring.

Setting	Description
Motor Force	Use the Motor Force field to set the strength, or amount of force, as well as the direction of influence.
Motor Rate	Use the motor rate field to set how much force pushes the affected object.

Joint object parenting

The relationship between Joint objects is important in determining the behavior of a joint and how much reaction is carried through it. This relationship becomes even more important when you create a chain of multiple joints. Whether an object is a parent or child object affects the direction that the reaction to the collision is spread, or propagated.

For example, to make a door swing back and forth in a door frame, the door frame must be the parent and the door be the child. If you assigned these Joint objects incorrectly, where the door was the parent and the door frame the child, the door would remain stationary while the dry-farm would swing back and forth.

The Parent/Child relationship can also define the number of objects connected to the parent. For example, one parent object can have many children that are linked to it by a joint, however you cannot have one child with many parents as this creates solve conflicts.

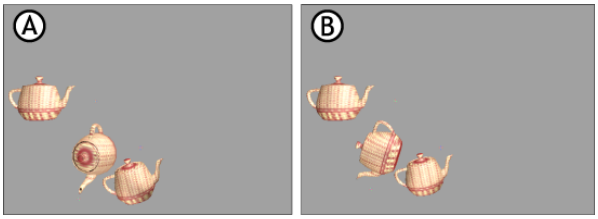
The following sections illustrate the reaction created by the collision propagation setting of each object when it is applied to three teapot models in a chain.

Three models before collision. (First model is set to Passive.)

Two way

A collision with either parent or child object affects the other. The collision reaction is spread through every connection.

In the following image, all objects in the chain are affected when the objects are set to Two Way propagation.

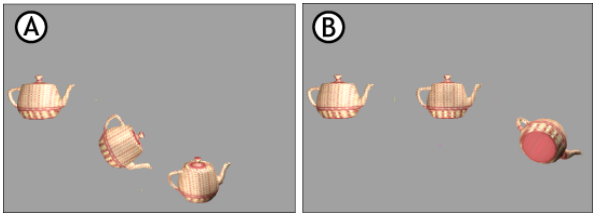


Two-way propagation: A. Collision with second object B. Collision with third object.

Parent-to-child

The Parent-to-Child relationship creates a one-way collision where the parent object affects the child object, but a collision with the child object does not affect the parent object.

The following image shows the result when an object is clicked in a chain where all objects are set to Parent-to-Child Propagation. In A, a collision is triggered with the second object, the effect of which influences its child, the third object. In B, a collision occurs with the third object, but it has no child to which it can pass its reaction, so only the third object is affected.

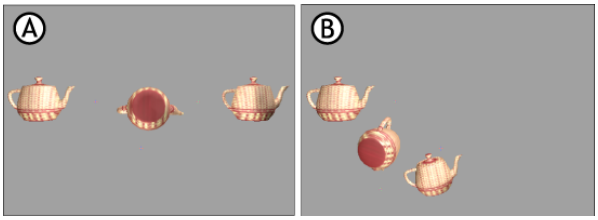


Parent-to-child: A. Collision with second object B. Collision with third object.

Child-to-Parent

The Child-to-Parent relationship creates a one-way collision where the child object affects the parent object, but a collision with the parent object does not affect the child object.

The following image shows the result when an object is clicked in a chain where all objects are set to Child-to-Parent Propagation. In A, a collision occurs with the second object where it cannot pass its reaction to the first object, its parent, because it is set to passive. In this case, only the object that has the collision is affected. In B, a collision occurs with the third object that is passed to its parent, the second object.

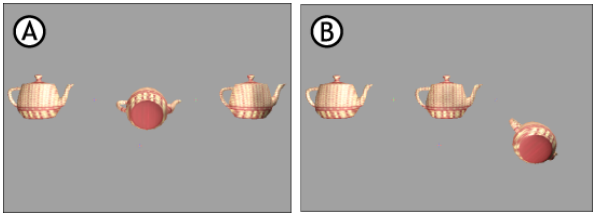


Child-to-Parent: A. Collision with second object B. Collision with third object.

No Propagation

A collision does not pass from the affected object to any of the joined objects.

The following image shows the result when an object is clicked in a chain where all objects are set to No Propagation. The collision behavior only affects the collision object and does not pass on the reaction to any other objects.



No Propagation: A. Collision with second object B. Collision with third object.

Creating a Joint object hierarchy

You can set the parent-child relationship of joint objects when you specify joint objects in the Joint Connections on page 1691 field.

To create a Joint object hierarchy:

1. Select objects in the scene. The first object you select is assigned to be the parent object and the next objects selected are children of the first object.
2. Drag the objects to the Joint Connections asset list.

Ragdoll Physical property

The Ragdoll Physical property lets you simulate and record collisions and collapses on characters with Control rigs.

If you use the Physics solver to write animation data to an object, it writes the data into the Translation and Rotation channels of the object. For a Character, it writes the data on the Control rig effectors.

MotionBuilder writes the key data out to the Control rig or the T/R values that are initially feeding the data in. Overwriting occurs when you plot or record, and a dialog box appears to ask if you want to overwrite the current take. If you choose yes, and you are on the same track, your animation data is overwritten.

NOTE If you do not wish to overwrite your animation data, copy the data to a new take and record over the copy. See Duplicating takes on page 797.

NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.

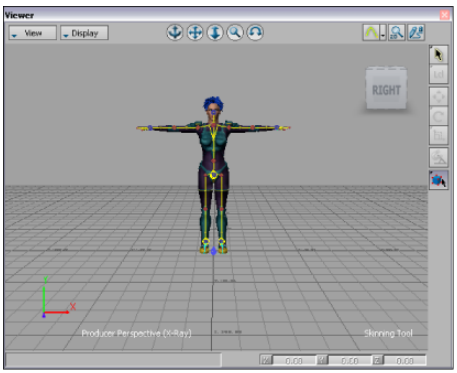
Creating a character collapse with Ragdoll

You can add Ragdoll solving behavior to any character with a Control rig so that the character collapses in a realistic way.

NOTE This workflow illustrates the basic ragdoll setup. For a Ragdoll workflow that incorporates character poses for further realism, see Creating a ragdoll solve with poses on page 1701.

To create Ragdoll collision effects on a character:

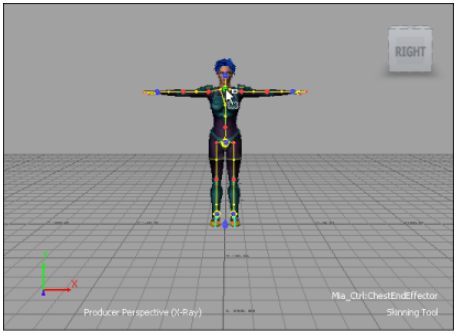
1. Load a character or skeleton with a Control rig into your scene. See Creating a Control rig on page 1437.
2. Make sure they are in the default T-Stance position. (See Stance on page 1292.)
3. Press Ctrl-A until you are in X-Ray mode.



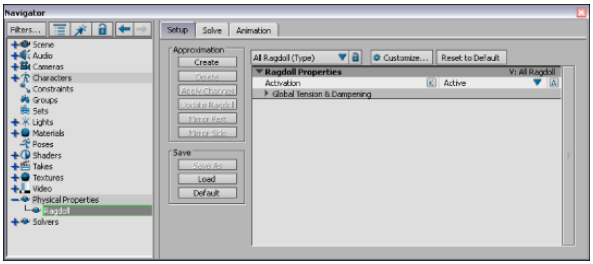
4 From the Asset browser Solvers folder, drag a Physics solver into the Viewer window.

5 From the Asset browser Physical Properties folder, drag the Ragdoll asset onto any part of a Control rig. This connects the ragdoll data to the Character solver.

NOTE The Control rig "lights up" when you are able to drop the Solver on it.

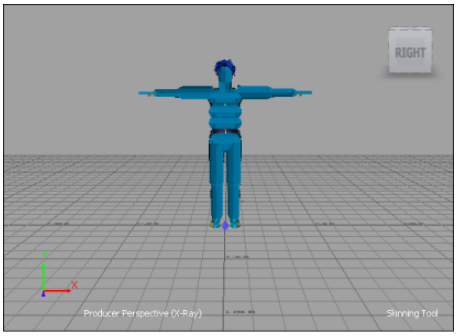


6 In the Navigator window Scene browser, expand the Physical Properties folder and double-click the Ragdoll Physical property.



7 In the Ragdoll settings Approximation area, click Create. A proxy body is created on top of the Control rig.

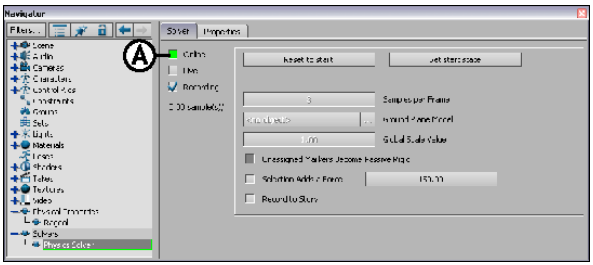
NOTE To hide the proxy, switch to Models Only mode (Ctrl-A).



8 Expand the Physical Properties and define specific properties for the object, as well as in the Solve, and Animation panes.

You can modify settings for individual body parts in the Properties area.

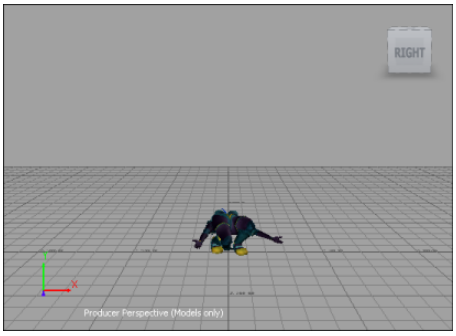
9 Switch to the Navigator window Solver > Physics Solver setup pane, and click Online. Or you can also click the Active option in the Physics Solver properties in the Properties window.



Solver Setup pane A. Click Online.

The Ragdoll solving is now active and you can test and tweak your scene. See Ragdoll settings on page 1705 for information on the different settings.

10 To test your scene, click Live. The Ragdoll solving occurs. To reset your scene after a test, click Reset to Start.



NOTE When you set the Physics Solver to Live, if you select an object that has a Physical property, such as Ragdoll, Rigid Body, or Joint attached to it, you need to deselect the object otherwise the object will ignore the Physics Solver. If the Physical property object is selected when the Physics Solver is Live during recording, the FCurves are re-evaluated based on the Frame Rate shown in the Transport Controls.

11 When you are ready to start recording the Ragdoll action so you can convert it to keyframes, disable the Live option.

12 Click Reset to Start to set the Control rig in the pre-collapse position.

13 Press Record in the Transport controls. A dialog box appears asking if you want to overwrite the take or create a take. Select an option.

14 Press Play in the Transport controls and Stop when the animation is over. The character collapses.

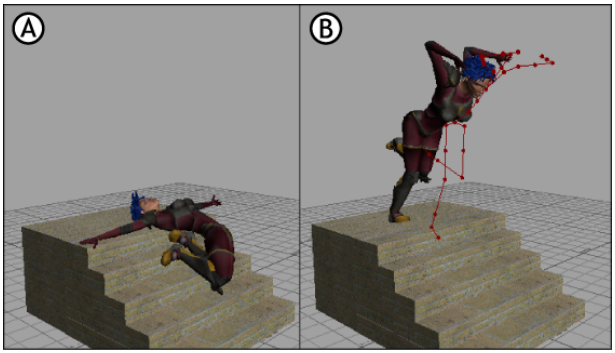
15 In the Physics Properties Setup pane, deactivate Online.

16 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurves window.

You can also press Ctrl-Home and then Play to replay your animation.

Creating a ragdoll solve with poses

You can use character poses in a Ragdoll solve so you can define how a character collapses or falls. Using poses in this way is useful if you want to create a specific reaction or impression.



Ragdoll solves A. Without pose B. With pose (shown in red)

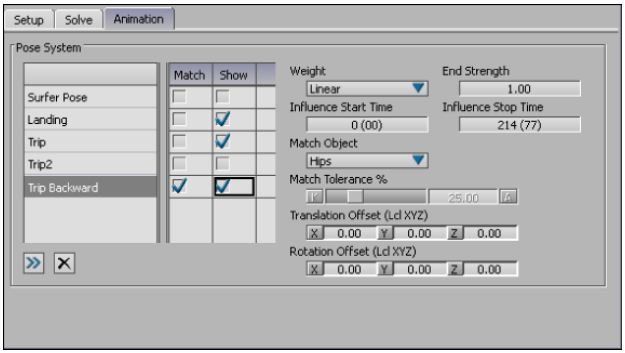
NOTE You must first create poses in the Pose Controls window to use with this solve. See Creating a pose on page 1486.

To use poses to define the collapse of a character:

1. Set poses for the solve in the Pose controls window. See Creating a pose on page 1486.
2. Make sure that your character is in the Stance pose. See Stance on page 1292.

Character in Stance pose.

3 Switch to the Ragdoll Animation pane and use the Add/Remove poses button on page 1715 to include your poses in the Pose system list.



The Ragdoll Animation pane

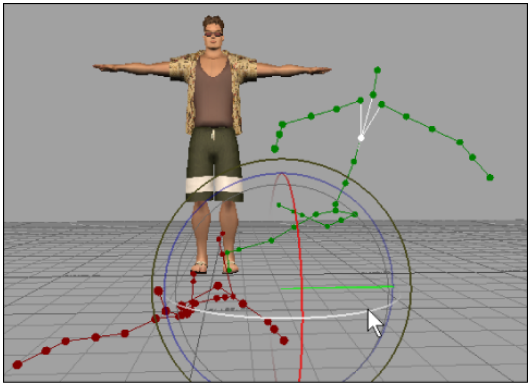
NOTE Avoid adding poses to the Pose list that you do not plan to use in the solve. All poses in the Pose list are used to derive the solve. Or to exclude a pose from the solve, set the Strength or Match Tolerance to 0.

---

4 Activate the corresponding option in the Match column if you want to create a Match pose. Leave the option disabled if you want to set a Guide pose. Choosing a Match or Guide type of pose so lets you specify how you want to achieve the solve.

For an explanation of the difference between Match and Guide poses, see Match and Guide poses on page 1720.

5 Activate the Show option in the Pose list to view the Pose ghosts in your scene. You can select the ghost and position it in your scene until is it where you want it.



Select a Pose ghost joint and transform it.

6 In the Pose settings, specify a weighing type from the Weight menu. See Weight on page 1717 for a description of the different types of weighing available.

NOTE The Weight menu is set to Linear by default. Using the Linear setting is a good place to start for your first solve. You can then fine-tune the Interpolation types later.

---

7 If you specified a Match pose, use the Match Object menu on page 1718 menu to set off which body part the pose match should be driven. The Match pose becomes the driving force of the solve.

If you specified a Guide pose, use the Match Tolerance on page 1718 slider to how little or how much you want the Guide pose to influence the solve. The Guide pose suggests which way the solve is driven without forcing the solve to match the pose exactly.

TIP Normally, Hips or the Chest are best to use as Match objects.

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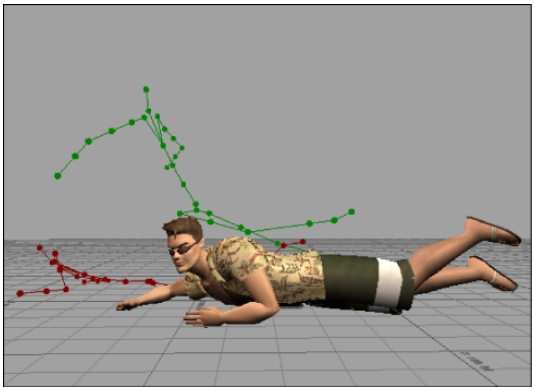
8 In the Navigator window Scene browser, expand The Solvers folder and set the Physics solver to Online.

9 When you are ready to start the solve, click Live.



Pose solve result

Observe the solve and note the areas for improvement, if any. See Perfecting your solve on page 1705. Pose Ghosts "light up" when they become active during the solve, so that a green Guide pose becomes a brighter green, and a red Match pose becomes a brighter red.

NOTE It is a good practice to record your first solve. Recording the solve creates a first iteration that you can use as a reference as you continue to perfect the movement.

---

10 When you are ready to start recording the Ragdoll solve so you can convert it to keyframes, disable the Live option.

11 Click Reset to Start to set the Control rig in the pre-collapse position.

12 Press Record in the Transport controls. A dialog box appears asking if you want to overwrite the take or create a take. Select an option.

13 Press Play in the Transport controls and Stop when the animation is over. The character collapses.

14 In the Physics Properties Setup pane, deactivate Online.

15 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurves window.

You can also press Ctrl-Home and then Play to replay your animation.

NOTE On 64-bit systems, the Physics solver cannot process objects that have degenerated polygons or invalid normals. When this occurs, a warning message appears that identifies the models that have this problematic geometry, and bounding boxes are used to approximate these shapes instead. Using these bounding boxes for the joint solve may produce solve results that differ from the expected behavior. If possible, use the Cube, Capsule, or Sphere approximations to match your geometry with more precision. For more complex geometry, reconstruct your model with 3D software to avoid these non-standard geometry problems. This problem does not occur in the 32-bit version of MotionBuilder.

Perfecting your solve

Once you have completed the steps in Creating a ragdoll solve with poses on page 1701, you can streamline and tweak your results.

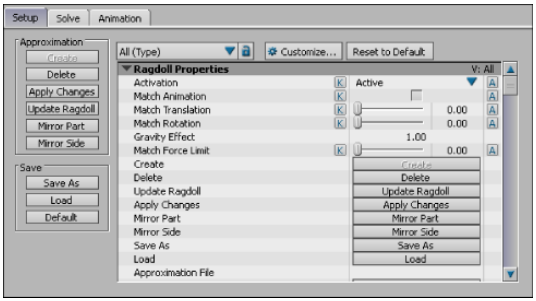
Adjust the Influence Start/Stop time on page 1718 and try different Weight on page 1717 types, where you can create a custom curve interpolation. See Custom Weight on page 1719.

Ragdoll settings

The following settings are for the Ragdoll asset.

Setup pane

The Ragdoll Setup pane is where you configure options that are generic settings, or system overrides.



Approximation area

The Approximation area lets you create a proxy or a "Dummy" for your character.

Approximation menu

Option	Function
Create	Generates a proxy model.
Delete	Deletes the proxy model.
Apply Changes	Applies current changes to the Ragdoll proxy model information, such as changes to color, size, mass, and so on.
Update Ragdoll	Updates the approximation to match the character pose when it has been transformed into a different position. **NOTE** The Physics solver cannot be set to Live while you pose the character.
Mirror Part	Mirrors a body part to the other side, or mirror the entire side.
Mirror Side	Mirrors a side of the character body to other side.

Save menu

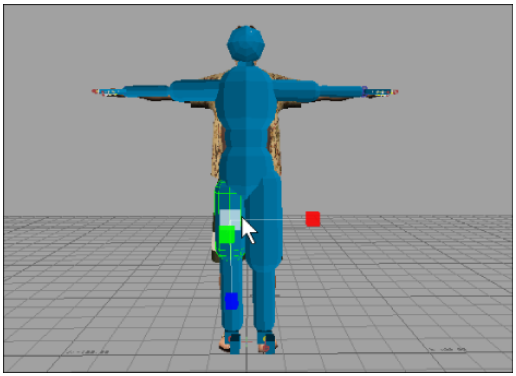
Use these options to create a text file that contains any modifications made to the current solve.

Option	Function
Save as	Save the current modifications as a text file.
Load	Lets you open a previously saved set of solve modifications.
Default	Sets the current settings as the default in the current Config file (DefaultRagdoll.txt) so that any time you click Reset to Default, the properties are reset to this state.

Manually adjusting the Ragdoll approximation

Since the Ragdoll approximation is generic creation, you can achieve better results if you customize it. You can select and transform the Ragdoll

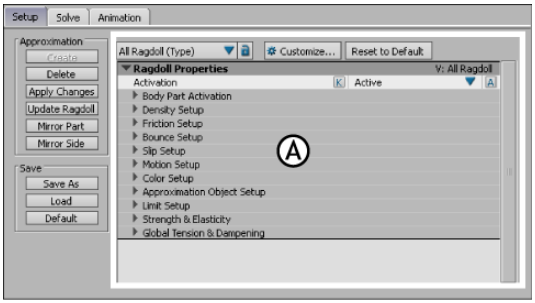
approximation components to create a better fit for your character. This can be especially useful when you work with pose matching.



Scaling a thigh approximation component.

Ragdoll properties area

The Ragdoll properties area is where you can configure the settings for the solve. Expand each heading to expose a list of body parts on which you can set custom levels for your solve.



Ragdoll solve pane: A. Properties area

The Ragdoll setup properties display along the top of the Ragdoll solve pane and displays different options for the Ragdoll properties. The properties options are the Lock option, View menu, Group properties menu, and the Customize button and are described in Property options on page 765.

NOTE Certain body-part settings only appear when you change the the Ragdoll properties View menu to All (type) or a specific body part view (for example, Right Foot).

Reset to Default button

Click Reset to Default to restore the Ragdoll properties to their original settings.

Activation menu

Use this menu to set when the collision reaction starts for the object. For example, you can create objects that only react when they are struck.

Option	Function
Active	Ragdoll solving begins when the session is set to Live.
Active at collision	Ragdoll solving reacts only when a collision occurs.
Passive	The object is not affected but still interacts with other objects in the scene.

Active

The Active option lets you turn the Joint solve on and off. Joint behavior for the affected object(s) begins when the session is set to Live or when recorded.

You can key and animate this setting to turn the Ragdoll behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Body Part Activation

Expand Body Part activation to expose a list of body parts affected by the solve. Disable a body part in the list to exclude that body part from the solve.

NOTE All body parts are included by default.

Activation Creation

These are the same settings as found in the Approximation area. See Approximation area on page 1706 for descriptions of each of these options.

Density Setup

Expand Density Setup to expose a list of body parts on which you can set custom density levels. The Density setting represents the thickness and mass of the character.

You can key and animate this setting to turn the Density behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Friction Setup

Expand Friction Setup to expose a list of body parts on which you can set custom levels for the solve's Friction settings. See the Rigid Body Friction (Mu) field on page 1728 section for a description of the Friction setting.

Bounce Setup

Expand the Bounce Setup sliders set the amount the character bounces when struck.

Slip Setup

Expand Slip Setup to expose a list of body parts on which you can set the amount that your solve object slides off-course.

Use this setting to set how a solve object will move perpendicular to the force. For example, if you had an animation of a car driving around a corner and you assigned a slip value to a tire, it would make the tire skid.

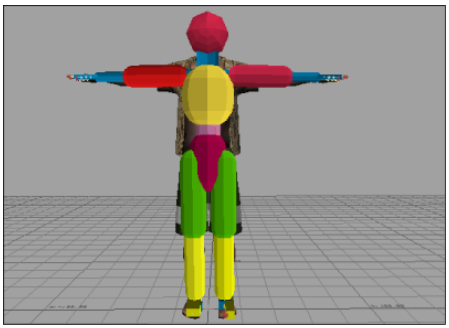
Motion Setup

Expand Motion Setup to expose a list of body parts on which you can cause the object to move by itself. For example, set a Motion value on a cube, and the Motion setting creates a conveyer belt-like action. X and Y refer to local directions from the object.

NOTE You cannot use Motion settings on the Global Y-axis.

Color Setup

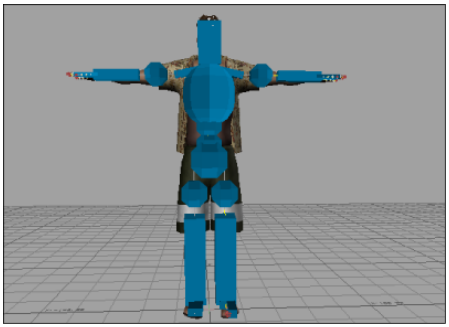
Expand Color Setup to expose a list of body parts on which you can set different colors for the Ragdoll approximation. This way you can single out body parts to observe during the solve.



Ragdoll approximation with custom coloring.

Approximation Object Setup

Expand Approximation Object Setup to expose a list of body parts for which you can choose an approximation shape that best fits the character. Select Capsule, Sphere, Cube, or Mesh.



Ragdoll approximation with non-standard object shapes.

Limit Setup

Expand Limit setup to expose a list of body parts on which you can set the High and Low limits for the Solve. The High and Low limits act like degrees of freedom that you can set and animate individually for each body part.

Use the limits settings to set behavior so that the affected body parts only move in specific direction, for example left to right, or no more than 90 degrees.

Strength and Elasticity

Expand Strength and Elasticity to expose a list of body parts on which you can set the amount of resistance, or force, needed to keep the ragdoll character connected.

You can key and animate this setting to turn the Strength and Elasticity behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Global Tension and Dampening

Expand Global Tension and Dampening and activate the Global Muscle option so you can use the Global Muscle Strength and Global Muscle Elasticity sliders.

Slider	Description
Global Muscle Strength	Use the Global Muscle Strength slider to sets the amount of resistance, or force used with the Ragdoll. The Global Muscle Strength slider sets a Strength setting for all body parts associated with the Ragdoll Physical property.
Global Muscle Elasticity	Use the Global Muscle Elasticity slider to specify how much give or rigidity the Ragdoll has in relation to the connected objects. This setting creates a stretch effect.

Approximation file field

The Approximation file field lets you view the path of the current Approximation file.

Dampen linear/angular settings

Use the Dampen settings to define the clamp value applied to the linear and angular velocity when calculating the rolling friction. Because the Physical property does not model rolling friction, it uses dampening clamps behavior so that objects can come to rest.

For example, without a dampening setting, a rolling sphere rolls on forever. The dampening is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below one decreases velocity, while any value greater increases it.

Value	Description
Linear	Change the Linear Velocity to modify the linear movement of the object
Angular	Change Angular velocity setting to modify the rotational movement of the object.

Collision Propagation menu

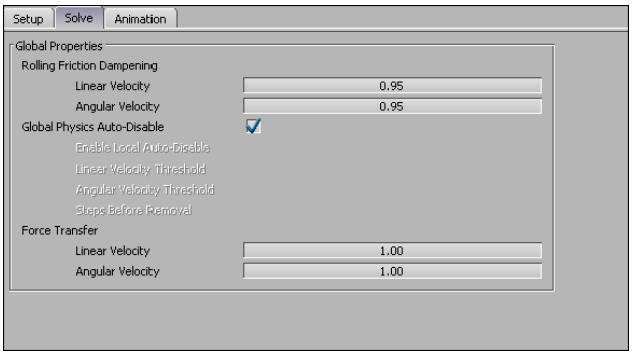
The Collision Propagation menu lets you select a relationship between the Ragdoll body parts. The Collision propagation menu determines how the motion in one body part in the solve transfers to the others. Select a direction that the range of movement is spread from the Collision Propagation menu.

NOTE You can find the Collision Propagation setting when you select All (type) or a specific body part view (for example, Right Foot) in the Ragdoll properties View menu.

Collision Propagation	Description
Two way	A collision with to either the parent or child body part affects the other.
Parent-to-child	A collision with the parent body part affects the child body part, but a collision with the child body part does not affect the parent body part.
Child-to-Parent	A collision with the child body part affects the parent body part, but a collision with the parent body part does not affect the child body part.
No Propagation	A collision does not pass from the affected body part to any of the other body parts.

Solve pane

The Ragdoll Solve pane contains the attributes related to the physical solve of the body such as weighting, and threshold.



Rolling friction dampening settings

Use the Dampen settings to define the clamp value applied to the linear and angular velocity when calculating the rolling friction. Because the Physical property does not model rolling friction, it uses dampening clamps behavior so that objects can come to rest.

For example, without a dampening setting, a rolling sphere rolls on forever. It is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below one decreases velocity, while any value greater increases it.

Value	Description
Linear	Change the Linear Velocity to modify the linear movement of the object.
Angular	Change Angular velocity setting to modify the rotational movement of the object.

Global Physics auto-disable

See System Autodisable options.

Force transfer

These values let you specify how forces are transferred to the solve objects.

Value	Description
Linear velocity	Change the Linear Velocity to specify how linear movement is transferred to your object.

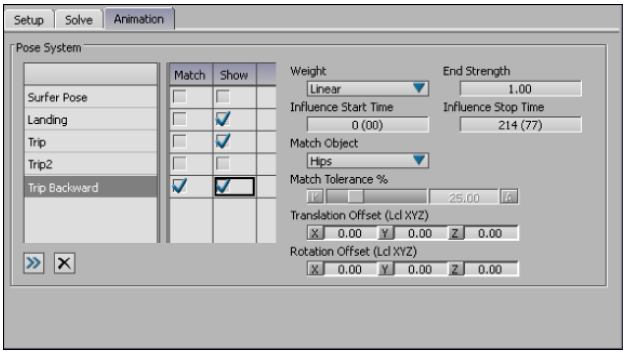
Value	Description
Angular velocity	Change Angular velocity setting to specify how rotational movement is transferred to your object.

Slip field

Animation pane

The Animation pane is where you find information related to Ragdoll pose matching. Using character poses with the Ragdoll solve is useful if you want to create a specific reaction or impression with the collapse.

Activate the Pose option to use the Animation settings. The Ragdoll animation pane is split into two areas: the Pose list and the Pose settings.



Pose list

The Animation pane Pose list displays all poses available to the Ragdoll solve. Use the Add poses button to copy poses to the Pose list.

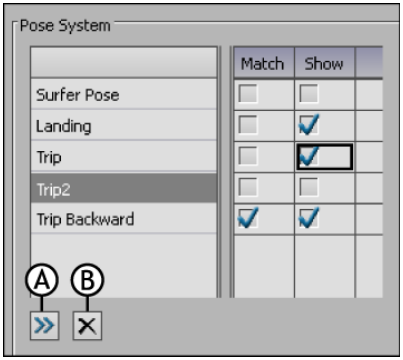
NOTE Avoid adding poses to the Pose list that you do not intend to use in the solve. All poses in the Pose list are used to derive the solve.

Select a pose from the Pose list to assign to the Ragdoll with the Add pose button. See Add/Remove poses button on page 1715.

See Pose Controls window on page 1492 for more on creating poses you can use with the Ragdoll Physical property.

Add/Remove poses button

Click the Add Poses button to display a list of poses currently active in the Pose controls window. You can also drag poses from the Pose controls window into the Pose list.



Ragdoll Pose list A. Add button B. Remove button

Select a pose (or Ctrl-click to select multiple poses,) and click the Remove button to delete a pose from the Pose list.

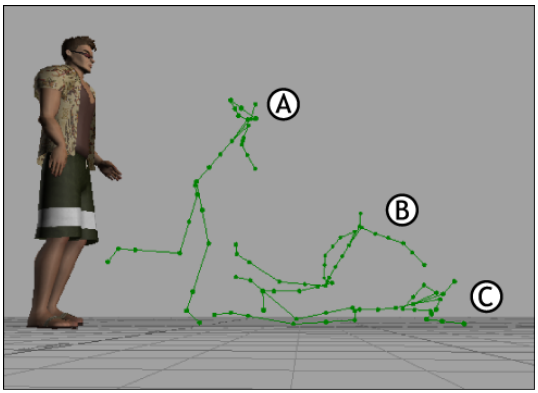
NOTE The Remove pose option only deletes a pose from the Ragdoll Pose list. If you use Remove Pose button to delete a pose from the Pose list, the pose remains in the Pose controls window. You can add the pose to the Ragdoll pose list again.

Match column

Activate the corresponding option in the Match column to select whether you want the pose to function as a Guide or a Match pose. See Match and Guide poses on page 1720.

Show column

Activate the corresponding option in the Show column to show or hide each Pose Ghost in the Viewer window. This way, you can visualize the position of the character so you can better position it.



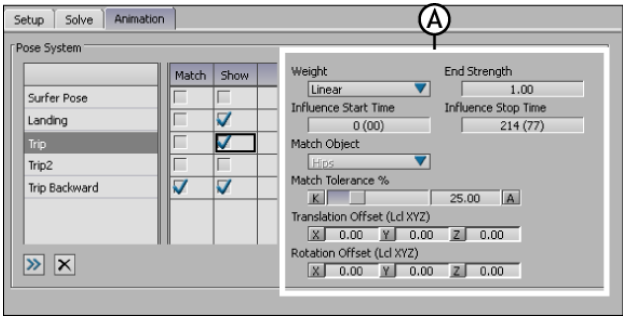
Ragdoll Pose Ghosts A, B, and C.

A Match pose is red and a Guide pose is green. See Match and Guide poses on page 1720 for more information.

Pose settings

The Pose settings appear on the right half of the Ragdoll Animation pane. By default the Pose settings are empty. To display the Pose settings, select a pose in the Pose list.

In the following figure, the settings display for the selected “Trip” pose.



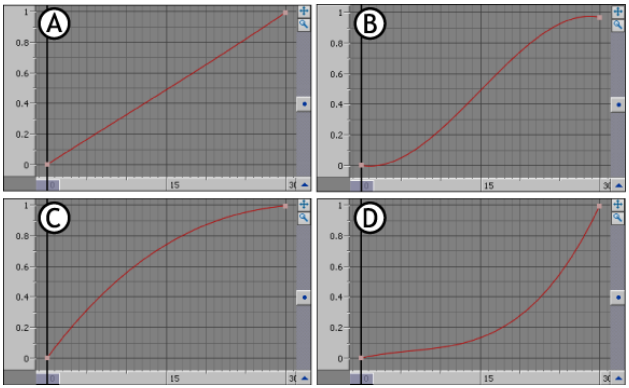
Ragdoll Animation pane: A. Pose settings

NOTE Some of these settings in this area are available only if you choose either a Match or a Guide pose. See Match and Guide poses on page 1720.

Weight

When you are pose matching, use the Weight menu to select the manner that the character uses to reach the specified pose before impact. The Weight menu settings represent an animation FCurve with the goal of reaching the pose.

Pose weight	Description
Custom	When you use this setting, a Custom tab is added where you can modify the pose matching FCurve to create custom effects. See Custom Weight on page 1719.
Linear	The linear setting is a good place to begin your pose solve. The animation curve is a constant straight line curve that creates an average reach to the pose match.
Smooth	Averages all keyframes to create smooth movement. The curve is an S-curve that is equal at top and bottom so that the pose match is attained evenly.
Slow	The Slow curve is a downward arc that bends up toward the end so the pose match is attained gradually. (Concave)
Fast	The Fast curve is an upward arc that bends down toward the end so the pose match increases towards the end. (Convex)



Weight curves: A. Linear B. Smooth C. Fast D. Slow

End strength

Use the End Strength field to enter a value to specify how flexible or rigid you want the solve to match your pose.

Influence Start/Stop time

Use the Influence Start and Stop fields to set an interval for the character to match a pose during a solve.

Option	Description
Start	Sets the moment when the influence of the pose takes over.
Stop	Sets the moment when the influence of the pose diminishes.

Match Object menu

NOTE You can use the Match Object option only when the Match pose type is activated.

The Match Object menu lets you specify a center of mass from which the solve matches the pose. Choosing a Match object is like setting an animation pose as the pose becomes the driving force of the animation. In most cases, the Hips or the Chest are used as a Match object.

For more information on how poses influence animation, see Poses on page 1485.

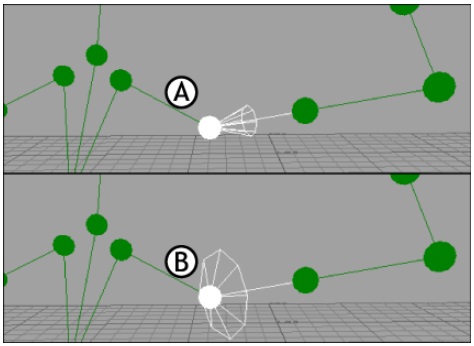
Match Tolerance

NOTE You can use the Match Tolerance slider only when the Guide pose type is activated.

Use the Match Tolerance slider to set a range of flexibility that the character joints have when performing a solve using a Guide pose. The Match Tolerance slider lets you set a limit on how hard the solve "tries" to make your character match the specified Guide pose. When you use this setting, you can give each Guide pose an individual level of importance in the solve.

Match Tolerance rings visually represent the Match Tolerance values in the Viewer window. They appear as white rings on a joint and indicate possible rotation combinations that the body part can reach. You can think of them as the percentage of the degrees of freedom that are available to the character.

To view Match Tolerance rings, select any joint on a Guide Pose in the Viewer window.



Match Tolerance rings on a guide pose: A. at 10% B. at 40%.

Translation Offset

Use the Translation offset X, Y, and Z fields to set coordinates for a Translation offset to position poses in your scene.

TIP If you select a pose "joint", you can translate and rotate the pose.

Rotation Offset

Use the Rotation Offset X, Y, and Z fields to set coordinates for a Translation offset to position poses in your scene Both Global and Match poses.

TIP You can translate and rotate Match and Guide poses if you select a pose "joint", and translate or rotate it.

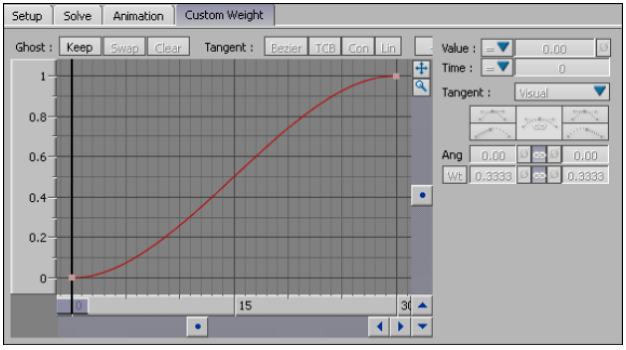
Custom Weight

The Custom Weight pane appears when you select the Custom option from the Ragdoll Animation Pane's Weight on page 1717 menu. You can use the Custom pane to modify the pose matching FCurve to fine-tune your animation and create custom effects.

The Custom weighting pane behaves almost exactly like the FCurves window, except that timelines change depending on the type of pose selected. For a Match pose, the bottom timeline reflects the start and end frames of the solve.

For a Guide pose, the bottom timeline depicts the frame rate set in the Transport controls.

For an explanation of how you can modify the animation curve, see FCurves window on page 971.



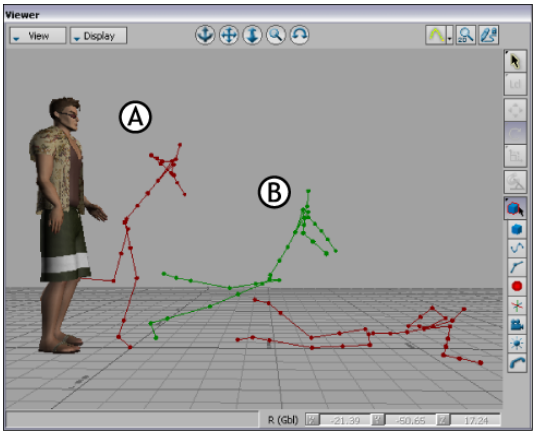
Ragdoll Custom Weight pane

The slope of the Weight function curve determines the speed at which the values change between keyframes: a steep slope means the value changes quickly, and a gradual slope makes the value changes more slowly over a longer period.

The Weight setting lets you specify what time versus strength values the solve uses to reach the pose. The Y-axis in the Weight FCurve pane represents the strength of the pose match while the X-axis represents the length of time.

Match and Guide poses

Specify whether your pose is a Match or a Guide pose when performing a Ragdoll pose solve.



Viewer window: A. Match pose B. Guide pose

When you activate the Match option in the Pose Settings Match column on page 1715, you set the corresponding pose as a goal that the Character must meet. Match poses appear in the Viewer window as a red stick figure.

When you leave the Match option deactivated in the Match column on page 1715, you are specifying a Guide pose. Use a Guide pose when you want the character to attempt to conform to a pose but not perform unrealistic contortions to ensure that the pose is assumed. Guide poses appear in the Viewer window as a green stick figure.

To make the character meet the pose, specify a Match pose by activating the Match option in the row of the corresponding pose.

TIP You can translate and rotate Match and Guide poses if you select a pose "joint", and translate or rotate it.

Rigid Body Physical property

Use the Rigid Body Physical property to create real-time collisions that you can use to prevent interpenetration of characters, objects, and other scene elements.

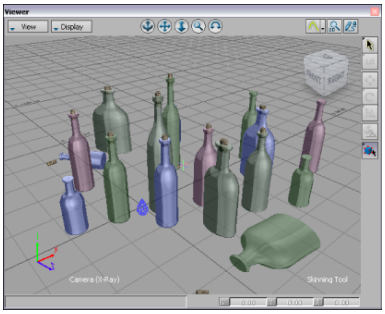
This is useful if you want to edit 3D animations involving characters interacting with objects.

Creating collision effects

The Rigid Body Physical property lets you create collision effects in your scene that you can record as keyframe animation.

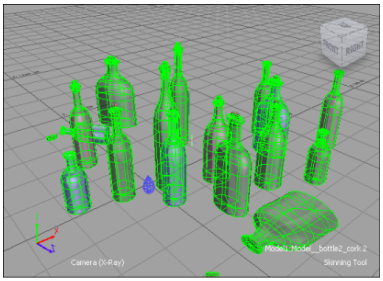
To create collision effects:

1 Load a scene or build a scene with primitives from the Asset browser Elements folder.



2 From the Asset browser Solvers folder, drag a Physics solver asset into the Viewer window.

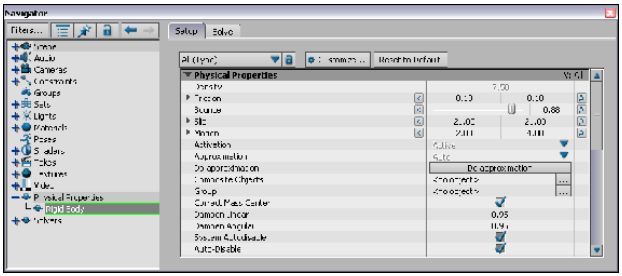
3 Select the item(s) to which you want to apply the Rigid Body collision settings.



4 From the Asset browser Physical Properties folder, drag the Rigid Body Physical property on top of your selected objects.

NOTE If you apply a Rigid Body Physical property to a group of selected objects, the same Rigid Body definitions control all the objects. If you want to define settings for different objects, apply a Rigid Body Physical property to each object. You can also group objects and apply a Physical property to the group.

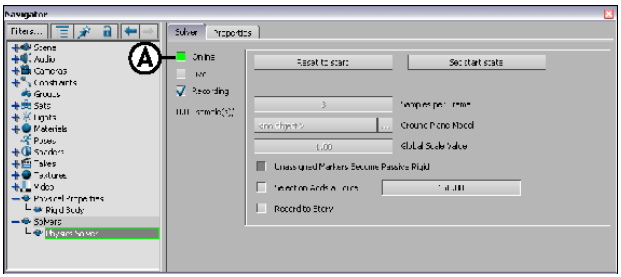
The Rigid Body properties display in the Navigator and Properties windows.



5 In the Navigator window Scene browser, expand the Physical Properties folder and double-click the Rigid Body Physical property.

6 Adjust the properties in the Rigid Body Setup pane (for example, Density, Friction, and so on).

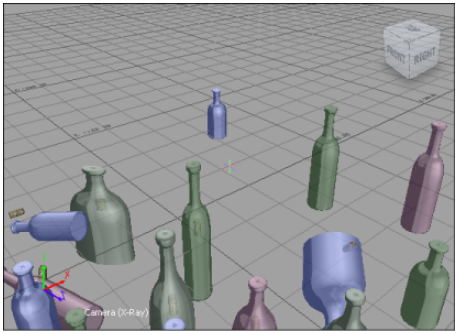
7 Switch to the Navigator window > Solvers > Physics Solver pane, and click Online. Or you can also click the Active option in the Physics Solver properties in the Properties window.



Physics solver Setup pane A. Click Online.

The collision solving is now active and you can test and tweak your scene. See Rigid Body settings on page 1727 for information on the different settings.

8 To test your scene, click Live. The rigid body solving occurs. To reset your scene after a test, click Reset to Start.



NOTE When you set the Physics Solver to Live, if you select an object that has a Physical property, such as Ragdoll, Rigid Body, or Joint attached to it, you need to deselect the object otherwise the object will ignore the Physics Solver. If the Physical property object is selected when the Physics Solver is Live during recording, the FCurves are re-evaluated based on the Frame Rate shown in the Transport Controls.

9 When you are ready to start recording the collision action so you can convert it to keyframes, disable the Live option.

NOTE If you modify properties in the Solver or the Rigid Body, switch the Solver offline, and then switch back online to have your changes recognized. You cannot add Physical properties (for example Rigid Body, Ragdoll or Joint) to objects while the Physics solver is online.

10 Click Reset to set up the objects in the pre-collision position.

11 Press Record in the Transport controls. A dialog box appears asking if you want to overwrite the take or create a take. Select an option.

12 Press Play in the Transport controls and Stop when the animation is over.

13 In the Physics Properties Setup pane, deactivate Online.

14 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurves window. Your object receives key-frame data corresponding to the Physical solve.

Transport controls A. Keys display along the timeline.

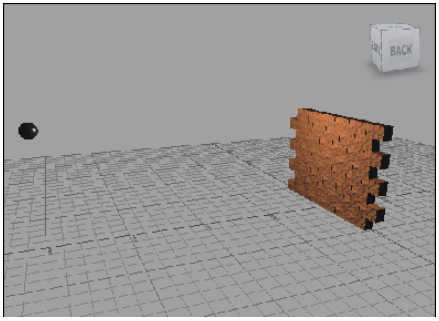
You can also press Ctrl-Home and then Play to replay your animation.

15 Save the take.

Creating multiple object collisions

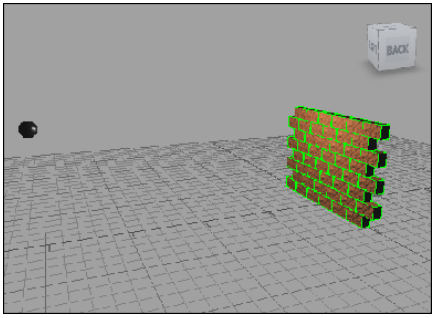
Sometimes you might want to animate collisions between more than one object. In this example, a cannonball is animated destroying a brick wall.

1 Open a file with elements you want to animate.



2 Create the animation you want to create the collision effect. In this example, the cannonball is keyframed to pass through the wall.

3 Select all the objects you want to affect with the collision.

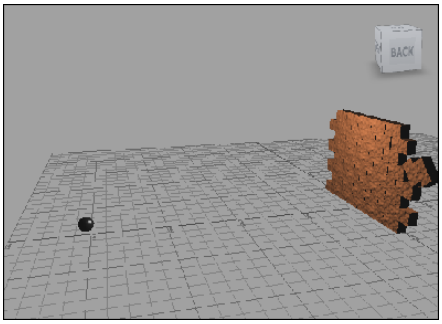


4 In the Asset browser, expand Physical Properties and drag a Rigid Body Physical property onto the wall.

5 Drop another Rigid Body Physical property onto the cannonball.

6 In the Rigid Body Physical property setup pane for both the Rigid Body assets, set Activate Physics Solve to Collision.

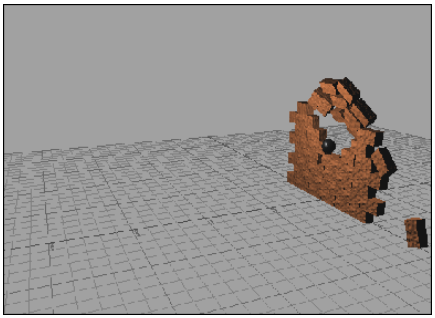
This ensures that the behavior of both objects changes only at the moment a collision occurs. Otherwise, the cannonball would fall to the ground and the wall would collapse under its own weight.



If the objects are not set to collision, the collision effect occurs before the actual collision.

7 Drag the Physics solver asset from the Navigator window Solvers folder anywhere into the Viewer window.

8 In the Navigator window Solvers > Physical Properties settings, click Online and Live to activate the solving.



9 Press Play in the Transport controls to view you results. Adjust both objects Rigid Body settings. See Rigid Body settings on page 1727.

NOTE Change the Rigid Body settings when the Physical Properties solver is not online. Also, you cannot add Physical properties (for example Rigid Body, Ragdoll or Joint) to objects while the Physics solver is online.

10 When you are satisfied with your result, press Record, followed by Play in the Transport controls. A dialog box appears asking if you want to overwrite the take or create a take. Select an option.

11 Press Record in the Transport controls.

12 Press Play in the Transport controls and Stop when the animation is over.

13 In the Physics Properties Setup pane, deactivate Online.

14 To view the recorded keyframes, select one of the animated objects. Keyframes appear in the Transport controls, and the FCurves window. Your object receives key-frame data corresponding to the Physical solve.

Transport controls A. Keys display along the timeline.

You can also press Ctrl-Home and then Play to replay your animation.

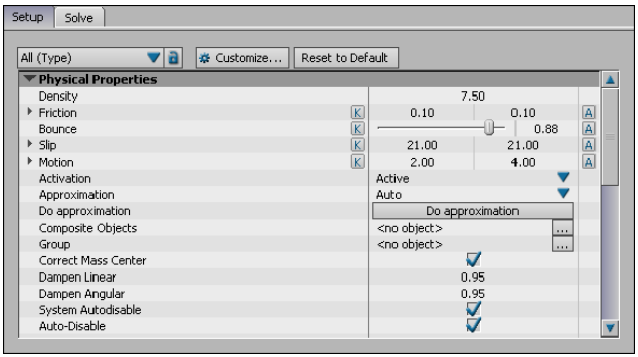
Rigid Body settings

Use the Rigid body settings to adjust your collision effects.

Setup pane

The Rigid Body Setup pane is where you can find generic Physical properties and basic setup information.

NOTE The maximum property values for Rigid Body properties are 999999.99 with a minimum value of -999999.99.



Customize button

The Customize button opens the Properties Editor. See Property Editor on page 775.

Reset to Default button

Click Reset to Default to restore the Ragdoll properties to their original settings.

Density field

Use this field to set the thickness and mass of an object.

You can key and animate this setting to turn the Density behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Friction (Mu) field

Use the Friction settings to set the surface resistance of an object. For example, use a setting of 0.1 for a smooth object and a setting of 10.00 for a rough object.

Bounce slider

Use the Bounce slider to set the amount the object bounces when struck.

Slip field

Enter values in the Slip field to set the possibility of a solve object sliding off-course.

Use this setting to set how a solve object will move perpendicular to the force. For example, if you had an animation of a car driving around a corner and you assigned a slip value to a tire, it would make the tire skid.

Motion field

Use the Motion field to make the object generate motion without intervention. For example, set on a cube, the Motion setting creates a conveyer belt-like action. X and Y refer to local directions from the object.

NOTE You cannot use Motion settings on the Global Y-axis.

Activation menu

Use this menu to set when the collision reaction starts for the object. For example, you can create objects that only react when they are struck.

Option	Function
Active	Collision reaction for the affected object(s) begins when the session is set to Live or when recorded.
Active at collision	The affected object reacts only when something collides with it.
Passive	The object is not affected by objects colliding with it, but still collides with other objects, it is a passive rigid body.

You can key and animate this setting to turn the Rigid Body behavior off and on during your animation. See Keyframe (K) and Animate (A) buttons on page 822 for more information.

Approximation menu

Approximation lets you specify the type of object, or the mesh that to use to approximate the solve. Select Auto, Sphere, Capsule, Cube, or Mesh.

Composite Objects

Composite objects let you specify the mesh that you want to use to approximate the solve.

Group menu

This menu provides a list of the available groups from which you can choose an approximation object.

Correct mass center option

Activate this option to offset the “Center” or “Center of Gravity” of an object to a given point to represent the center of gravity for an object.

Dampen linear/angular

Use the Dampen linear/angular settings to define the clamp value applied to the linear and angular velocity when calculating rolling friction. Because the Physical property does not model rolling friction, it uses a dampening system so that objects can come to rest.

For example, without a dampening setting, a rolling sphere rolls on forever. It is done by scaling linear velocities at each simulation step by dampening factor for all colliding objects.

A value of 1 retains actual velocity. Any value below one decreases velocity, while any value greater increases it.

Value	Description
Linear	Change the Linear Velocity to modify the linear movement of the object
Angular	Change Angular velocity setting to modify the rotational movement of the object.

System Autodisable option

System Autodisable clamps the calculation of collisions below a specified threshold. By default, MotionBuilder uses the same Auto-disable settings as in the Physics Solver.

Activate the System Autodisable option so that the animation is cut off below a threshold, otherwise system resources are absorbed processing vibrations so minute that they are no longer visible.

But on a per-property list basis, you override the default Autodisable settings. Disable the System Autodisable option to override these settings for every object to which the Property list is applied.

Linear/angular threshold fields

Use these fields to specify a speed for the solve process.

Option	Description
Linear Threshold	The linear velocity that controls the linear rate of speed.
Angular Threshold	The angular velocity that controls the rotational speed.
Steps	The Step Value setting lets you specify the number of steps that an object must process before it falls below the threshold.

Weight linear/angular velocity fields

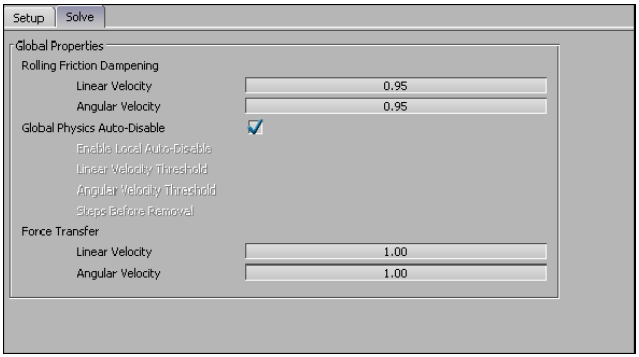
When a collision occurs with an object, velocities are used to calculate the force of the collision.

Modify the Linear and Angular Velocity settings to override the default transfer of energy that occurs in a collision, for example, to assign more or less collision force to an object than what is already specified in the Physical property.

NOTE You must have both colliding objects enabled for velocity settings to work.

Solve pane

The Rigid Body Solve pane contains the attributes related to the physical solve of the object such as density, friction, and bounce.



Rolling friction dampening settings

Use the Dampen settings to define the clamp value applied to the linear and angular velocity when calculating the rolling friction. The Rolling friction dampening settings are documented in detail in the Ragdoll Rolling friction dampening settings on page 1713.

Global Physics auto-disable

See System Autodisable options.

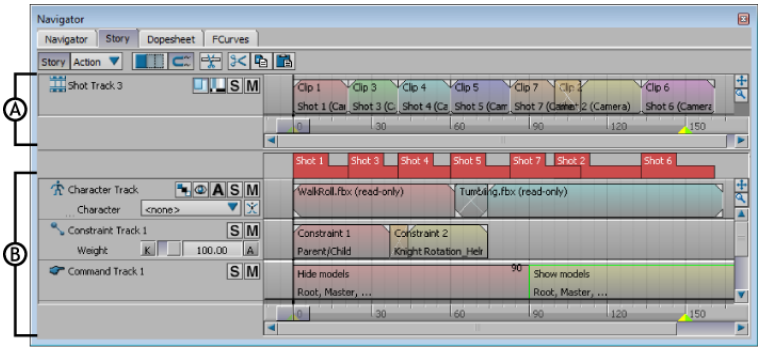
Force transfer

These values let you specify how forces are transferred to the solve objects.

Value	Description
Linear velocity	Change the Linear Velocity to specify how linear movement is transferred to your object.
Angular velocity	Change Angular velocity setting to specify how rotational movement is transferred to your object.

Part 13: Animating within the Story Window

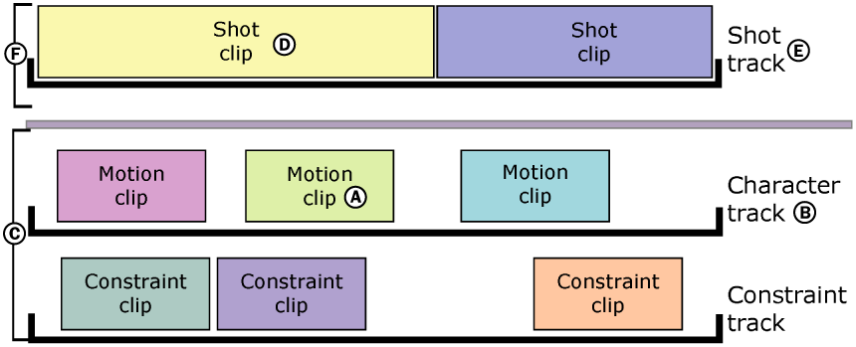
A story is defined as a series of events. Similarly, the Story window lets you assemble scenes by combining and manipulating elements such as characters, lights, cameras, audio, and animation along a timeline, much like a non-linear editor.



Story window *A.* **Edit timeline** *B.* **Action timeline**

The Story window is made up of two timelines that look similar but are used for different purposes. You can switch between these two timelines using the Story Mode button at the top left corner of the Story window.

- Action timeline: This is where you build the scene using tracks and clips.
- Edit timeline: Once you have arranged your scene along the Action timeline, this is where you can then rearrange the order of shot clips to create camera switches or editing effects.



Story window clip illustrations (A) Clips on Character track on the Action timeline (B) Character track on Action timeline (C) Action timeline (D) Shot clips on Shot track (E) Shot track on Edit timeline (F) Edit timeline

To use the Story window, you need to create clips of data (A and D) that represent objects or actions in your scene and arrange them on tracks placed in the Action and Edit timelines (C and F). Which timeline you use determines what you can do with the clips on tracks.

NOTE No matter how you arrange clips and shots on tracks, you do not alter the current take.

Once you have assembled the story's actions in the Story window, you can edit and rearrange them without losing your original action.

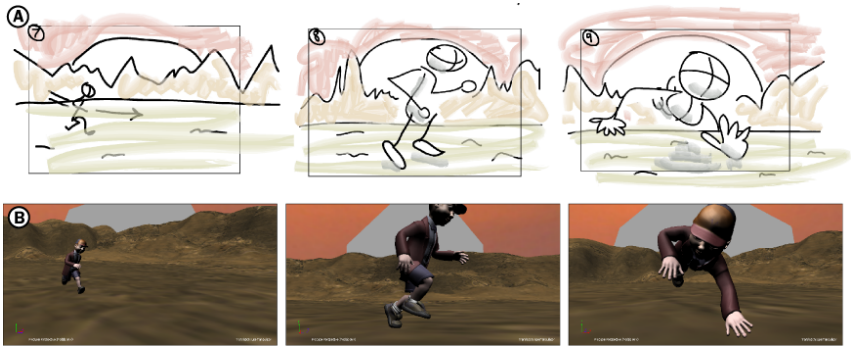
To access the Story window, select Window > Story from the menu bar. The Story window also appears in the Story layout. To select the Story layout, select Layout > Story from the menu bar.

Story window animation can be edited in the FCurves and Dopesheet windows, as well as the Transport Controls. For more information, see Editing Story data in the FCurves and Dopesheet windows on page 1751.

- Story controls on page 1741
- Edit Track list on page 1857
- Action Track list on page 1757
- Contextual menu for selected clips on page 1790
- Contextual menu for selected tracks on page 1772
- Story clips on page 1777

Storyboarding

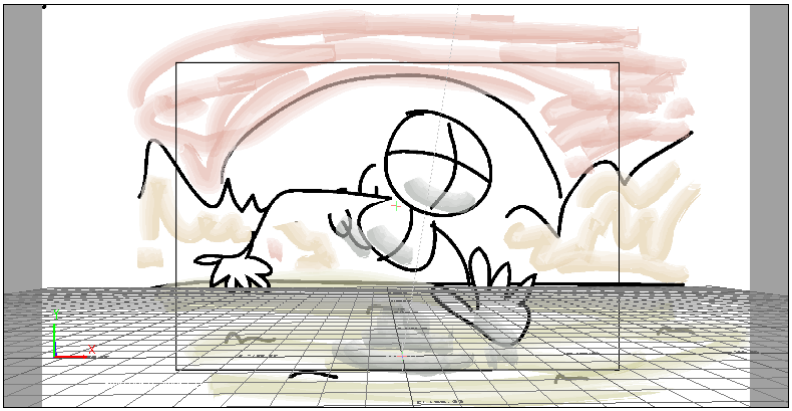
Storyboarding is a way of planning a scene before you build it to give you an idea of the way your scene will finally look. You can base models, sets, and animation on what is contained in a Storyboard.



A. **Hand-drawn storyboard** *B.* **Finished 3D scene in MotionBuilder**

Traditional storyboards are a series of images that show the sequence of events in a story, much like a comic book. Each storyboard panel lets you plan the camera shot, the action, and the character's position in a scene.

With the Story window, you can project images of a storyboard on the background of camera shots, then schedule each image and camera shot to show the sequence of events. This creates a kind of slide show.



Camera shot with a back plate storyboard image

You can also rough out your scene using models and animation. Or you can use storyboards as guides when you set up your scene and animate. For example, you can use a static storyboard image as a guide when you set up your scene and animate your characters.

This way, you can experiment with camera angles and timing before you have the characters and props you need. Use this technique to create scenes that are just the way you planned them.

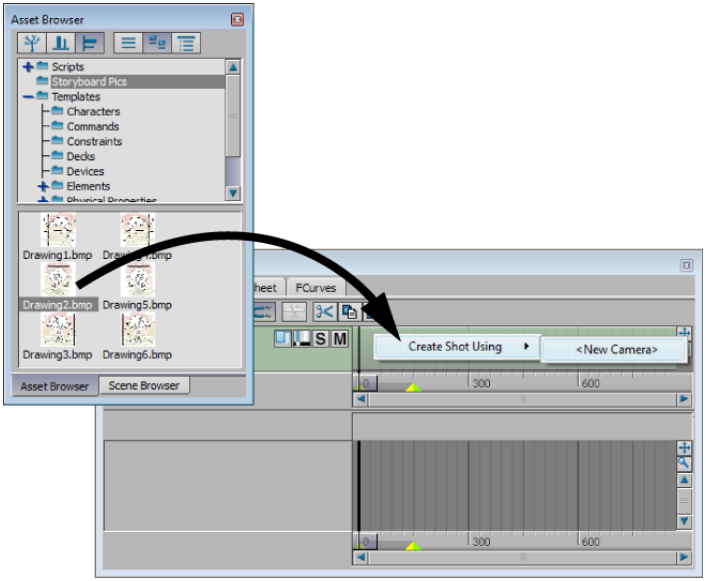
■ Creating a storyboard on page 1736

Creating a storyboard

You can use the Story window to create a storyboard that lets you plan your action before you start animating.

To create a storyboard using storyboard images:

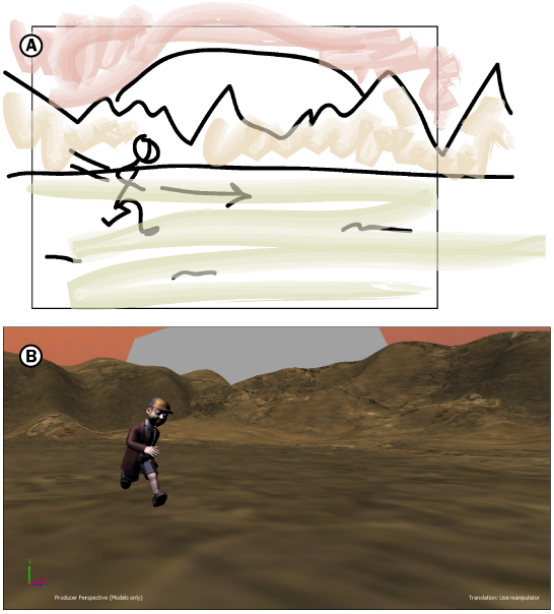
1. Drag an image to use for a storyboard from the Scene or Asset browser into the Story window Edit track.
2. Select New Camera from the Create Shot Using menu that appears. If you want to assign the image to a camera that is already in the scene, select it from the menu.



NOTE If you want to assign the image to a camera in the scene, select it from the menu.

3 Right-click the resulting shot clip and select Make Camera Switcher Current from the contextual menu.

4 Resize and schedule each camera shot to show the sequence of events, creating a slide show with which you can time the length of action as well as set up camera angles.

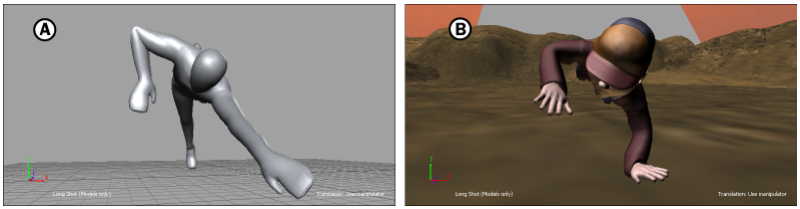


A. **Storyboard image** *B.* **Shot with models and set**

5 If you want to use cross-dissolve effects between camera shots, switch to Edit mode and overlap the camera shots on the Edit track.

You can also create a storyboard using models and animation so you can rough out your scene before you create the characters and props you need without the use of traditional storyboard images.

To do this, set up as much of your scene in the Story window as possible and then use any characterized model to “stand in” for your yet-to-be-created character. Position cameras and tweak the scene until you are satisfied with the animation.



A. **Storyboard using models and animation** *B.* **Final scene using the storyboard**

When you have the correct character, drag it into the scene and select it from the Character menu of the Action track. Doing this lets you arrange and set up elements can be reused when you create the final scene. For example, you can reuse any camera shots or poses you create while building your storyboard.

■ Storyboarding on page 1735

Framing Story window clips

You can frame takes in the Story window using the Frame Start/End option. This makes the first clip on the track become the starting time of the take, with the end value of the last clip being the end time of the take.

To frame a take in the Story window:

1. Right click in the Action or Edit track list.
2. Select Frame Start/End to set the Start and End values of the take.

   When you use Frame Start/End, the Start value of the take becomes the start time of the earliest clip and the End value of the take becomes the end time of the last clip.

■ Zooming in on Story window clips on page 1739

Zooming in on Story window clips

To zoom in on part of a take in Story window:

1. Right-click in the Action or Edit Track list.
2. Select Frame Zoom Bar from the contextual menu.

   The Start value becomes the start time of the earliest clip and the End value becomes the end time of the latest clip.

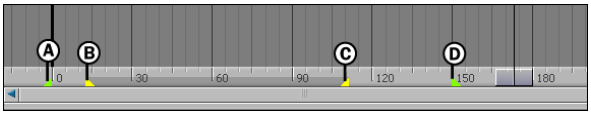
   NOTE To zoom in on a single clip only, right-click it and frame it using the command in the contextual menu.

3. Press A to center the clips in the Story window.

■ Framing Story window clips on page 1739

Story window time range

In the Story window, the length of the take is referred to as the *time range*. A timeline displays at the bottom of each track list. The time range displays along the timeline as green and yellow markers.



A. **Start of take** *B.* **Start of zoom bar** *C.* **End of zoom bar** *D.* **End of take**

Marker color	Indicate
Green	The start and end of the take (A and D).
Yellow	A selected segment of that take (B and C).

NOTE These markers correspond with the Start and End fields and the Zoom bar in the Transport Controls window. See Transport Controls contextual menu on page 807" for more information.

- Changing the length of a Story take on page 1740

Changing the length of a Story take

To change the length of a take in the Story window:

➤ In the Story window, drag the green markers at the bottom of the Action Track list.

The green markers indicate the start and end of the take and correspond with the Start and End fields in the Transport Controls window.

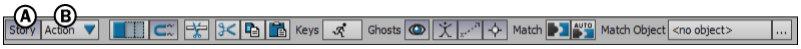
- To select a different segment of the take, drag the yellow markers.
- You can also scroll the zoomed area without changing its length by dragging the gray bar between the yellow markers. Double-click this bar to expand it to the length of the take.
- Transport Controls on page 801

Disabling the Story window

When there is animation in your scene other than that in the Story window, you can mute the Story window so you can see it instead of the Story window's action.

To disable the Story window:

1 Click the Story Mode option in the Story controls to disable the Story window. Only the take selected in the Transport Controls window plays.



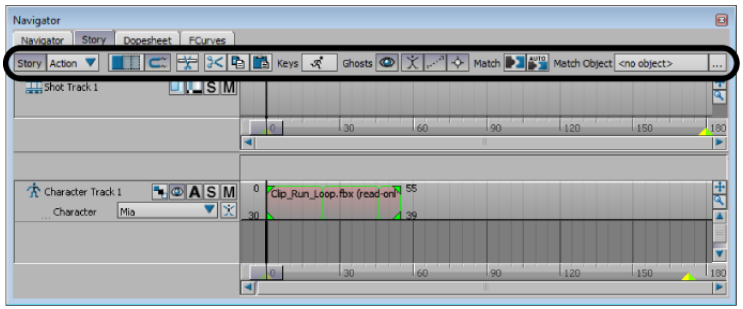
Story controls *A.* **Story Mode option** *B.* **Story Mode menu**

2 To activate the Story window, click the Story Mode option again. The animation in the Story window overrides or blends with the take selected in the Transport Controls window.

For more on the Story Mode option, see Story Mode option on page 1742.

Story controls

The Story controls, arranged along the top of the Story window, let you manipulate tracks, clips, and animation. The Story controls that display change depending on what is currently selected. For example, the Clips and Edit options are always shown, but the Keys and Ghosts options appear only if a Animation, Camera Animation, or Character track is selected.

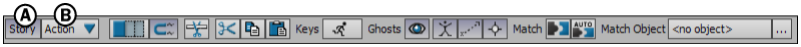


Story controls (circled) in the Story window

This section covers the Story controls that appear when any clip is selected. Story controls that are specific to particular types of tracks are covered with the track information.

Story Mode option

The Story Mode option lets you activate and disable the Story window. The Story Mode menu lets you select between Action and Edit modes. This option is also in the Transport Controls window.



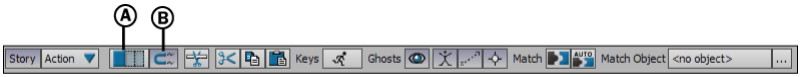
Story controls *A.* **Story Mode option** *B.* **Story Mode menu**

Disable Story Mode so that only the take selected in the Transport Controls window plays. If Story Mode is active, the animation in the Story window can override or blend with the take selected in the Transport Controls window.

When Story window animation is active, the Story Mode menu is also active. This menu lets you select between the Story window Action and Edit modes. See Disabling the Story window on page 1741 for more information.

Manipulation options

The Manipulation options let you manipulate clips:

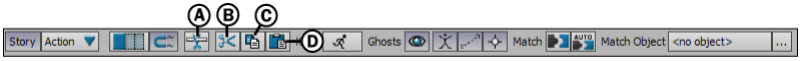


Manipulation options *A.* **Loop/Scale** *B.* **Snap**

Manipulation option	Behavior
Loop/Scale	Lets you loop and trim clips, or scale clips. Looping is the default clip manipulation mode. See Looping clips on page 1804.
Snap	Lets you snap the clip to frames, clips, shots, or to the current time, when you drag a clip along a track, depending which option is active in the Snap contextual menu. See Snap menu options on page 1750 for descriptions of the different Snap options.

Edit buttons

The Edit buttons let you slice, cut, copy and paste clips.



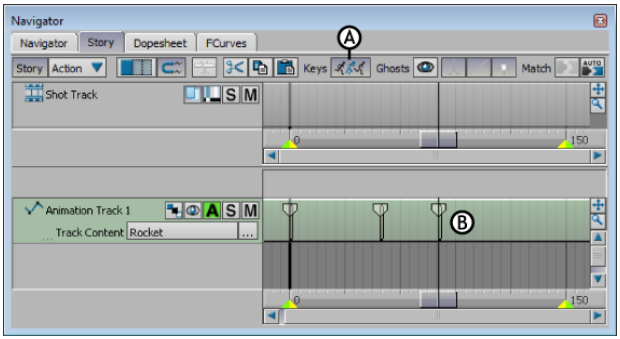
Edit buttons *A.* **Razor** *B.* **Cut** *C.* **Copy** *D.* **Paste**

Button	Function
Razor	Lets you slice a selected clip in two. **NOTE** To slice selected clips on multiple tracks at the same time, place the Timeline indicator over the clips and use the Razor option in the contextual menu instead. See Razoring clips on page 1808.
Cut	Removes selected clips and stores them in memory. You can also use the keyboard short-cut *Ctrl-X* to cut selected clips.
Copy	The Copy button copies selected clips. You can also use the keyboard short-cut *Ctrl-C* to copy selected clips.
Paste	Inserts a copied or cut selection into another location.

Multiple Clips option

The Multiple Clips option displays when an Animation, Camera Animation, or Character track is selected.

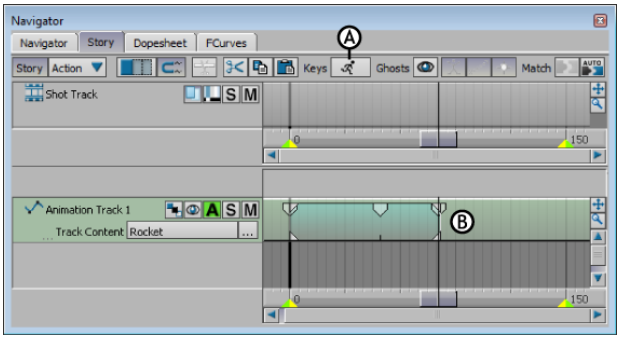
When the Multiple Clips option is active, clips are automatically created along the track as you move the Timeline indicator and transform selected assets. A clip is created for each keyframe.



Story window *A.* **Multiple Clips option set to active** *B.* **Clips created for keyframes at frame 0, 49, and 81**

NOTE The color of the clips on the track represent the keyframes they represent.

When the Multiple Clips option is disabled, only one clip is created when you transform selected assets. When the option is disabled, the clip stretches to include the keyframes you set.



Story window *A.* **Multiple Clips option disabled** *B.* **Clip encompassing keyframes at frame 0, 49, and 81**

You can change the contents of a keyless clip by placing the Timeline indicator over it and transforming the selected assets again.

Ghosts options

The Ghosts options let you hide and show various ghosts. These options display only when Animation, Camera Animation, and Character tracks or clips are selected.

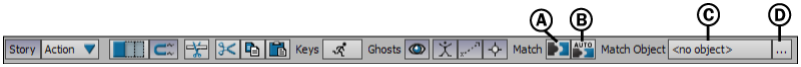
The Ghosts options consist of the following:

Option	Behavior
Ghost option	Hides or shows all ghosts of selected tracks or clips. For more information, see Ghost option on page 1827.
Model option	Hides or shows a model's ghost.
Clip Vector/Travelling Node	Hides or shows either clip vector ghosts or travelling nodes, depending on whether tracks or clips are selected. For more information, see Clip Vector/Travelling Node on page 1828.
Ghost Match Object	Hides or shows the match object ghosts of tracks and clips. Ghosts of match objects look like crosses in the Viewer window. See Matching clips on page 1810 for more information on match objects.

Option	Behavior
Travelling Node(s)	Lets you define a different travelling node for an Animation, Character, or Camera Animation track. For more information, see Travelling node on page 1824.

Match Controls

The Match Controls let you blend animation between clips and tracks smoothly. You can match a selected clip to the clip that comes before or after it. You can also match more than one clip at once by selecting all but the first clip.



Story controls *A.* **Match Options button** *B.* **Auto Match option** *C.* **Match Object field** *D.* **Match Object button**

The Match Controls are active only when an animation, camera animation, or character clip is selected. See Matching clips on page 1810 for more information.

Story contextual menu

This section describes the options found in the Story window's contextual menu that are available regardless of what you right-click in the Story window. See Contextual menu for selected tracks on page 1772, Contextual menu for selected clips on page 1790, and Edit track contextual menus on page 1862 for information on additional menu options.

The following contextual menu items appear regardless of what is selected in the Story window:

- Insert on page 1746
- Make Camera Switcher Current on page 1747
- Plot Shot Track To on page 1747
- Plot Whole Scene To Current Take on page 1747
- Razor on page 1748
- Cut on page 1748

- Copy on page 1748
- Copy Time Range on page 1748
- Paste on page 1748
- Key At Time on page 1748
- Delete on page 1749
- Select Clips on page 1749
- Frame Start/End on page 1749
- Frame Zoom Bar on page 1749
- Step by All Fades on page 1750
- Snap menu options on page 1750
- Time Discontinuity on page 1751
- Sync Action and Edit Views on page 1751

Insert

The Insert menu lets you add folders and tracks to the Track lists.

Tracks let you use specific kinds of clips along a timeline. For example, a Command track lets you use commands and application launches, whereas an Animation track lets you manipulate animation clips. See Story clips on page 1777 for information on the clips you can create for each type of track.

The types of track the menu lets you insert depend on where you right-click. For example, you can insert Shot tracks, Audio tracks, and Video tracks in the Edit Track list. In the Action Track list, there are three different types of animation tracks, as well as Audio, Video, Constraint, and Command tracks.

Track Type	Purpose
Folder	Lets you insert folders, which you can use to organize your tracks. You can create hierarchies of tracks by dragging one track onto another or into a folder. To remove a track from a folder, drag it to an empty place in the track list.
Shot	Lets you create a series of camera switches using camera shots.

Track Type	Purpose
Generic Animation	Lets you create keyframe animation for translation, rotation, and scaling for assets such as lights and cubes.
Character Animation	Lets you animate characters with keyframes and motion data.
Camera Animation	Lets you animate cameras with keyframes.
Video	Lets you loop video clips and schedule when they play.
Audio	Lets you set audio cues at specific times in a take, as well as loop and play audio clips.
Command	Lets you show and hide models at specific frames in your track. You can also use the Command track to launch an external application.
Constraint	Lets you select, blend, and fade constraints.

NOTE A Constraint track must be placed *below* the track containing the animation that the constraint is meant to affect. To move a track, click on its name and drag it up or down to the desired location.

Make Camera Switcher Current

The Make Camera Switcher Current option sets the Camera Switcher as the current camera in the Viewer window, which lets you see the results of the shots and camera switches in the Edit Track list.

NOTE This option is active when you right-click in the Edit Track list.

Plot Shot Track To

The Plot Shot Track To menu lets you plot camera switches from the Edit Track list to a take. This lets you use the camera switches in the Camera Switcher settings. See Camera switcher on page 483.

NOTE This option is active when you right-click in the Edit Track list.

Plot Whole Scene To Current Take

The Plot Whole Scene To Current Take options combines all the animation in a scene with the take selected in the Transport Controls window.

NOTE This plotting includes the animation of the take selected in the Transport Controls window as well as the animation in the Story window.

See Plotting Animation on page 1887 for more information on plotting.

Razor

The Razor option lets you slice selected clips in two at the Timeline indicator. You can also use the keyboard shortcut *Alt-R* to razor selected clips. To make sure to slice only one selected clip at a time, use the Razor button in the Story controls instead of this contextual menu option. See Razoring clips on page 1808.

Cut

The Cut option removes selected clips and store them in memory for pasting into another location. See Cutting, copying, and pasting clips on page 1797.

Copy

The Copy option lets you copy selected clips and store them in memory for pasting into another location. See Cutting, copying, and pasting clips on page 1797.

Copy Time Range

The Copy Time Range option lets you copy all the clips in the selected time range. You can then paste these copied clips. See Story window time range on page 1740.

Paste

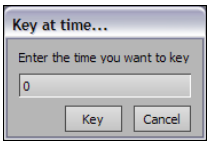
The Paste option lets you insert a copied or cut selection in another location. See Cutting, copying, and pasting clips on page 1797.

Key At Time

The Key At Time option opens a Key at Time dialog box which lets you set one or more keyframes for the selected properties at any point in time, regardless of the current time.

You can also access the Key at Time dialog box by right-clicking the Key button in the Key Controls window, or by pressing *Ctrl-Shift-K*.

See Setting many keyframes at once on page 826.



Key at time dialog box

Delete

The Delete option lets you delete a selected track or clip. You must select a track or clip to delete it.

NOTE Deleting a parent track also deletes its sub-tracks.

Select Clips

The Select Clips option lets you select clips with All, Clear, Inverse, and Time-based options. Which track list you right-click determines which clips and shots are affected.

Option	Function
All	Lets you select all the clips in a track list.
Clear	Lets you deselect all clips and shots. Clicking in either Clip area also deselects everything.
Inverse	Lets you select all the clips and shots that are not selected, and deselects all selected clips and shots.
Time Based	The Time Based menu lets you select clips depending on the location of the Timeline indicator. See Time based menu options for details on what options are available.

Frame Zoom Bar

Use the Frame Zoom Bar option to set the Zoom bar start and end values. See Zooming in on Story window clips on page 1739.

Frame Start/End

Use Frame Start/End to set the Start and End values of the take. When you use Frame Start/End, the Start value of the take becomes the start time of the

earliest clip and the End value of the take becomes the end time of the last clip. See Story window time range on page 1740.

Step by All Fades

You can press Shift-Left arrow and Shift-Right arrow to step the Timeline indicator between the points of clips in the Story window.

When the Step by All Fades option is disabled, the shortcuts move the Timeline indicator between clip In and Out points.

Points of a clip *A.* **In point** *B.* **Out point**

When the Step by All Fades option is active, the shortcuts move the Timeline indicator between clip Fade In and Out points, Still In and Out points, as well as In and Out points.

Points of a clip *A.* **Still In point** *B.* **In point** *C.* **Fade In point** *D.* **Out point** *E.* **Fade Out point** *F.* **Still Out point**

You can step through the clips in only one track list at a time. Hover the mouse over either the Edit Track list or the Action Track list to step through the clips.

Also, when no clip or track is selected, you can step through all clips on all tracks within a track list.

Snap menu options

The Snap menu let you snap the clips you move to the nearest frame, clip, or shot, or to the Timeline indicator. All options are selected by default.

The following table describes the options in the Snap menu:

Active	Turns snap options on or off.
On Time Cursor	Snaps to the Timeline indicator.
On Clips	Snaps to the exact frame of the start or end of another clip.

On Frames	Snaps dragged clips to exact frames.

Time Discontinuity

The Time Discontinuity option affects how you can manipulate shot clips.

See Edit Track list on page 1857 for more information.

Sync Action and Edit Views

The Sync Action and Edit Views option affects the way you manipulate the view in the Action Track list and the Edit Track list.

You can manipulate the view in either track list by Shift-dragging to scroll and *Ctrl*-dragging to zoom. When the Sync Action and Edit Views option is active, manipulating the view affects both track lists at once. For example, zooming in the Action Track list also zooms in the Edit Track list.

Time based menu options

The Time based menu options let you select clips depending on the location of the Timeline indicator.

Option	Function
Before Time Cursor	Selects all the clips before the Timeline indicator, but does not select clips at the Timeline indicator.
Before And At Time Cursor	Selects all the clips before the Timeline indicator, including those at the Timeline indicator.
After Time Cursor	Selects all the clips after the Timeline indicator, but does not select clips at the Timeline indicator.
After And At Time Cursor	Selects all the clips after the Timeline indicator, including those at the Timeline indicator.

Editing Story data in the FCurves and Dopesheet windows

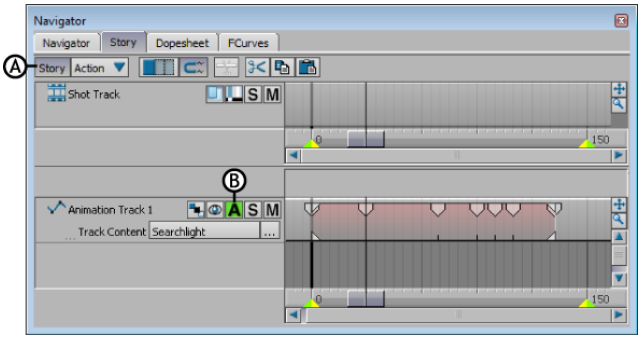
You can view and edit Story window animation in the FCurves and Dopesheet windows, as well as the Transport Controls.

1 Activate the Story Mode option.

2 Select the asset that has the animation you want to view or edit in the Scene browser or the Viewer window. You can view any keyframes placed on the animation clip, but they cannot be edited.

3 If the clip is read-only, activate the animation track's Animate option, right-click the clip and select "Make Track Writeable".

4 Open the FCurves or Dopesheet window and view or edit the animation's keyframes. You can also view and edit the animations keys in the Transport Controls.



Story window *A.* **Story Mode activated** *B.* **Animate option activated**

■ Transport Controls on page 801

Story tracks

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In the Story window, a track is a path along which you can move and edit clips along a timeline. There are six different track types, based on what the track contains:

- Animation tracks on page 1753
- Character Animation tracks on page 1753
- Camera Animation tracks on page 1754
- Constraint tracks on page 1754
- Command tracks on page 1754
- Shot tracks on page 1754

The type of track you create depends on what asset you drop into the Action Track list from the Viewer window, Asset or Scene browser. You can also create tracks using the Insert option in the Story contextual menu. See Story contextual menu on page 1745.

There can be many clips on a single track, and each track has various settings that affect the clips it contains. See Action Track controls on page 1758 for detailed information on track settings. Each of these tracks can also have subtracks.

Animation tracks

An animation track appears when you drag an *.fbx* file containing animation or motion data from the Asset Browser to the Asset Track list.

Character Animation tracks

A Character Animation track appears whenever you drag an *.fbx* file from the Asset browser to the Asset Track list. The *.fbx* file must contain motion data or keyframe animation plotted to any characterized skeleton.

Unlike other tracks, a Character Animation track also has a Track Contents menu, which lets you use props with characters.

NOTE Story Character Animation tracks cannot use data mapped to a Character Reference Node as part of its characterization. The Travelling Node in the Character Animation track prevents access to this data.

Camera Animation tracks

A Camera Animation track appears when you drag a camera from the Viewer window into the Action Track list. You could also add a Camera Animation track to the Action Track list and select a custom camera from the Track Content menu.

Constraint tracks

A Constraint track appears when you drag a constraint from the Asset browser or Scene browser into the Action Track list. See Creating constraints clips on page 1788.

NOTE A Constraint track must be placed *below* the track containing the animation that the constraint is meant to affect. To move a track, click on its name and drag it up or down to the desired location.

Command tracks

A Command track appears when you drag one of the Command assets from the Asset browser into the Action Track list. There three types of commands. See Command clips on page 1780.

Shot tracks

A Shot track appears whenever you drag a camera from the Viewer window or Scene browser into the Shot Track list. Shot tracks are unique to the Edit Timeline. See Editing with shot clips on page 1847 and Edit Track list on page 1857 for more information.

Track priority

Clips placed on the same track blend horizontally. In cases where there are multiple tracks of the same type, the top tracks have priority. These tracks are read vertically, blending from top to bottom. The top-most “track” is in fact the Transport Controls window.

You can change how multiple animation tracks are read by using track options like Additive, Override, and Passthrough.

NOTE A Constraint track must be placed *below* the track containing the animation that the constraint is meant to affect. To move a track, click on its name and drag it up or down to the desired location.

When you have many clips on one track, you can merge or "flatten" them into a clip by processing the track. You can also do this to multiple tracks and subtracks, provided they are all the same track type.

You can merge clips of tracks and subtracks into a clip to save the result of the animation clips in your scene without altering the original animation clips.

Creating Story tracks

All tracks are created when you drag an object, or element into an empty space in the Action Track list from the Viewer window, Asset or Scene browser. The type of track created depends on what you drag.

To create an Animation track:

- Drag a model, camera, or other asset such as a light, into an empty space in the Action Track list from the Viewer window, Asset or Scene browser.
  An Animation track appears, and the object is automatically selected in the track's Track Contents menu.

To create a character Animation track:

- Drag a characterized model into an empty space in the Action Track list from the Viewer window, Asset or Scene browser.
  A Character Animation track appears, and the character is selected in the track's Character menu.

To create a Camera animation track:

- Drag a camera into an empty space in the Action Track list from the Viewer window, Asset or Scene browser.
  A Camera Animation track appears, and the camera is automatically selected in the track's Track Content menu.

NOTE You can also drag objects onto a track. If the track contains one or multiple objects, you can then choose to either replace or add to them.

Selecting track content

Select a track's content to determine the models, cameras, or assets it affects.

A track's contents are selected in the track's Track Contents menu whenever you drag a model, camera, or other asset such as a light, into an empty space in the Action Track list. If you drag in a characterized model, the character is selected in the track's Character menu.

NOTE You can also drag objects onto a track. If the track contains one or multiple objects, you can then choose to either replace or add to them.

To manually select Track Content for Animation or Camera Animation tracks:

1. Add a camera, or a cube or light, to your scene.
2. Insert an Animation or Camera Animation track in the Action Track list.
3. In the new track, click the Track Content button and select the camera or other asset from the Asset list.

To manually select a character for Character tracks:

1. Add a characterized character to your scene.
2. Insert a Character track in the Action Track list.
3. Select the character from the track's Character menu.

To select individual body parts:

1. In a Character track, make sure a character is selected in the Character menu.
2. Click the Body Parts button, and deselect the body parts you do not want the track to affect. All body parts are selected by default.

■ Story tracks on page 1753

Renaming tracks

To rename a track:

1. Right-click the Track Name field.

2 Select Rename from the contextual menu and type in a name.

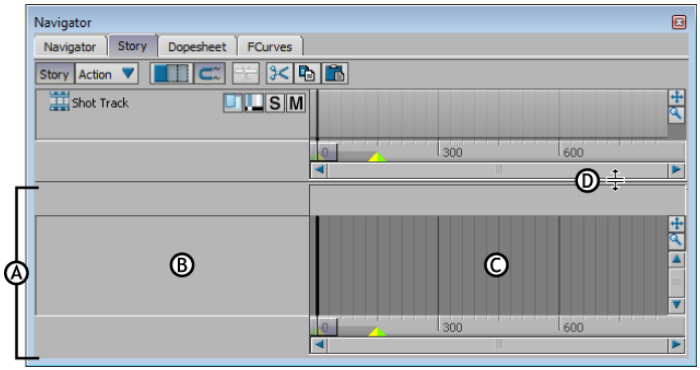
NOTE You can also rename tracks by typing in the Character Track field of the Asset Settings window.

- Creating Story tracks on page 1755

Action Track list

The Action Track list is found in the bottom half of the Story window, below the Edit Track list. This is where you can build animation along the timeline using tracks and clips.

The animation in the Action Track list overrides or blends with the take selected in the Transport Controls, depending on the settings in the Action Track controls.



Story window *A.* **Action Track list** *B.* **Action Track controls area** *C.* **Action Clip area** *D.* **Resizing bar**

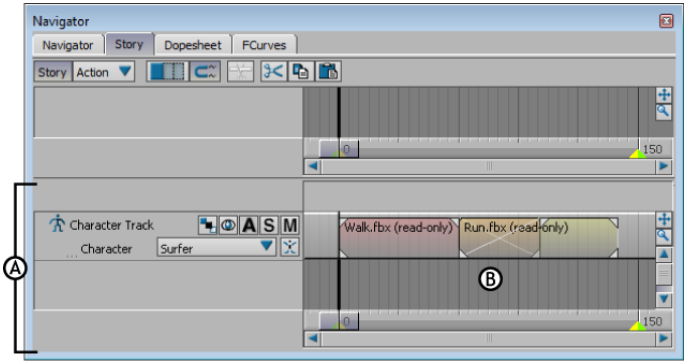
To display the results of the Action Track list, you must select Action from the Story Mode menu (see Story Mode option on page 1742).

The Action Track list consists of the following:

- Action Clip area on page 1758
- Action Track controls on page 1758

Action Clip area

The Action Clip area displays the timeline, as well as the tracks and clips you insert. It lets you add, schedule, and blend clips along the timeline.



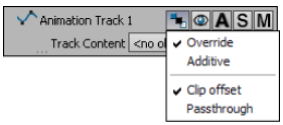
Story window *A.* **Action Track list** *B.* **Action Clip area**

To navigate in the Clip area, *Ctrl*-drag to zoom and Shift-drag to scroll. You can also click in the Clip area and press A to frame all clips or press F to frame a selection. See Story window time range on page 1740 for information on changing the time range.

Action Track controls

In the Story window, every time you insert a track, track controls appear in the Action Track list.

These Action Track controls let you move, stretch, expand, and collapse tracks. They also let you select animation options, hide or show ghosts, and activate or disable tracks.



Track Controls

The Track Controls change depending on what track you have. For example, all tracks have Solo and Mute buttons, but only a Character track has a Character menu.

Track controls include the following:

- Collapse and Expand on page 1759
- Track Name on page 1760
- Track Options on page 1760
- Ghost Visibility option on page 1762
- Animate option on page 1762
- Solo and Mute options on page 1763
- Character menu on page 1763
- Body Parts menu on page 1763
- Track Content list on page 1764
- Weight on page 1765
- Destination on page 1765
- Volume on page 1766

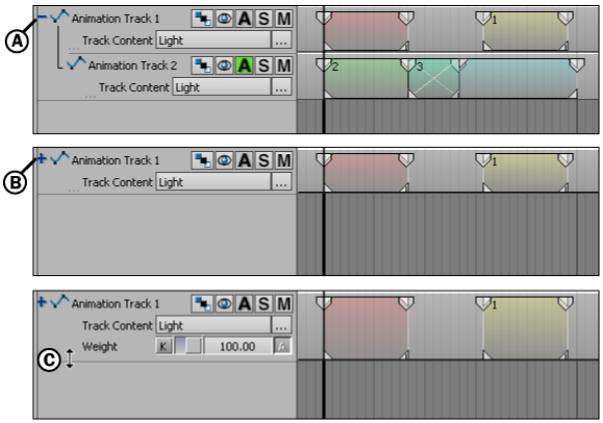
NOTE You can also find these settings in the Asset Settings window when the appropriate track is selected.

Collapse and Expand

You can expand and collapse folders and tracks when you have a hierarchy of folders, tracks, or subtracks.

To hide or show the selected track's subtracks, click the Collapse/Expand (-+) button (A and B) located at the upper left of the Track controls. Collapse and expand tracks when you use multiple hierarchies of tracks, or do not want to view all tracks simultaneously. See Insert Subtrack on page 1773 for more information on creating track hierarchies.

You can also resize tracks vertically if you want to display additional options or a better view of a track's audio waveform. To resize the track, drag the bottom of its Track controls up or down.



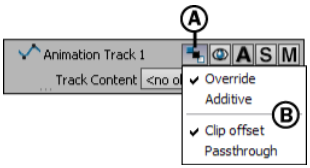
Tracks *A.* **Collapse symbol** *B.* **Expand symbol** *C.* **Stretched track**

Track Name

The Track Name indicates the track type. Double-click the Track Name to display additional track settings in the Asset Settings and in the Properties windows. Use the Story layout (Ctrl-Shift-5), to see the Asset Settings window next to the Story window.

Track Options

The Track Options button displays a menu, where you can select options that set how Animation, Character Animation, and Camera Animation tracks interact.

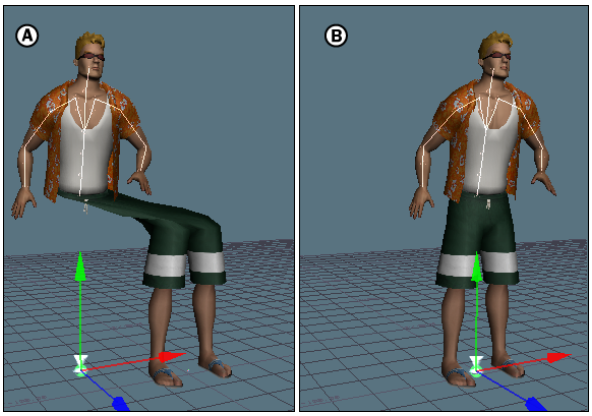


Track Controls *A.* **Track Options button** *B.***Track Options menu**

When you select an Animation, a Character, or a Camera Animation track, these options also display in the Asset Settings window. You can find the Override and Additive options in the Compo Mode menu.

The Track Options menu includes the following options:

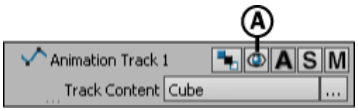
Option	Function
Override	When you set a track to Override, you give the current track priority over any the tracks above it that have the same track content. The animation of any tracks above is disabled. For example, if the first track contains animation of a cube moving back and forth, and the track beneath contains animation of the same cube moving up and down, the first track's animation does not play if you set the second track to Override. Note: The track also overrides the current take selected in the Transport Controls window.
Additive	When you set a track to Additive, the track influences animation on other tracks. For example, if the first track contains animation of a cube moving back and forth, and the track beneath it contains animation of the same cube moving up and down, the animation in both tracks blend together.
Clip Offset	When you disable Clip Offset, the clip trajectories are locked in their original location. If you activate Clip Offset, you can translate and rotate clip trajectories in the Viewer window. Clip Offset is useful when you need to keep part of a model in its original location. For example, when only a character's upper body is selected in a track, translating the track's clips stretches the character's body apart unnaturally. The character's upper body is translated but the lower body is left behind. To keep this from happening, disable the Clip Offset option. If you want to use the Clip Offset option but freeze the clip vector in a location, you can move the clip vector, save the clip, then enable Clip Offset. The Clip Offset option displays in the Track Options of Animation, Character, and Camera Animation tracks, as well as the Asset Settings window.
Passthrough	When you select Passthrough for a Animation, Character, and Camera Animation track, the animation on tracks beneath the selected track plays when there is no clip on the selected track. When there is only one track in the Story window, and that track has no clips, the animation of the take selected in the Transport Controls window plays.



Using Clip offset *A.* When Clip offset is active, translating clips can create unwanted results *B.* When Clip offset is disabled, clips remain in their original position and cannot be translated or rotated.

Ghost Visibility option

Activate the Ghost Visibility option to hide and show all a track's ghosts. Ghosts are hidden by default.



Track Controls *A.* Ghost Visibility option

See Ghosts options on page 1826 for more information on hiding all ghosts or only certain types of ghosts.

Animate option

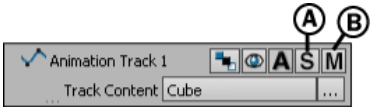
When a track's Animate option is active, you can set keyframes on the track. You can see and edit these keyframes in the FCurves, Transport Controls, Dynamic Editor, and Dopesheet windows.

The Animate option is always disabled by default.

See Keyframe (K) and Animate (A) buttons on page 822 for information on Animate options elsewhere in MotionBuilder.

Solo and Mute options

Use the Solo (S) and Mute (M) options (A and B) to activate or disable tracks. When a track's Solo option is active, only that track plays and when a track's Mute option is active, that track does not play. This means that all animation, video, audio, command, or constraint clip on a muted track is disabled.



Track Controls *A.* **Solo option** *B.* **Mute option**

NOTE You can also find the Solo and Mute options in the Asset Settings window when you double-click a track.

Character menu

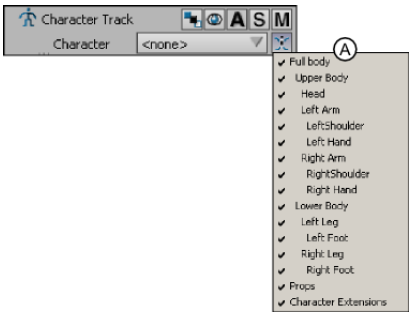
Use a Character track Character menu to select the character you want to animate. Only characterized characters can be selected in Character tracks.

Track Controls *A.* **Character menu**

Body Parts menu

Use the Body Parts menu to select the parts of the character that are to be used in the animation. Use the menu to also select or deselect any character extensions or props included as track content.

Only the body parts selected in the Body Parts menu can be animated.



Track Controls *A.* **Body Parts menu**

For example, when only Right Arm and Right Hand are selected in the menu, you can only transform and animate the character's right arm and hand. No other body part moves from its original location.

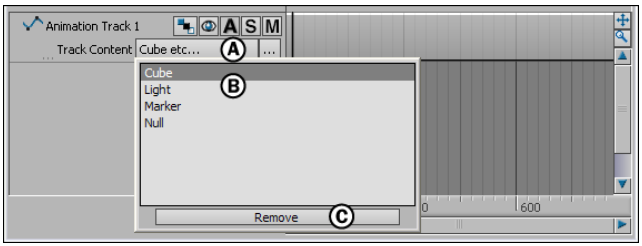
Selecting only a few parts of a character's body also lets you create local blends. A local blend consists of replacing the motion in one track with motion from another track on only part of a hierarchy. For example, blending the lower body of a running character with the upper body of a waving character to create animation of a character running and waving at the same time.

NOTE Character shoulders are considered as a subset of the arm in a Story window Character track or subtrack. However, previous versions of MotionBuilder (version 7.5 ext. 2 and earlier) show shoulders included as part of the Character chest (without the rest of the arms). This difference preserves shoulder animation created in earlier versions of the software.

Track Content list

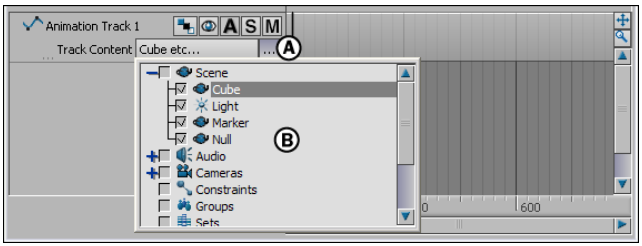
The Track Content list displays the name of the asset that you drag onto an Animation, Character, or Camera Animation track. A track's clips affect the asset selected in the Track Content list. These selected assets are often referred to as the track content.

Clicking the Track Content list displays the entire list of assets you have dragged into the track. The Remove button lets you remove objects from the list.



Animation track *A.* **Track Content list** *B.* **Click on the list to see what you dragged into the track.** *C.* **Remove button**

The Track Content button displays the Asset list. This Asset list lets you select assets and create local blends.



Animation track *A.* **Track Content button** *B.* **Asset list**

You can also find the Track Content list in the Asset Settings window when you double-click an Animation, Character, or Camera Animation track.

Weight

The Weight field appears in Animation, Character, Camera Animation, and Constraint tracks. It also displays in the Asset Settings window when you double-click on one of these tracks.

Weight field *A.* **Animation track** *B.* **Constraint track**

The Weight field lets you determine and animate to what percentage a track's clips are in effect, with 100% meaning fully animated and 0% meaning disabled.

For example, a Constraint track's Weight field lets you define how much a track's constraints are in effect. If you set the Weight value for a Constraint track containing a Position constraint at 50%, the position of the constrained object is halfway between its original position and the position of its source object.

Destination

The Destination menu in Audio tracks lets you select the audio card on which the audio track plays. When <none> is selected in the Destination menu, the track's audio does not play.

Audio track *A.* **Audio Destination menu**

Volume

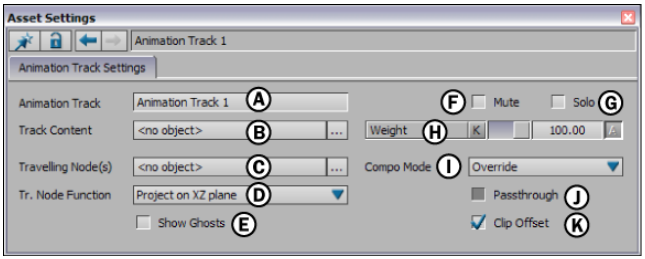
The Volume settings in Audio tracks let you modify and animate the volume of the audio clips on Audio tracks.

Audio track *A.* **Volume settings**

■ Ghosts options on page 1826

Track settings

When different types of tracks are selected in the Story window, different settings that display in the Asset Settings window. These settings are generally the same as what is found on the track's Action Track list area and the settings change depending on what type of track is selected.



Animation track settings *A.* **Track Name field for an Animation track** *B.* **Track Content field** *C.* **Travelling Node(s) field** *D.* **Tr. Node Function menu** *E.* **Show Ghosts option** *F.* **Mute option** *G.* **Solo option** *H.* **Weight settings** *I.* **Compo Mode menu** *J.* **Passthrough option** *K.* **Clip Offset option.**

NOTE To see the Asset Settings window and the Story window at the same time, select Layout > Story from the menu bar.

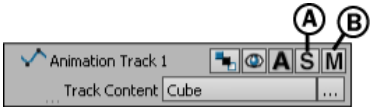
Track Name

The Track Name indicates the track type. Double-click the Track Name to display additional track settings in the Asset Settings and in the Properties windows.

NOTE This setting is available for all track types.

Solo and Mute options

Use the Solo (S) and Mute (M) options (A and B) to activate or disable tracks. When a track's Solo option is active, only that track plays and when a track's Mute option is active, that track does not play. This means that all animation, video, audio, command, or constraint clip on a muted track is disabled.



Track Controls *A.* **Solo option** *B.* **Mute option**

For more information about tracks, see Edit Track list on page 1857 and Action Track list on page 1757.

NOTE This setting is available for all track types.

Weight

The Weight field lets you determine and animate what percentage a track's clips are in effect, with 100% meaning fully animated and 0% meaning disabled.

For example, a Constraint track's Weight field lets you define how much a track's constraints are in effect. If you set the Weight value for a Constraint track containing a Position constraint at 50%, the position of the constrained object is halfway between its original position and the position of its source object.

NOTE This setting is available for Animation, Character, Camera Animation, and Constraint tracks.

Destination

The Destination menu in Audio tracks lets you select the audio card on which the audio track plays. When <none> is selected in the Destination menu, the track's audio does not play.

Audio track *A.* **Audio Destination menu**

NOTE This setting is available only for Audio tracks.

Show Back Plate

The Back Plate option lets you hide or display a Shot clip's background image or video clip.

The background plane is a separate plane used only for projecting images or video clips. The size of the background plane matches the camera's viewing area and remains a part of the camera's view, even with the 2D magnifier, and the Turn Table options. For more information, see Back Plate pane on page 439.

NOTE This setting is available only for Shot tracks in the Edit timeline.

Character menu

Use a Character track's Character menu to select the character you want to animate. Only characterized characters can be selected in Character tracks.

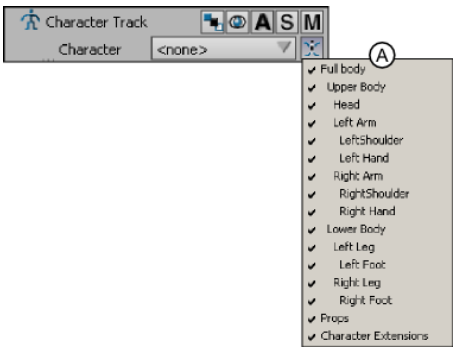
Track Controls *A.* **Character menu**

NOTE This setting is available only for Character tracks.

Body Parts menu

Use the Body Parts menu to select the parts of the character that are to be used in the animation. Use the menu to also select or deselect any character extensions or props included as track content.

Only the body parts selected in the Body Parts menu can be animated.



Track Controls *A.* **Body Parts menu**

For example, when only Right Arm and Right Hand are selected in the menu, you can only transform and animate the character's right arm and hand. No other body part moves from its original location.

Selecting only a few parts of a character's body also lets you create local blends. A local blend consists of replacing the motion in one track with motion from another track on only part of a hierarchy. For example, blending the lower body of a running character with the upper body of a waving character to create animation of a character running and waving at the same time.

NOTE Character shoulders are considered as a subset of the arm in a Story window Character track or subtrack. However, previous versions of MotionBuilder (version 7.5 ext. 2 and earlier) show shoulders included as part of the Character chest (without the rest of the arms). This difference preserves shoulder animation created in earlier versions of the software.

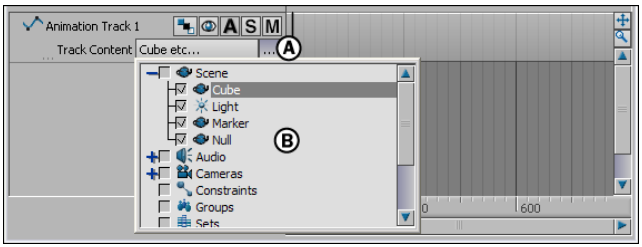
NOTE This setting is available only for Character tracks.

Track Content list

The Track Content list displays the name of the asset that you drag onto an Animation, Character, or Camera Animation track. A track's clips affect the asset selected in the Track Content list. These selected assets are often referred to as the track content.

Clicking the Track Content list displays the entire list of assets you have dragged into the track. The Remove button lets you remove objects from the list.

The Track Content button displays the Asset list. This Asset list lets you select assets and create local blends.



Animation track *A.* **Track Content button** *B.* **Asset list**

You can also find the Track Content list in the Asset Settings window when you double-click an Animation, Character, or Camera Animation track.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Travelling Node(s)

Double-click a character track in the Story window to access the Travelling Node(s) field in the Asset Settings window.

The Travelling Node(s) field lets you define a different travelling node. You can change where the travelling node displays by changing the option in the Travelling Node function menu (see Tr. Node Function on page 1770).

NOTE This setting is available only for Character tracks.

Tr. Node Function

The Travelling Node Function menu lets you determine where the travelling node displays. See Tr. Node Function on page 1844 for more information on travelling nodes.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Show Ghosts option

The Show Ghost option lets you show or hide the ghosts of a selected clip. Ghosts are hidden by default. This option displays when an animation, camera animation, or character clip is selected.

The ghosts affected by the Show Ghost option include a selected clip's model, clip vector, and match object ghosts. The Show Ghost option controls the visibility of these ghosts as a group.

Also, clip ghosts can display only if the ghost visibility options of the clip's track is active. See Ghosts options on page 1826 for more information on track ghosts.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Compo Mode menu

The Compo Mode menu lets you prioritize your track order and includes the following options:

Option	Track behavior
Override	When you set a track to Override, you give the current track priority over any the tracks above it that have the same track content. The animation of any tracks above is disabled.For example, if the first track contains animation of a cube moving back and forth, and the track beneath contains animation of the same cube moving up and down, the first track's animation does not play if you set the second track to Override.The track also overrides the current take selected in the Transport Controls window.
Additive	When you set a track to Additive, the track influences animation on other tracks.For example, if the first track contains animation of a cube moving back and forth, and the track beneath it contains animation of the same cube moving up and down, the animation in both tracks blend together.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Passthrough option

When you activate the Passthrough option, the animation on tracks beneath the selected track plays when there is no clip on the selected track.

When there is only one track in the Story window, and that track has no clips, the animation of the take selected in the Transport Controls window plays.

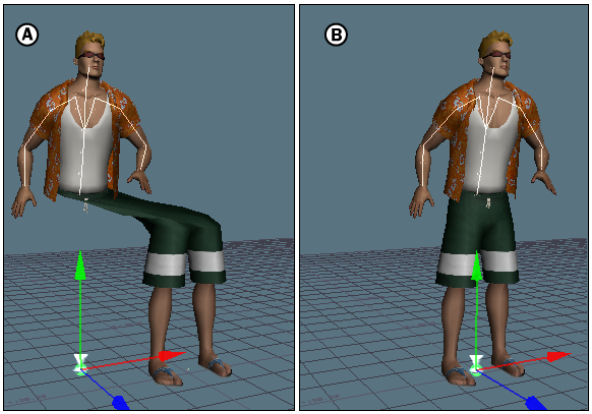
NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Clip Offset

When you disable Clip Offset, the clip trajectories are locked in their original location. If you activate Clip Offset, you can translate and rotate clip trajectories in the Viewer window.

Clip Offset is useful when you need to keep part of a model in its original location. For example, when only a character's upper body is selected in a track, translating the track's clips stretches the character's body apart unnaturally.

The character's upper body is translated but the lower body is left behind. To keep this from happening, disable the Clip Offset option.



Using Clip offset *A*. When Clip offset is active, translating clips can create unwanted results *B*. When Clip offset is disabled, clips remain in their original position and cannot be translated or rotated.

If you want to use the Clip Offset option but freeze the clip vector in a location, you can move the clip vector, save the clip, then enable Clip Offset.

NOTE This setting is available only for Animation, Character, or Camera Animation tracks.

Contextual menu for selected tracks

This section describes the options found in the Story window's contextual menu that are available when you right-click a track. See Story contextual menu on page 1745 and Contextual menu for selected clips on page 1790 for information on additional menu options.

You can also access some of these options from the Story Controls. See Story controls on page 1741.

Depending on where you right-click and what is selected, the options in the contextual menu may change. For example, right-clicking in the Edit Track list shows different options than right-clicking in the Action Track list. The options that appear also change depending on which tracks or clips are selected and apply to the selection.

Insert Subtrack

Inserts a subtrack onto the track.

You can also create subtracks by dragging a track onto another track. Character tracks can only be dragged onto other Character tracks. Animation tracks can only be dragged onto Camera Animation tracks, Character tracks, and other Animation tracks.

NOTE The Insert Subtrack option appears when any track is selected.

To unparent subtracks, drag them to an empty space in the track list.

Option	Behavior
Animation Override	Inserts an Animation subtrack which is set to Override by default.
Animation Additive	Inserts an Animation subtrack which is set to Additive by default.
Character Override	Inserts a Character subtrack which is set to Override by default. This subtrack can only be the child of a Character track. The same character is automatically selected in the subtrack's Character field.
Character Additive	Inserts a Character subtrack which is set to Additive by default. This subtrack can only be the child of a Character track. The same character is automatically selected in the subtrack's Character field.

■ Track Options on page 1760

Insert Animation/Audio/Video File

Load files as clips using the Insert <*x*> File option, where <*x*> is either Animation, Audio, or Video.

Insert Animation File	Displays an Open File dialog box, which lets you load *.fbx* files as clips for Animation, Character, and Camera Animation tracks.
Insert Audio File	Displays an Open File dialog box, which lets you load audio files for Audio tracks.
Insert Video File	Displays an Open File dialog box, which lets you load video files for Video tracks.

NOTE The Insert Animation/Audio/Video File options offered depend on what type of track is selected.

Insert Current Take

Insert Current Take lets you paste keyframe animation from the take selected in the Transport Controls window to a track in the Action Track list.

You can also insert a take into the Story window by dragging it from the Scene browser. You must drag the take onto an Animation, Character, or Camera Animation track whose Animate button is active and whose track content is defined.

NOTE The Insert Current Take option appears when any track is selected.

Process Track/Subtracks to New Clip

The Process Track/Subtracks To New Clip option combines the animation of a track and its subtracks into one clip. The animation that is merged involves the selected track, all of the selected track's subtracks, and all tracks above the selected track that have the same track content as the selected track. However, the animation of muted tracks is not merged.

NOTE The Process Track/Subtracks To New Clip option appears when any track is selected.

Import Camera Switcher From

Camera switches created with the Camera Switcher appear as keyframes in the Transport Controls window. The Import Camera Switcher From menu lets you move these camera switches from the takes in the Transport Controls window to the Story window, where they appear as camera shots on a selected Shot track in the Edit Track list.

NOTE The Import Camera Switcher From option appears only when a Shot track is selected.

Export to Camera Switcher

When a Shot track is selected, the Export to Camera Switcher menu lets you plot camera switches from a single Shot track to a take. This lets you use the camera switches in the Camera Switcher settings.

NOTE The Export to Camera Switcher From option appears only when you select a Shot track.

Rename

The Rename option lets you rename a selected track in the Story window. You can also rename selected tracks and clips in the Asset Settings window.

NOTE The Rename option appears when you select any track.

Story clips

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Scenes are assembled in the Story window with clips. Nothing happens in the Story window until you create at least a clip or two.

In the Story window, a clip is an individual instance of a camera shot, a command, a constraint, animation, audio, or video. There are eight types of clips:

- Animation clips on page 1778
- Character clips on page 1779
- Camera animation clips on page 1779
- Command clips on page 1780
- Constraint clips on page 1781
- Audio clips on page 1782
- Video clips on page 1782
- Shot clips on page 1783

Clips display on tracks, along which they can be manipulated. The steps you take to create clips depend on the type of track you use.

There is a different kind of track for every type of clip. See Story tracks on page 1753 for more information.

In and Out points

The values that display near the top left and right corners of a selected clip (A and B) are Global In and Global Out points, which refer to the start and end of the clip along the Action timeline or Edit timeline.

A clip in the Story window

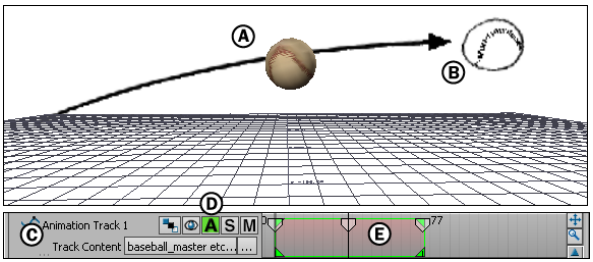
A. **Global In point** *B.* **Global Out point** *C.* **Local In point** *D.* **Local Out point**

The values that display near the bottom left and right corners of a selected clip (C and D) are Local In and Local Out points, which refer to the start and end of the clip when it was first created and exported, and display near the bottom of selected clips.

Animation clips

Animation clips are clips of keyframe animation you can create, save, and reuse. You create animation clips on Animation tracks to animate models and assets.

For example, when a character throws a baseball, the baseball model arcing through the air alone can be one animation clip.



Keyframe animation *A.* **Baseball model in the Viewer window.** *B.* **A static storyboard panel used as a template.** *C.* **Animation track for a baseball.** *D.* **The track's Animate button is active.** *E.* **Animation clip which consists of keyframes.**

The animation in the Story window can be also edited in the FCurves, Transport Controls, and Dopesheet windows when the Story window is active and when an animation track's Animate option is active.

While you can animate almost anything with animation clips, you should use character animation clips and camera clips on Character tracks and Camera tracks to animate characters and cameras. See Character clips on page 1779 and Camera animation clips on page 1779.

- Creating animation clips on page 1783

Character clips

Character animation involves a series of actions which flow into one another. Final character animation is composed of many bits of motion, or character clips which you can blend and edit to create a part of a scene.

For example, to create a scene that builds on the storyboard (see Storyboarding on page 1735), you could use character clips of Surfer walking around, of Surfer throwing a ball, and of Surfer standing and looking at Rufus run. You can also retarget Character animation to any character, meaning that one character clip can be used to animate many types of characterized characters.

See Creating character clips on page 1784.

Camera animation clips

Custom cameras in your scene can be static, or you can animate them in the Story window to create more interesting shots. For example, in the next figure, an animated custom camera captures Rufus as he runs after the ball and catches it.

A camera follows Rufus as he tries to catch the baseball.

See Creating camera animation clips on page 1785.

Command clips

Three kinds of command clips let you show and hide selected models, or launch an application at any time in your story. You drag these command clips from the Asset browser.

With three types of Command clips, you can make objects appear and disappear at specific points in time using command clips. You can also use command clips to launch external applications.

A command clip makes Rufus disappear at a specific point in time.

Command assets

In the Asset browser, the Commands folder contains Command assets. Drag any one of the Command assets into the Story window to insert Command clips with which you can build animation in the Story window.

You can apply more than one model to the same command clip by Ctrl-clicking a group of them in the Viewer window and dragging them into the command clip or Clip content field.

Following are the three commands available in the Asset browser: Application Launch, Hide Models, ans Show Models.

Command	Description
Application Launch	The Application Launch command clip lets you launch an external application when the clip plays.

Command	Description
Hide Models	The Hide Models command clip lets you hide models assigned to the clip.
Show Models	The Show Models command clip lets you shoe models assigned to the clip.

Constraint clips

You create constraints clips to schedule a constraint, turning on and off at specific points in time. For example, a baseball can be constrained to Surfer and Rufus in turn, at different points in time, because of a series of constraint clips. The baseball is not constrained to Surfer's hand until he touches it, and the ball follows his hand until he throws it.

The baseball is constrained to Surfer's hand for a specific moment in time. When Surfer throws the ball, the constraint is turned off and the ball is no longer constrained to his hand.

NOTE A Constraint track must be placed *below* the track containing the animation that the constraint is meant to affect. To move a track, click on its name and drag it up or down to the desired location.

See Creating constraints clips on page 1788.

Audio clips

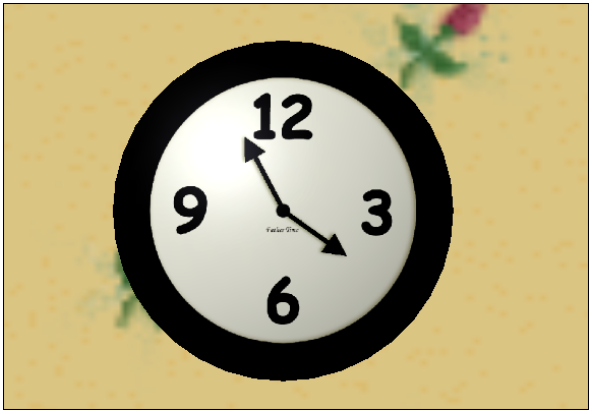
An audio clip is an audio file you can schedule in the Story window. For example, you can schedule an audio clip so that Surfer says “Good boy, Rufus” at a specific point in time, such as when he pats the dog.

An audio clip determines when Surfer says “Good boy, Rufus” when he pats his dog.

See Creating audio clips on page 1789.

Video clips

A video clip is a video file you can schedule in the Story window. Using a video file as a video clip forces it to start and stop playing at specific times. For example, the clock in a scene can be a model to which a video texture of moving hands is applied.



The clock's video texture is a video clip scheduled in the Story window.

Creating video clips on page 1790

Shot clips

A shot clip, also called a camera shot, is a section of time captured with a single camera.

See Creating shot clips on page 1848.

Creating animation clips

Used with Animation tracks, animation clips let you animate the properties of all models and elements with keyframes and *.fbx* files.

Before you can create an animation clip, you need to drag models or elements from the Viewer window or Scene browser into the Action Track list. You can also select them from the Track Content button's Asset list.

To animate characters or cameras using specialized tracks, see Character clips on page 1779 or Camera animation clips on page 1779.

To create the animation clip:

1. Right-click in the Action Track list and select Insert > Generic Animation Track from the contextual menu.
2. Activate the track's Animate option.

3 Select the track's asset in the Animation track's Track Content menu.

4 Make sure the track's asset is selected in the Viewer window.

5 Press K to set a keyframe.

6 Move the Timeline indicator, transform the asset, and press K again.

NOTE The animation in the Story window can be also edited in the FCurves, Transport Controls, and Dopesheet windows when the Story window is active and when an animation track's Animate option is active.

To animate an asset, you can also drag an *.fbx* file from the Asset browser into the Animation track. The *.fbx* file must contain animation plotted to an asset with the same name as the one selected in the track. You can also insert an animation file as a clip using the Insert Animation File option in the contextual menu. See Insert Animation/Audio/Video File on page 1773 for more information.

■ Animation clips on page 1778

Creating character clips

Used with Character tracks, character clips let you animate characters with keyframes and *.fbx* files.

Before you can create a character clip, you must open a file containing a characterized character.

To create a character clip:

➤ From the Asset browser, drag an *.fbx* file containing motion data or keyframe animation plotted to any characterized skeleton onto the Asset Track list.

A Character Track appears and a clip is created from the *.fbx* file.

You can also use keyframes to create a character clip. Your character must be characterized.

To create the clip using keyframes:

1 Activate the Character track's Animate option.

2 Select and transform either the character's skeleton or the effectors of the character's Control rig

3 Press K to set a keyframe.

4 Move the Timeline indicator, transform the bones or effectors, and press K again.

- Character clips on page 1779

Creating camera animation clips

Used with Camera Animation tracks, camera animation clips let you animate cameras with keyframes and *.fbx* files.

Before you can create a camera clip, there must be at least one camera in your scene.

To create a camera animation clip:

1 Drag a camera from the Viewer window into the Action Track list.

NOTE If you drop the camera accidentally into the Edit Track list instead of the Action Track list, you can delete the created Shot track or shot clip by selecting it and pressing Delete.

A Camera Animation track and clip appear. The dropped camera is automatically selected in the Track Content menu of the new track.

You could also add a Camera Animation track to the Action Track list and select a custom camera from the Track Content menu.

2 Make sure the track's camera is selected in the Viewer window, and press K to set a keyframe.

3 Move the Timeline indicator, transform the camera, and press K again.

You can transform the camera using two different methods:

- Select and transform it in the Viewer window as you would other assets.
- Transform it with the Current Camera keying mode in the Key Controls window. When you select this keying mode, you can transform and set keyframes for the current custom camera. This method is useful when you are animating multiple cameras.

To animate the camera, you can also drag an *.fbx* file from the Asset browser into the Animation track. The *.fbx* file must contain animation plotted to any custom camera. You can also insert an animation file as a clip using the Insert Animation File option in the contextual menu. See Insert Animation/Audio/Video File on page 1773 for more information.

- Reusing camera clips on page 1863

Creating command clips

The following steps use the Story Layout.

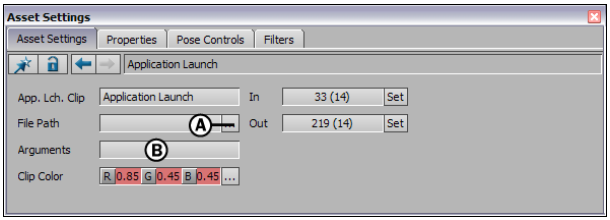
To create a command clip in the Story window:

1. In the Asset browser, open Templates > Commands.
2. There are three types of Command asset in the Commands folder. Drag one of these into the Story window.
3. A command clip appears on a Command track.

NOTE You can add several types of commands to the same Command track.

To create an Application Launch command clip:

1. Double-click the Application Launch clip to select it.
   The clip's settings display in the Asset Settings window.
2. Click the browse button of the File Path setting, select the application you want to launch.



Asset Settings window *A.* **Browse button of the File Path settings.** *B.* **Arguments field.**

3. Type arguments in the Arguments field, if necessary.

For example, to open Internet Explorer you can type the following path in the File Path field:

```
C:\Program Files\Internet Explorer\IEXPLORE.EXE
```

When the Application Launch clip plays, the Web browser opens.

Add arguments by typing in the Arguments field. For example, to open the Autodesk Web site when an Application Launch command clip opens Internet Explorer, enter the following in the Arguments field:

```
www.Autodesk.com
```

When the Application Launch clip plays, Internet Explorer opens to the Autodesk web site.

The arguments you type in the Arguments field depend on the application you launch.

Use spaces to separate arguments. For example, the following are separate arguments:

```
argumentOne argumentTwo
```

If there are spaces in an argument, place quotation marks (“”) before and after each argument, as follows:

```
“This is one argument” “Followed by a second  argument”
```

You can also place a back slash (\) before each space. A back slash indicates that the next character is *escaped*, meaning it is only a character. For example:

```
This\ is\ one\ argument
```

If an argument contains a back slash or quotation marks, place another back slash before it, as follows:

```
“He said: \“I love animation.\””
```

4 Press Ctrl-Spacebar. The application you selected launches.

To create a Hide Models Command clip:

1 Drag an object, such as a light or a model, from the Viewer window and drop it on the Hide Models Command clip.

The name of the object displays at the bottom of the clip.

TIP You can also drag objects from the Scene browser into the Command clip.

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2 Press Ctrl-Spacebar. The object disappears when the Timeline indicator passes over the clip. The object does not reappear, unless you add a Show Models Command clip.

TIP You can apply more than one model to the same command clip by Ctrl-clicking a group of them in the Viewer window and dragging them into the command clip or Clip content field.

To create the Show Models Command clip:

1 Drag an object, such as a light or a model, from the Viewer window and drop it on the Hide Models Command clip.

The name of the object displays at the bottom of the clip.

TIP You can also drag an object from the Scene browser.

2 Press Ctrl-Spacebar. The object displays when the Timeline indicator passes over the clip. The object does not disappear again, unless you add a Hide Models Command clip.

TIP You can apply more than one model to the same command clip by Ctrl-clicking a group of them in the Viewer window and dragging them into the command clip or Clip content field.

■ Command clips on page 1780

Creating constraints clips

Used with Constraint tracks, constraint clips let you animate the use of constraints.

Use constraint clips to make constraints active for only a segment of a take. For example, you can use a Parent-Child constraint between a cup and a character's hand. You can create a constraint clip with the Parent-Child constraint to make the constraint active only when the clip plays, so that you can give the impression that the character is actually picking up the cup halfway through the animation.

NOTE A Constraint track must be placed *below* the track containing the animation that the constraint is meant to affect. To move a track, click on its name and drag it up or down to the desired location.

To create constraint clips:

1. Drag constraints from the Asset browser or Scene browser to the Action Track list.

   Dropping the constraint into an empty area of the track list creates a new Constraint track with a constraint clip, and dropping the constraint onto a Constraint track creates a new clip on the track.

2. Make sure the Constraint track is *below* the track with animation the constraint is meant to affect.

   To move the Constraint track, click on its name and drag it up or down to the new location in the Action Track list.

3. If you have not already done so, set up the constraint. See Animating with Constraints on page 1023.

- Constraint clips on page 1781
- Animating with Constraints on page 1023

Creating audio clips

Used with Audio tracks, audio clips let you animate the use of audio files.

NOTE You can create Audio tracks in both the Action and Edit timelines.

To insert an audio clip:

1. Right-click the Action Track list and select Insert > Audio Track from the contextual menu.
2. Right-click the new Audio track and select Insert Audio File from the contextual menu.
3. Use the Open File dialog box that opens to browse to the audio file of your choice and click Open. The audio file appears as a clip on the Audio track.

NOTE If you are creating an Audio track on the Edit timeline, you may need to expand the timeline to see anything other than the first Shot track.

■ Audio clips on page 1782

Creating video clips

Used with Video tracks, video clips let you animate the use of video files.

NOTE You can create Video tracks in both the Action and Edit timelines.

To create a video clip:

1. Drag a video file from the Asset browser or Scene browser into the Action Track list.
2. Drag the Video track containing the video clip into the Viewer window.

   You can use the video as a background or video plane if you drag the track into empty space, or you can drop it on a model to use it as a video texture.

   NOTE If you are creating an Video track on the Edit timeline, you may need to expand the timeline to see anything other than the first Shot track.

■ Video clips on page 1782

Contextual menu for selected clips

This section describes the options found in the Story window's contextual menu that are available when you right-click one or more selected clips. See Story contextual menu on page 1745 and Contextual menu for selected tracks on page 1772 for information on additional menu options.

You can also access some of these options from the Story Controls. See Story controls on page 1741.

Depending on where you right-click and what is selected, the options in the contextual menu may change. For example, right-clicking in the Edit Track list shows different options than right-clicking in the Action Track list. The

options that appear also change depending on which tracks or clips are selected and apply to the selection.

The options described in the rest of this topic are listed according to the order in which they appear in the contextual menu. The options that are listed appear regardless of which Track list you right-click, unless otherwise indicated.

The following contextual menu items may appear when one or more clips are selected in the Story window:

- Select Camera on page 1791
- Make Camera Current on page 1791
- Change Media File on page 1791
- Change Take on page 1791
- Make Clip Writable on page 1792
- Make Clip Read-Only on page 1793
- Export Clip on page 1793
- Clear Values Without Keys on page 1793
- Assign Sources To Destinations on page 1794

Select Camera

Select Camera lets you select a shot clip's camera. This option appears when a shot is selected in the Edit Track list.

Make Camera Current

Make Camera Current switches the camera view in the Viewer window to a camera that can be used by a camera shot. The Make Camera Current option is available when a shot is selected in the Edit Track list.

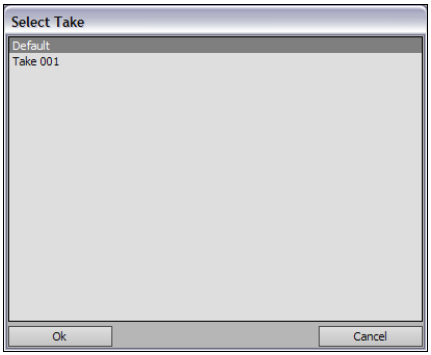
Change Media File

Active when an audio, video, or character clip is selected, the Change Media File option lets you select a different media file for the clip.

Change Take

The *.fbx* files you use as animation, character and camera animation clips can contain more than one take. The clip uses only one of the takes by default.

The Change Take option opens a dialog box, which lets you select a different take for the clip.



Select Take dialog box

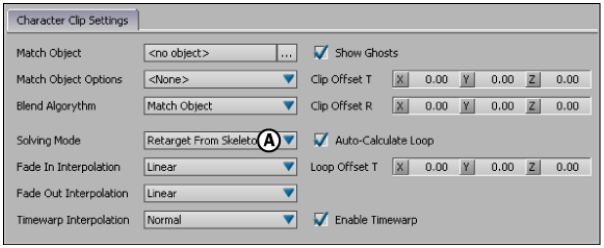
Make Clip Writable

The Make Clip Writable option lets you make read-only clips writable. When a clip is writable, its keyframes display, letting you edit them and set new keyframes. A writable clip's keyframes display and can be edited only when the clip's track content is selected and the track's Animate option is active.

The Make Clip Writable option appears when you right-click a read-only animation clip, camera animation clip, or character clip. However, this option does not appear if the clip's animation is retargeted.

For example, a character clip's animation is automatically retargeted when the skeleton it was plotted to is different than the skeleton of the character selected in the track's Character field.

The Solving Mode menu, which displays in the Asset Settings window, lets you see which solving mode a character clip is using. If Retarget From Skeleton is selected, the clip can only be made writable if you plot the animation to the current skeleton. When Skeleton or Control Rig is selected in the menu, the clip can be made read-only.



Asset Settings window *A.* **Solving Mode menu**

Make Clip Read-Only

The Make Clip Read-Only option appears when you right-click a writable animation clip, character clip, or camera animation clip. This option lets you save the contents of a clip and make them read-only.

The clip is saved as an *.fbx* file the you can reuse by dragging it from the Asset browser to the Story window. See Creating animation clips on page 1783, or Creating camera animation clips on page 1785 for more information.

When a clip is read-only, its keyframes do not display and you cannot set keyframes on it.

Export Clip

The Export Clip option appears when you right-click on a writable animation clip, character clip, or camera animation clip.

The Export Clip option lets you save a clip as an *.fbx* file without making it read-only as well. You can reuse the *.fbx* file by dragging it from the Asset browser to the Story window.

Clear Values Without Keys

A clip can exist without keyframes. A clip without keyframes is created when a track's Animate button is active and you translate, rotate, or scale the track's selected asset. Such a clip displays the letter "c" in parentheses.

This clip contains certain initial values, even though it does not have keyframes. These values are the transform values of the track's selected asset.

For example, if you rotate an object 90 degrees, the clip that is created contains that value and the object remains rotated 90 degrees. If you create a second similar clip, where you rotate the object again, the object rotates between the two clips.

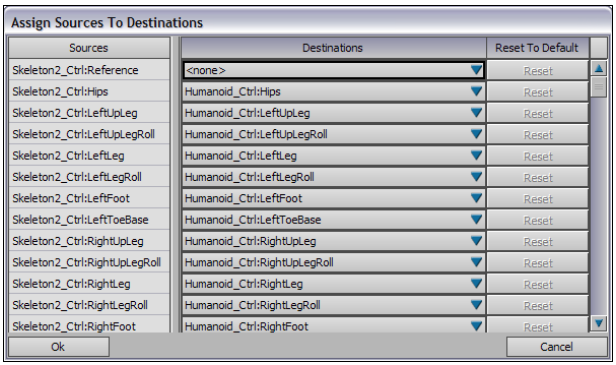
You can change the values of a clip by placing the Timeline indicator on the clip and transforming the object again.

The Clear Values Without Keys option lets you erase the transform values of a selected clip. When a clip is empty, it contains no values and does not animate the object in any way. The “c” in parentheses does not display on an empty clip.

Assign Sources To Destinations

The selected assets in a track and the track’s clips are linked automatically. The Assign Sources To Destinations option opens a dialog box which lets you view and change these links.

The Assign Sources To Destinations option is active when you right-click animation, camera animation, and character clips.



Assign Sources To Destinations dialog box

Saving animation clips

You can save animation clips to use with new objects. This can be useful when you want to reuse a complex animation.

To save an animation clip:

1. In the Story window, Alt-drag an animated object into the Action Track area.

   An empty track appears and the name of the animated object displays in the Track content field.

2 Right-click the empty track and select Process Track/Subtracks to New Clip to create a clip from the object's animation.

3 The Process Tracks and Subtracks dialog box appears. Set the frame rate and activate any filtering from the Process Tracks and Subtracks dialog box options. Click OK.

4 A Save Clip window appears. Name and save your clip.

   A new animation track appears with your clip on it.

Reusing animation clips

You can use animation clips with other objects if you reassign the objects used in them.

To reuse an animation track:

1 In the Story window, right-click an empty Action track and select Insert Generic Animation track from the contextual menu.

   A new Animation track is added.

2 Right-click the new track and select Insert Animation file from the contextual menu.

   Select the animation clip you want to use from the Open File dialog box. The animation clip is added to the track.

3 Rename the object you want to use the animation clip so it has the same name as the object that used the original animation.

4 In the Track Content asset list, assign a new object as the object to be used by the Animation clip.

Manipulating clips

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Once you have created a clip (see Story clips on page 1777), you can manipulate it to edit the animation, video, and audio in your scene.

Selecting clips

Select clips to rearrange them on their tracks. In some cases, you can only access some contextual menu items or perform actions if a track has been selected.

To select a clip, do one of the following:

- Select a clip by clicking on it once. You can select multiple clips by *Ctrl*-clicking, *Shift*-clicking, or by Spacebar-dragging around them.
- You can also select clips using the Select contextual menu option (see Select Clips on page 1749).
- You can also select a clip from the Viewer window by double-clicking its clip vector ghost.

NOTE If you have a clip selected when you change panels, they become deselected. This is to protect you from accidentally razoring, cutting or deleting clips that are not visible or active.

Cutting, copying, and pasting clips

The following steps show you how to cut, copy, and paste clips in the Story window.

To cut clips:

1 Select a clip or many clips.

2 Click the Cut button. The selected clip is removed and stored in memory. You can also use the keyboard shortcut *Ctrl-X* to cut selected clips.

NOTE You can also cut a clip and paste it onto another track by dragging it from one track to another.

To copy clips:

1 Select a clip or many clips.

2 Click the Copy button to copy selected clips and store them in memory for insertion into another location. You can also use the keyboard shortcut *Ctrl-C* to copy selected clips.

To paste clips:

1 Select a clip or many clips.

2 Click the Paste button to insert a copied or cut selection into another location. You can also use the keyboard shortcut *Ctrl-V* to paste the copied or cut selection.

3 The selection is pasted onto a selected track at the current timecode or to the right of all the clips if there is no room.

NOTE You can also cut a clip and paste it onto another track by dragging it from one track to another.

Related Topics

- Story clips on page 1777

Moving clips

You can move a clip in time and in space. Moving a clip along a track in the Story window alters the time at which its animation plays. Moving a clip in the Viewer window alters where and in which direction its assets move.

To move a clip:

1 Select a clip or many clips.

2 Drag the clip(s) left and right on the track.

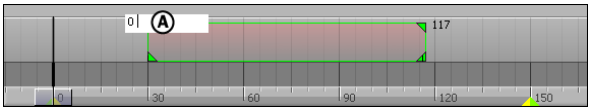
To move more than one clip at once, you can *Ctrl*-click each one to select them, then drag them. You can slash (/)-drag one clip to make all the clips to the right retain their distance from each other on the track.

To move a clip using its Clip In timecode:

1 Select a clip.

2 Double-click the clip.

3 Enter a new value in the Clip In timecode, and press Enter.



A. **Change the value of a Clip In timecode to move the clip.**

NOTE Do not change the Clip Out timecode of a clip unless you want to trim the clip.

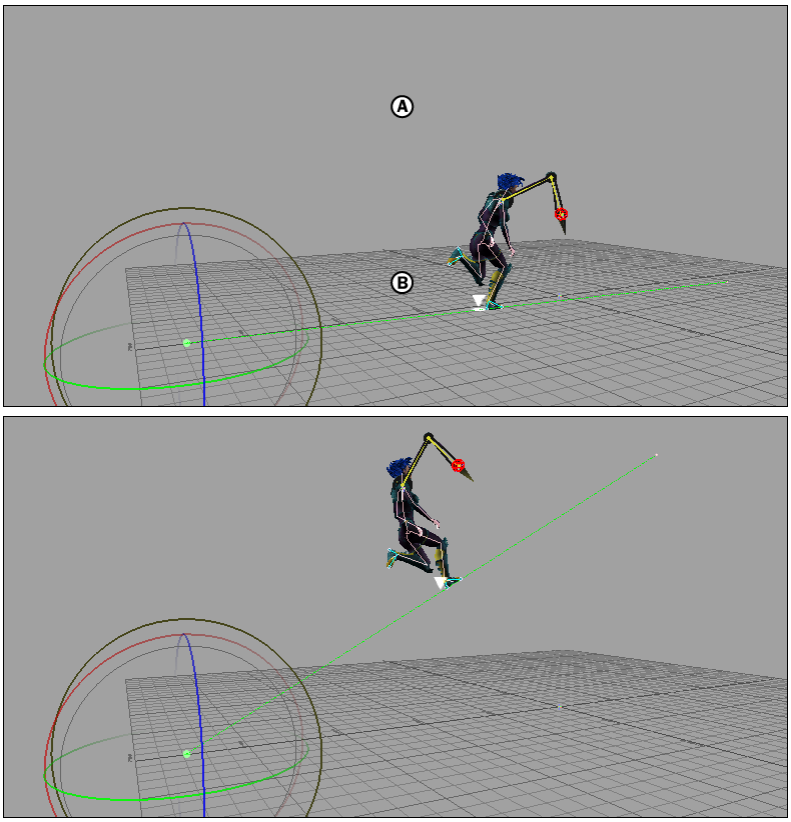
To change a clip's trajectory in the Viewer window:

1 Select a clip in the Story window.

2 Translate and rotate it the Viewer window by manipulating its ghosts.

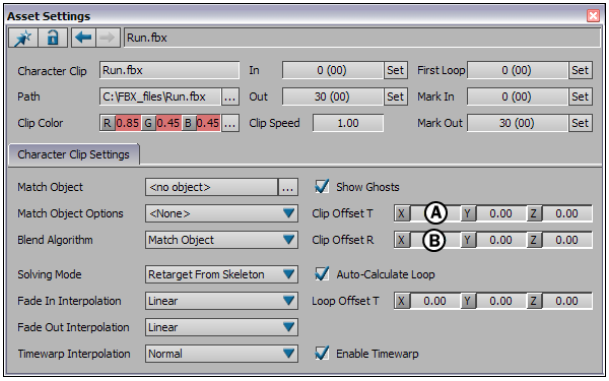
Translating and rotating a clip's ghost changes where the animation plays and in what direction. The ghost you select is the pivot point of the clip when you rotate it.

For example, in the next image, the start of the clip's ghost clip vector is selected. The clip pivots around the selection. If part of the model ghost is selected instead, the clip rotates around that part.



Moving a clip in the Viewer window *A.* **The start of a clip's clip vector ghost is selected.** *B.* **The clip vector is rotated around the selection.**

You can also translate and rotate a clip in the Viewer window by changing the values in the Clip Offset T and Clip Offset R fields (A and B) that display in the Asset Settings window and Properties window. These settings display in the Asset Settings window and Properties window when you double-click a clip.



Asset Settings window *A.* **Clip Offset T settings** *B.* **Clip Offset R settings**

See also:

- Manipulating ghosts on page 1821

Cross-blending Story clips

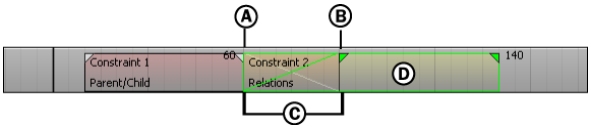
When two animation, character, or camera animation clips on the same track do not overlap, the animation is blended by interpolation. When two clips overlap, the blend is called a cross-blend.

You can cross-blend animation, character, camera animation, and constraint clips. Cross-blending animation clips can create smoother animation. For example, blending constraints clips is useful when you want to create the impression that a model is under the influence of many actions.

To cross-blend two clips:

1 Select a clip in the Story window.

2 Drag one clip over another.



Constraints cross-blend *A.* **First clip's Fade Out handle** *B.* **Selected clip's Fade In handle** *C.* **Blend area** *D.* **Selected clip**

When an Animation, Character, or Camera Animation track's Animate option is active, the beginning and end of cross-blends on these tracks are represented in the FCurves window by small vertical lines.

Fine-tune the blend by dragging the clip's Fade and Still handles.

To create a cross-blend for camera shots, see Creating a cross-fade effect with camera shots on page 1850.

Related topics

- Story clips on page 1777
- Fading clip animation on page 1802
- Holding clip animation on page 1803

Fading clip animation

You can fade the animation of character clips, animation clips, camera animation clips, and constraints clips.

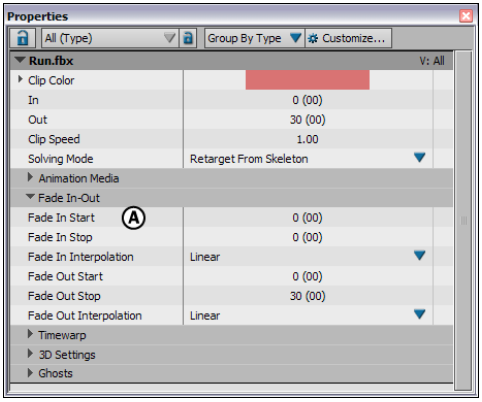
To fade clip animation:

1. Select a clip in the Story window.
2. Drag a clip's Fade In and Fade Out handles inward (A and B).

   This changes where the clip starts and ends without scaling it or moving the clip.

Character clip *A.* **Fade In handle** *B.* **Fade Out handle**

You can also change the values of a selected clip's Fade In and Fade Out points in the Properties window.



Properties window *A.* **Fade In-Out properties**

Related Topics

- Story clips on page 1777

Holding clip animation

You can put a hold on the animation of character clips, animation clips, camera animation clips, and constraint clips.

To hold a clip's animation:

1. Select a clip in the Story window.
2. Dragging the Still In or Still Out handles outward (A and B) to hold the first or last state of a clip's animation.

   When you drag these handles out, you can maintain the first or last frame of the animation for any number of frames without scaling or moving the clip.
3. You can also change the values of a selected clip's Still In and Still Out points in the Properties window (A and B).

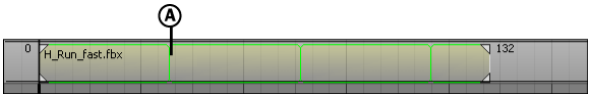
Character clip *A.* **Still In handle** *B.* **Still Out handle**

Related Topics

- Story clips on page 1777

Looping clips

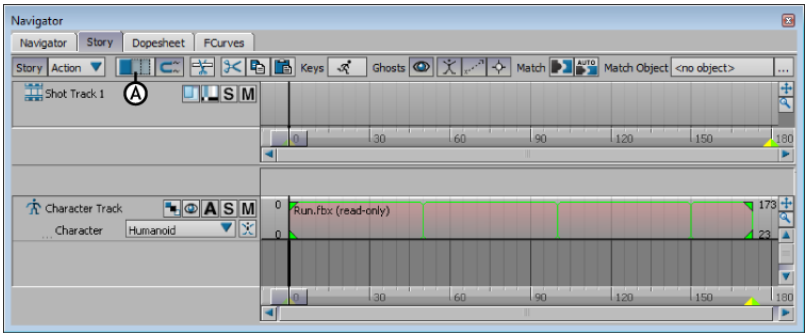
Looping clips lets you quickly duplicate animation so that it repeats. When a clip is looped, you can see the seams where it starts over again.



Looping character clip *A.* **Seam**

To loop a clip:

1. Select a clip in the Story window.
2. Make sure that Loop is selected in the Story Controls.
3. Drag the start or end of the clip outwards. You can also double-click the frame number at the start and end of a selected clip and enter a new frame number.

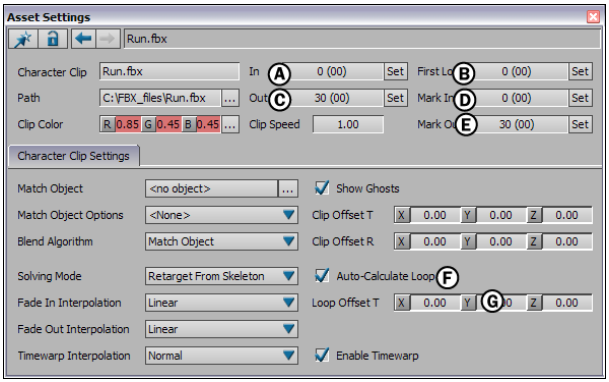


Story window *A.* **Loop is active, letting you loop and trim clips.**

4. If you want to trim the last loop of the clip, select the clip and use the Last Loop field in the Properties window to set an ending time for the loop. For example, if you have a clip that loops three times, you can set the end of the third loop so that it is shorter than the previous loop.

5 The Auto-Calculate Loop option in the Clip's Asset settings window lets you turn the automatic calculation of the loop offset on or off.

6 Use the Asset settings Loop Offset T values to change the loop's translation offset.



Asset Settings window *A.* **In field** *B.* **First Loop field** *C.* **Out field** *D.* **Mark In field** *E.* **Mark Out field** *F.* **Auto-Calculate Loop option** *G.* **Loop Offset T settings**

Related Topics

- Story clips on page 1777

Reversing clips

There are two different ways to make clips play backward, depending on whether or not the clip has been edited first.

To make an unedited clip play in reverse, follow the instructions for reversing an uncut clip. If you want to reverse only a segment of a whole clip, follow the instructions for reversing an edited clip.

To reverse an uncut clip:

1 Double-click the clip you want to reverse so that the clip's Asset settings display.

2 In the Clip settings area, activate the Enable Timewarp option.

3 Select the appropriate option from the Timewarp Interpolation menu.

The clip is reversed on the track so that it starts with the ending.

See TimeWarp Interpolation menu on page 1840 for a description of the Timewarp Interpolation menu options.

To reverse an edited clip:

1. In the Story window, right-click on the character track (or clip) you want to reverse and select Plot Whole Scene to Current Take.
2. The Plot All Properties dialog box appears. Click Plot.

   This plots everything the character is doing currently into the scene as one take.
3. Delete the selected clip.
4. Right-click the empty track and select Insert Current Take from the contextual menu.

   The clip now becomes a keyframe animation clip on the track.
5. Select the clip and trim it using the Razor button.
6. Once you have made your edits, double-click the clip so that the Character Clip settings appear.
7. In the Character Clip settings, activate the Enable Timewarp option.
8. Select the appropriate option from the Timewarp Interpolation menu.

   The clip is reversed on the track.

See TimeWarp Interpolation menu on page 1840 for a description of the Timewarp Interpolation menu options.

Related Topics

- Story clips on page 1777

Scaling clips

Scaling clips lets you alter the length and speed of animation, character, camera animation, and video clips.

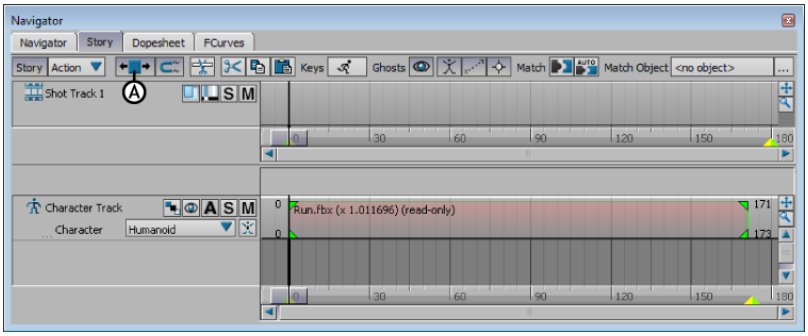
To scale a clip:

1 Select a clip in the Story window.

2 Select Scale in the Story Controls.

3 Drag the start or end of the clip left or right until it is resized.

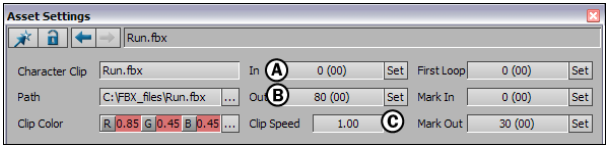
Scale more than one clip at a time by selecting multiple clips and dragging the start or end of one of them. You can also double-click the frame number at the start or end of a selected clip and enter a new frame number.



Story options *A.* **Scaling is active.**

When you double-click a clip in the Story window, the clip's settings display in the Asset Settings window. Some of these settings also let you scale a selected clip.

Changing the values in the In and Out fields (A and B) lets you scale a clip when Scaling is active. Changing the value in the Clip Speed field lets you scale a clip with a precise value.



Asset Settings window *A.* **In field** *B.* **Out field** *C.* **Clip Speed field**

Related Topics

- Story clips on page 1777

Razoring clips

Use the Razor button to permanently delete segments of a clip. If you want to change the starting and ending points of a clip without cutting any part of the clip, trim your clips instead. (See Trimming clips on page 1809 for more information.)

Razoring a clip can be useful when, for example, you want to add a right turn to a walk cycle. With the Razor button, you can cut a walk-cycle clip in half and then rotate one of the clip vectors in the Viewer window to create the turn.

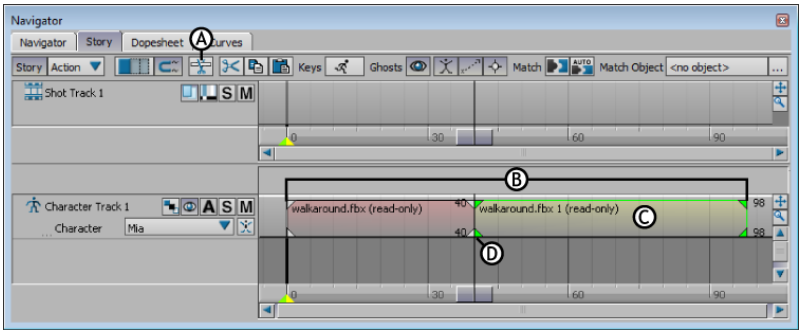
To razor a clip:

1 Select a clip.

2 Place the Timeline indicator where you want to razor the clip.

3 Click the Razor button.

The clip is split into two separate clips at the Timeline indicator's position.



Story window *A.* **Razor button** *B.* **Length of the original clip** *C.* **The new clip** *D.* **The clip was razored at the current time.**

4 Delete any parts of the clip you do not need by selecting and pressing Delete.

NOTE Deleting razored portions of clips is permanent. If you want to alter the clip so it starts or ends later, without cutting the clip see Trimming clips on page 1809.

You can choose to slice more than one clip at a time. To razor multiple clips, place the Timeline indicator over the selected clips. Clips that are not selected are not sliced.

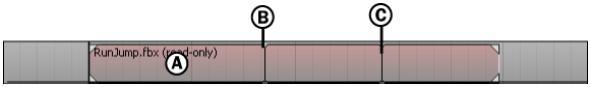
Related Topics

- Story clips on page 1777

Trimming clips

Trim a clip when you want to alter the In and Out points for a specified length of time without affecting the clip. When you Trim a clip, you select only a segment of the original animation, audio or video, which you can then loop or scale.

NOTE To edit a clip so that parts are deleted from it, use the Razor tool. see Razoring clips on page 1808.



Looping clip *A.* **First loop** *B.* **Mark In** *C.* **Mark Out**

To trim an animation, video, or audio clip:

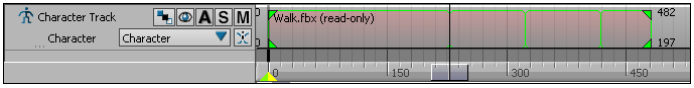
1 Double-click the clip to display its settings in the Asset Settings window.

2 Move the Timeline indicator to the point in the clip where you want it to start and click the Mark In field's Set button.

Move the indicator to where you want to trim the start of the clip.

3 Now, move the timeline indicator to where you want the clip to end and click the Mark Out field's set button.

The entire original clip is shown with the marked segment of the clip added to the end. The marked segment is shown looped until the end time of the original take.



Move the indicator to where you want to trim the start of the clip.

4 To trim the beginning part of the take, enter a value in the First Loop field, above the Mark In and Out fields. The First Loop field lets you trim the clip's first loop. This way, the first loop can be of a different length than the loops in the rest of the clip.

NOTE These values use the local time of the selected clip.

See also:

- First Loop field on page 1834

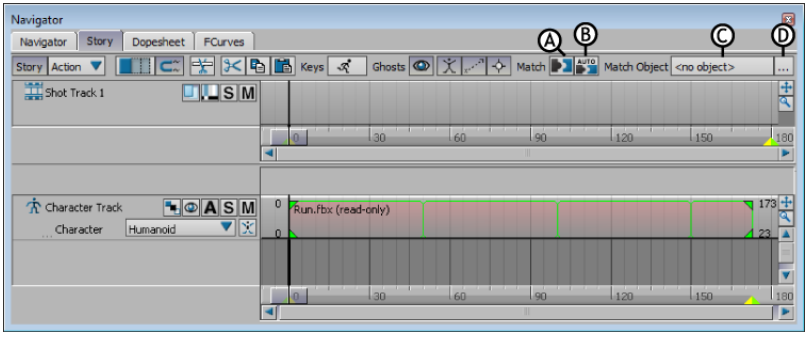
Related Topics

- Story clips on page 1777

Matching clips

When you blend animation in the Story window, it is important to match the animation between each clip. You can match a selected clip to the clip that comes before or after it along a track.

You can also match more than one clip at once by selecting all but the first clip.



Match Controls in the Story window *A.* **Match Options button** *B.* **Auto Match option** *C.* **Match Object field** *D.* **Match Object button**

To match a clip:

1 Select the character to which you want to match clips in the Character track's Character menu.

NOTE The Match Controls are active only when an animation, camera animation, or character clip is selected.

---

2 If you have not done so, add two motion clips to the Character track and push them together so that there is no gap between them.

Character track with two motion clips added.

NOTE It is a good idea to use two motion clips that you have edited to facilitate matching. If the end of the first clip is similar to the beginning of the second clip, for example, the Character's left foot is flat on the ground, the match is smoother, and you will have less fine-tuning to make.

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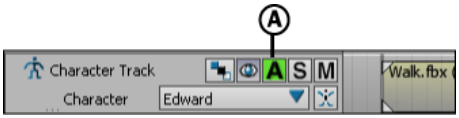
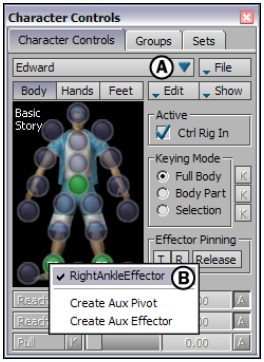
3 Click the Animate (A) button in the Character track controls so you can create animation.



Character track *A.* **Animate button**

4 Select the second clip on the Character track.

5 In the Character Controls, select the character from the Character menu, and right-click a character effector to select it to be the Matching object, for example, the character's right foot.



Character Controls window *A.* **Select your Character in the Character menu** *B.* **Right-click an effector to select it.**

NOTE You can also select the matching object from the Viewer window or the Schematic view.

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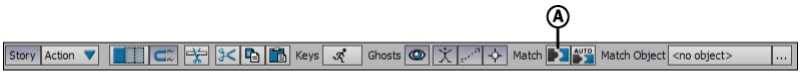
6 Click the Match Options button in the Story controls.



Story controls *A.* **Match Options button**

7 The Match Options dialog box displays with the name of the selected node appearing in the Match Object menu.

8 Activate the appropriate matching options for the match you are trying to create. For a description of options in the Match Options dialog box, see Match options dialog box on page 1813.

9 Click OK.

The clips match using the new match object.

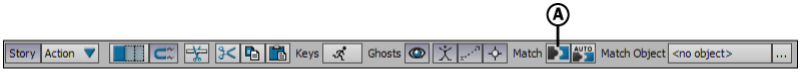
Related Topics

- Story clips on page 1777

Match options dialog box

Use the Match Options button in the Story window to open the Match Options dialog box, which lets you match clips to each other.

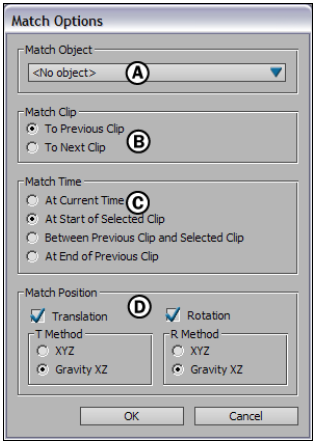
When you match two clips, the match object of a clip is matched with the match object of the clip before or after it on the track. When you do not select a match object, the travelling node is used by default to match clips.



Story Controls *A.* **Match Options button**

The Match Options dialog box consists of the following areas:

- Match Object menu on page 1813, A
- Match Clip options on page 1814, B
- Match Time options on page 1814, C
- Match Position options on page 1816, D



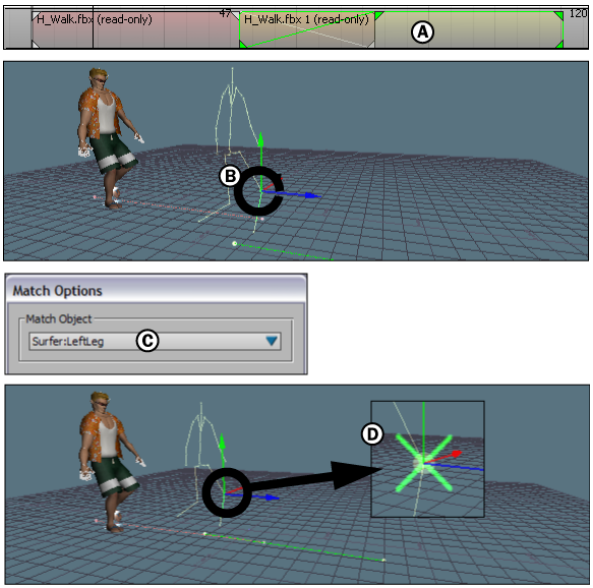
Match Options dialog box *A.* **Match Object menu** *B.* **Match Clip options** *C.* **Match Time options** *D.* **Match Position options**

Match Object menu

Use the Match Object menu to select which part of the track content used to match clips.

You can also disable the match object so that the blend does not take it into account when you match clips. See Blend Algorithm menu on page 1838 for more information.

You can also select a match object using the Match Object field and button. See Match Object field on page 1817 for more information.



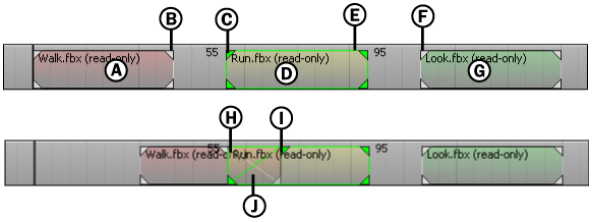
Choosing a new match object *A.* **Select the clip** *B.* **Select the new match object** *C.* **The name of the new match object appears in the Match Object menu.** *D.* **The match object is used when you click Match.**

Match Clip options

The Match Clip options in the Match Options dialog box let you select which clip you are matching. There are two choices: To Previous Clip, where the selected clip is matched to the clip before it on the track, or To Next Clip, which matches the selected clip the clip after it on the track.

Match Time options

The Match Time options let you select at which point of a cross-blend the selected clip is matched.



Cross-blend *A.* **Previous clip** *B.* **Previous clip's Out point** *C.* **Selected clip's In point** *D.* **Selected clip** *E.* **Selected clip's Out point** *F.* **Next clip's In point** *G.* **Next clip** *H.* **Blend start** *I.* **Blend stop** *J.* **Mid-blend**

The Match Time options change depending on which Match option is selected.

NOTE When matching clips, it is always the selected clip that plays in the Viewer window.

To Previous Clip

When To Previous Clip is selected in the Match Time area, the Match Time menu contains the following options:

Option	Function
At Current Time	Matches the start of the selected clip to the previous clip at the current time.
At Start of Select Clip	Matches the start of the selected clip to the start of the blend with the previous clip. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip.
Between Previous Clip and Selected Clip	Matches the selected clip and the previous clip at the middle of the blend. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip.
At End of Previous Clip	Matches the end of the blend with the selected clip to the end of the previous clip. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip.

To Next Clip

When To Next Clip is selected in the Match Time area, the Match Time menu contains the following options:

Option	Function
At Current Time	Lets you match the start of the selected clip to the next clip at the current time.
At Start of Next Clip	Matches the start of the blend with the selected clip to the start of the next clip. When there is no cross-blend between clips, the end of the selected clip is matched to the start of the next clip.
Between Selected Clip and Next Clip	Matches the selected clip and the next clip at the middle of the blend. When there is no cross-blend between clips, the end of the selected clip is matched to the start of the next clip.
At End of Selected Clip	Matches the end of the selected clip to the end of the blend with the previous clip. When there is no cross-blend between clips, the start of the selected clip is matched to the end of the previous clip.

Match Position options

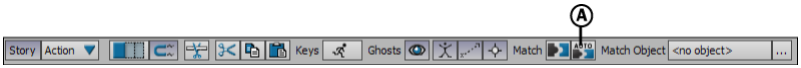
The Match Position options (C and D) let you determine if and how a clip's match object is translated and rotated to match another clip's animation, by selecting XYZ or Gravity XZ. The Match Position menu items are as follows:

XYZ	Translates or rotates a selected clip's match object to the same location or orientation as the previous clip's match object.
Gravity XZ	With the Translate (T) option, translates a selected clip's match object along the global X and Z axes.With the Rotation (R) option, rotates a selected clip's match object around the global Y axis.

Auto Match option

The Auto Match option lets you match clips automatically as you add or paste clips. A clip you add or paste is matched to the clip on its left.

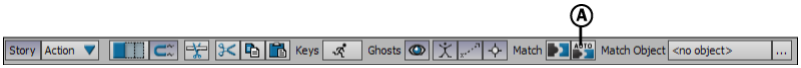
Matching with the Auto Match option involves the options selected in the Match Options dialog box. See Match options dialog box on page 1813 for more information.



Story Controls *A.* **Auto Match option**

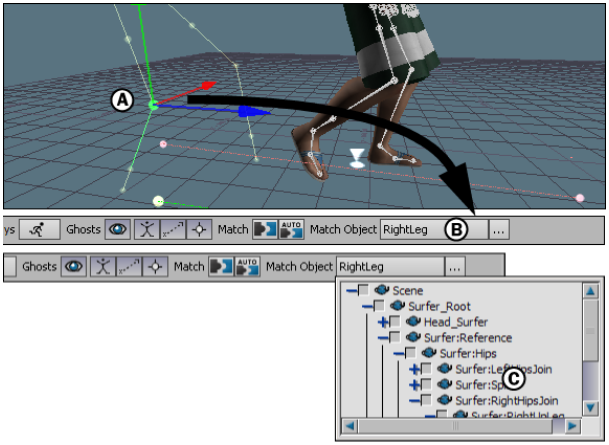
Match Object field

The Match Object field (A and B) lets you select a match object for each animation, character, or camera animation clip. The match object you select affects how clips match. By default, a clip has no match object and the travelling node is used to match clips.



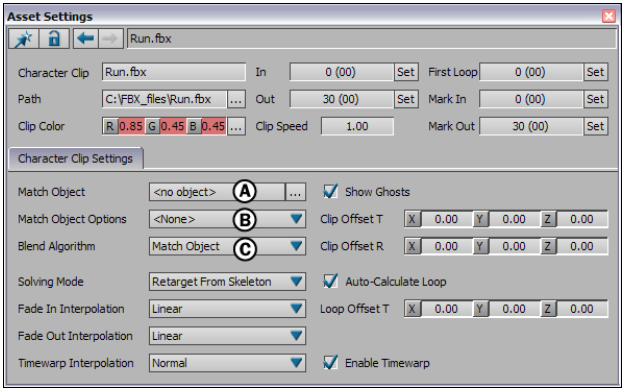
Story Controls *A.* **Match Object field**

To select a match object, *Alt*-drag a selection into the Match Object field (A and B). You can also click the Match Object button, which lets you select a match object from the Asset list. The Asset list displays the entire contents of a scene, but you should only select a match object that is selected in the track.



Selecting a match object *A.* **Drag a selected node into the Match Object field** *B.* **The name of the custom match object appears in the Match Object field** *C.* **Asset list.**

When you double-click on animation, camera animation, or character clip, its settings display in the Asset Settings window. These settings include the Match Object Options menu and the Blend Algorithm menu, as well as the Match Object field and button. What you select in the Match Object Options menu and in the Blend Algorithm menu affects the match object selected in the Match Object field. See Match options dialog box on page 1813 and Blend Algorithm menu on page 1838 for more information.



Character Clip settings in the Asset Settings window *A.* **Match Object field** *B.* **Match Object Options menu** *C.* **Blend Algorithm menu**

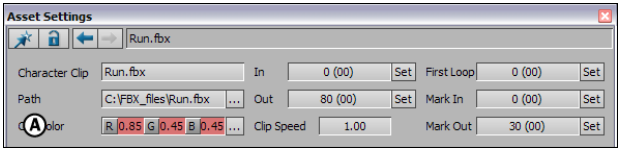
Changing the color of a clip in the Story window

The Clip Color settings let you change the color of a selected clip. This can be useful if you need to quickly identify a group of clips.

To change the color of a clip:

1 Double-click a clip on a track in the Story window. The Asset settings appear.

2 Change the values in the R, G, and B, fields of the Clip Color field, or click the Color Window (...) button to open the Color window.



Asset Settings window *A.* **Clip Color settings**

For more on the Color window, see Using the Color window on page 6.

Manipulating ghosts

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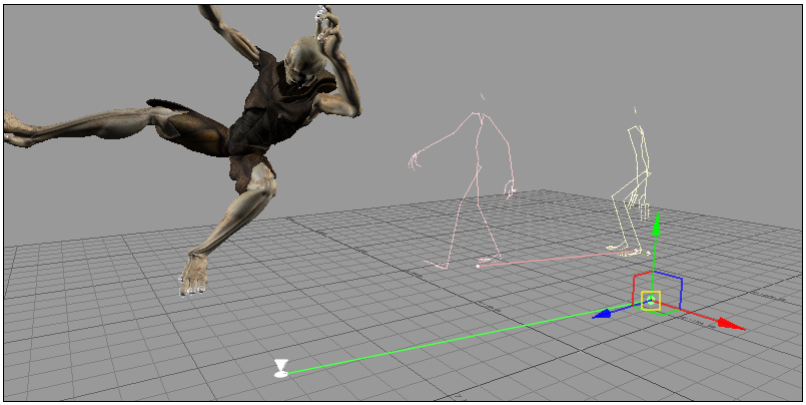
Ghosts are wireframe skeletons displayed in the Viewer window. When you play the animation, the ghosts enable you to see the animation of selected clips and tracks.

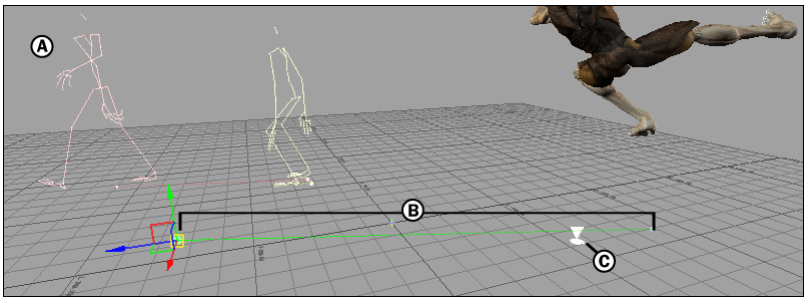


Ghosts displayed in the Viewer window

You can use the ghosts of clips and tracks to change the location and orientation of animation.

Ghosts represents a track's or clip's content and change depending on what is selected. For example, when a character is selected in the Character field of a Character track, the character's ghost resembles the character's skeleton. When a cube is selected in a Track Content field, the cube's model ghost is a circle.

There are model ghosts for both clips and tracks. A clip's ghost has the same color as the clip on the track. A track's ghost is white and represents the result of all the animation in the track.

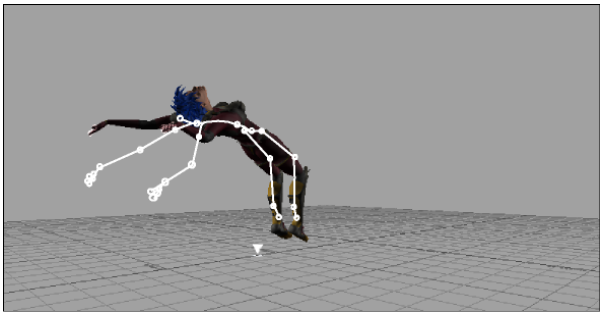


Viewer window showing ghosts *A.* **Model ghost** *B.* **Clip ghost** *C.* **Travelling ghost**

There are three types of ghosts in the Story window:

- Track ghost
- Clip ghost
- Travelling ghost (also known as Travelling node)

A track ghost is a white wireframe ghost that shows the result of a track. The Track ghost resembles a white skeleton on top of a model, as shown in the following figure.

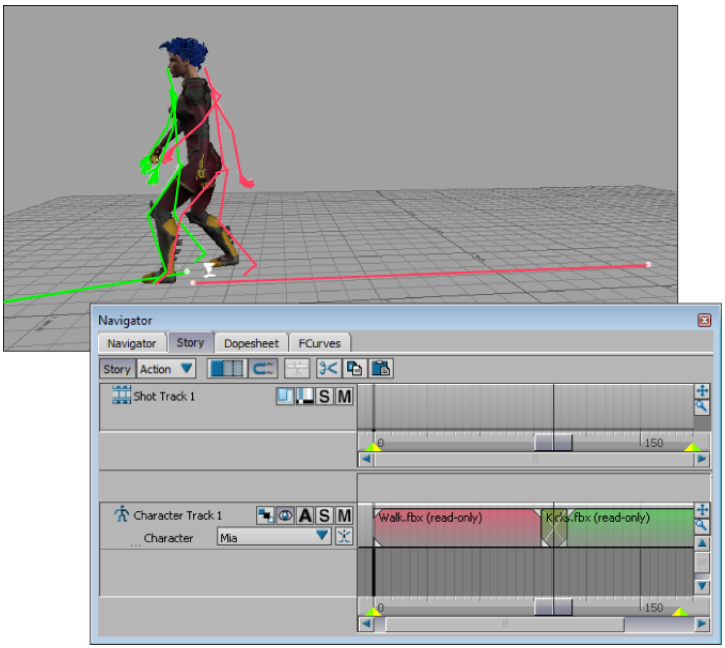


Track ghost

NOTE It is often difficult to see Track ghosts because they are usually hidden by the model.

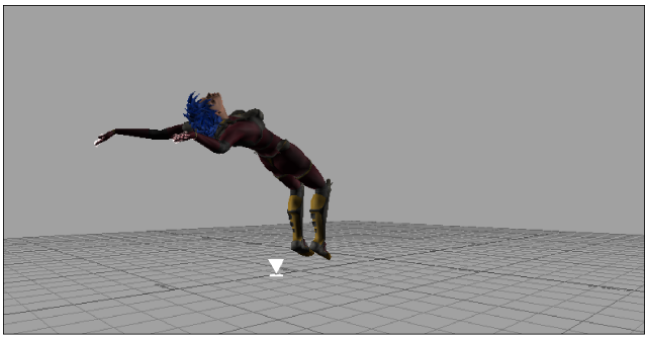
A track's ghost shows a composite of the result of the clips on that track or subtrack. (Click the Show/Hide Ghost button on that track to hide the ghost.) Track ghosts let you see the difference between the clip and the changes created by its sub-clips.

Clip ghosts are different-colored wireframe ghosts that show the length, location, and direction of a clip. Clip ghosts show the progress of the clips on a track. Notice how the color of the ghost in the following figure corresponds with the clip color.



Clip ghosts when blending clips

A Travelling ghost, also known as a Travelling node displays as a gray triangle that follows the track contents along the clip trajectories in the Viewer window.



Travelling ghost

Clip vector

A clip vector ghost displays as a dotted line in the Viewer window. It represents the length, location, and direction of a clip. You can select and manipulate clip vector ghosts in the Viewer window. See Selecting Story ghosts on page 1825

Travelling node

A travelling node displays as a gray triangle in the Viewer window and follows the track contents along the each clip's trajectory.

A travelling node is the ghost of the track content or part of the track content. The default travelling node differs depending on the type of track content. For example, a character's default travelling node is its hips, but a cube's default travelling node is the entire cube.

By default, the travelling node displays on the floor (XZ plane), underneath the part of the track content that defines the travelling node.

You can modify a track's travelling node and where it displays using settings in the Asset Settings window. See Travelling nodes on page 1829 for more information.

- Selecting Story ghosts on page 1825
- Ghosts options on page 1826
- Travelling nodes on page 1829

Showing Story ghosts

Story ghosts can include model, clip vector, travelling node, and match object ghosts, depending on whether tracks or clips are selected.

NOTE A clip ghost is the same color as its associated clip on the track. You can make clip ghosts more visible by changing the clip's color.

1. Switch into X-Ray mode (Ctrl-A).
2. Select either a track or a clip.
   - When a clip is selected, the Ghost option hides or shows only that clip's ghosts.
   - When a track is selected, the Ghost option hides or shows that track's ghosts as well as the shown ghosts of the track's clips.

NOTE A track has a model ghost, a match object ghost, and a travelling node. A clip has its own model and match object ghosts, as well as a clip vector ghost (A, B, and C).

3 Select the Ghost option to hide or show all ghosts of selected tracks or clips .

Ghosts option

■ Manipulating ghosts on page 1821

Selecting Story ghosts

Select ghosts to change their location and orientation, or to select a match object.

To select and move a clip vector ghost:

1 Double-click a clip in the Story window.

2 The clip vector of the clip is selected in the Viewer window.

You can also click the clip vector in the Viewer window.

TIP The color of a ghost in the Viewer window matches the color of its clip in the Story window.

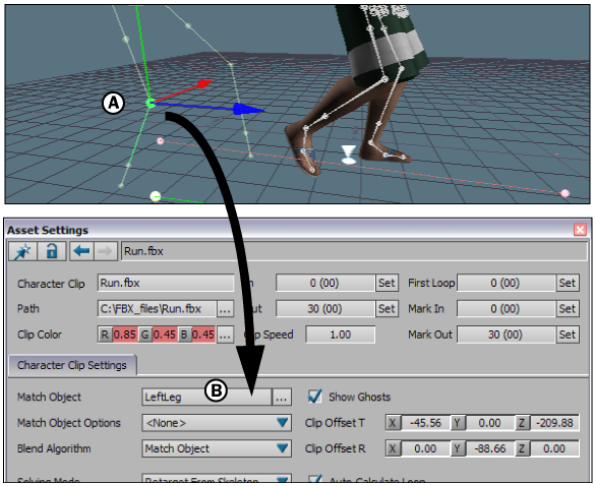
3 Translate and rotate the selected clip vector ghost.

To select a match object:

1 Double-click an animation, character, or camera animation clip in the Story window to access the Match Object field in the Asset Settings window.

The match object you select affects how clips match. By default, a clip has no match object and the travelling node is used to match clips.

2 Alt-drag an object into the Match Object field . You should only select a match object from part of the track contents.



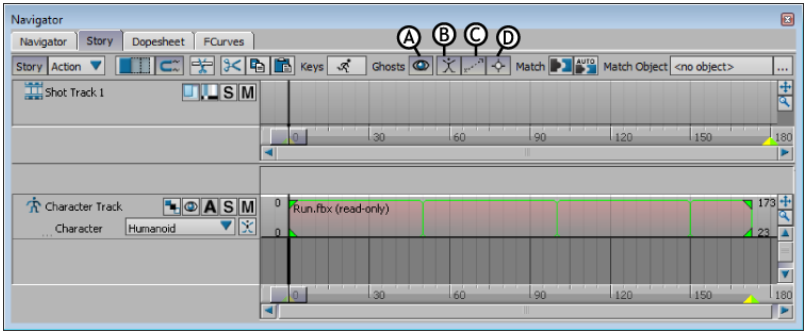
Selecting a match object *A*. Drag a selected node into the Match Object field *B*. The name of the custom match object displays in the Match Object field

The content of the Match Object field is affected by the options selected in Match Object Options menu and in the Blend Algorithm menu. See Ghost Match Object option on page 1828 and Blend Algorithm menu on page 1838 for more information.

Ghosts options

The Ghosts options let you hide and show various ghosts. These options display only when Animation, Camera Animation, and Character tracks or clips are selected.

Tracks and clips each have their own ghosts. Which ghost you hide or show depends on whether tracks or clips are selected as well as on which option you click. For example, you can hide a clip's model ghost but show a track's model ghost at the same time.



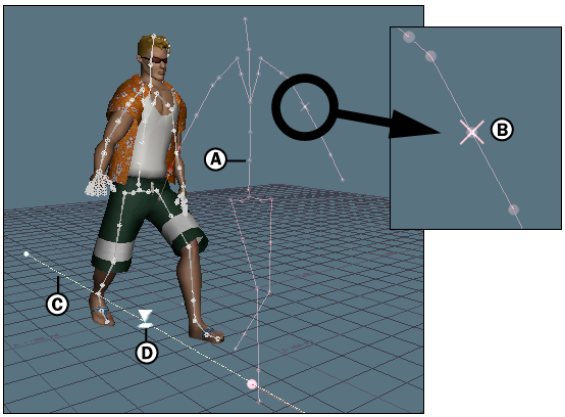
Ghosts options in the Story window *A.* **Ghost option** *B.* **Model option** *C.* **Clip Vector/Travelling Node option** *D.* **Match Object option**

The Ghost options consist of the following:

- Ghost option on page 1827
- Model option on page 1828
- Clip Vector/Travelling Node on page 1828
- Ghost Match Object option on page 1828

Ghost option

The Ghost option hides or shows all ghosts of selected tracks or clips . These ghosts can include model, clip vector, travelling node, and match object ghosts depending on whether you select tracks or clips.



Story ghosts *A.* **Clip's model ghost** *B.* **Match object ghost** *C.* **Clip vector ghost** *D.* **Travelling node**

A track has a model ghost, a match object ghost, and a travelling node. A clip has its own model ghost and its own match object ghost, as well as a clip vector ghost.

Model option

The Model option hides and shows a model's ghost.

Models have ghosts when the models are a track's content (the selected asset of a track). For example, when a character is selected in the Character field of a Character track, the character's model ghost looks like the character's skeleton. When a cube is selected in a Track Content field, the cube's model ghost is a circle.

When a clip is selected, the Model option lets you hide and show the clip's model ghost. A clip's model ghost is the same color as the clip.

When a track is selected, the Model option lets you hide or show the track's model ghost. A track's model ghost is white and represents the result of all the animation in the track.

Clip Vector/Travelling Node

The Clip Vector/Travelling Node option hides or shows either clip vector ghosts or travelling nodes, depending on whether tracks or clips are selected.

When a clip is selected, the Clip Vector/Travelling Node option lets you show or hide the clip vector ghost for a selected clip. When a track is selected, the Clip Vector/Travelling Node option lets you show or hide the track's travelling node.

See Clip vector on page 1824 and Travelling node on page 1824 for more information.

Ghost Match Object option

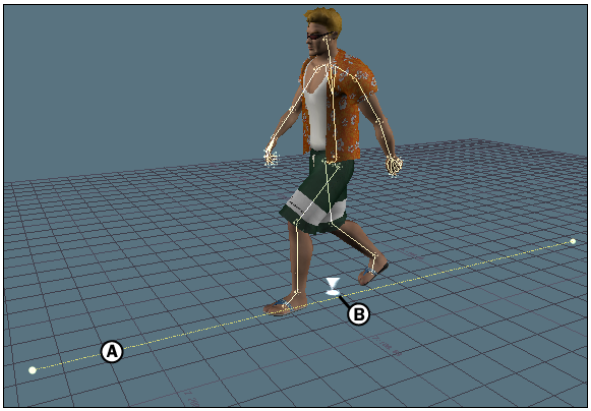
The Match Object option hides or shows the match object ghosts of tracks and clips. Ghosts of match objects look like crosses in the Viewer window. See Matching clips on page 1810 for more information on match objects.

- Ghost Visibility option on page 1762
- Showing Story ghosts on page 1824

Travelling nodes

A travelling node is the ghost of the track content or part of the track content. The default travelling node is different depending on the type of track content. For example, a character's default travelling node is its hips, but a cube's default travelling node is the entire cube.

A travelling node displays as a gray triangle in the Viewer window and follows the track contents along the clip trajectories.



Ghosts *A.* **Clip vector** *B.* **Travelling node**

By default, the travelling node displays on the floor (XZ plane), underneath the part of the track content that defines the travelling node.

NOTE

You can show and hide the travelling node using the Clip Vector/Travelling Node option. See Clip Vector/Travelling Node on page 1828 for more information.

■ Changing the position of a travelling node on page 1829

Changing the position of a travelling node

You can change where the travelling node for an Animation, Character, or Camera Animation track displays by changing the option in the Travelling Node function menu.

By default, travelling nodes display on the floor (XZ plane), underneath the part of the track content that defines the travelling node.

To change the default travelling node:

1 Alt-drag a selected asset or bone from the Viewer window into the Travelling Node field, or click the Travelling Node button and select an asset or bone from the Asset list that is part of the track contents.

NOTE You can use more than one asset or bone as a travelling node. For example, you can Alt-drag a bone and a Null into the Travelling Node(s) field.

2 Select either Project on XZ Plane or Average from the Tr. Node function menu to specify where the node displays in the scene.

Option	Position
Project on XZ Plane	Displays the travelling node on the floor (XZ plane). If more than one asset or bone is selected in the Travelling Node menu, the travelling node displays at an average distance between the assets or bones on the XZ plane.
Average	Displays the travelling node at the average distance between the assets or bones selected in the Travelling Node field.When only one asset or bone is selected in the Travelling Node(s) field, the travelling node displays at the location of the selected asset or bone.

Story clips in the Asset Settings window

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Clip settings display in the Asset Settings window when you double-click on a clip in the Story window. Select Layout > Story from the menu bar to see both windows at the same time.

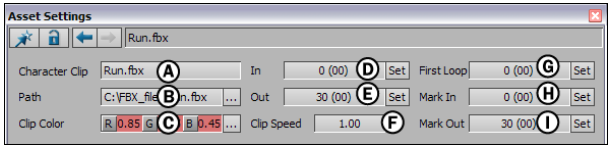
- Common clip settings display in the top half of the Asset Settings window when you select any type of clip. See Common clip settings on page 1831.
- Additional clip settings display in the bottom half of the Asset Settings window when specific types of clips are selected. See Additional clip settings on page 1835.

Common clip settings

This section describes all the settings that display in the top half of the Asset Settings window when most types of clip are selected. The settings in this section are:

- Clip Name field on page 1832
- Path field on page 1832
- File Path field on page 1832
- Clip Content field on page 1833
- Clip Color settings on page 1833
- In and Out fields on page 1833
- Clip Speed field on page 1834
- First Loop field on page 1834

- Mark In and Mark Out fields on page 1835



Common clip settings *A.* **Clip Name field for a selected Character clip** *B.* **Path field and button** *C.* **Clip Color** *D.* **In field** *E.* **Out field** *F.* **Clip Speed** *G.* **First Loop field** *H.* **Mark In field** *I.* **Mark Out field**

Clip Name field

The Clip Name field lets you rename each clip. Renaming a clip this way does not change the name of the clip's *.fbx* file.

Path field

The Path field displays the path of the selected animation, character, camera animation, audio, or video clip. An empty Path field indicates that the selected clip has not been saved.

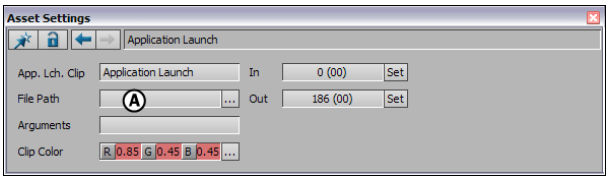
You can also click the browse (...) button beside the field to locate and load a different *.fbx* file for the clip.

File Path field

The File Path field displays in the Asset Settings window when an Application Launch command clip is selected. The File Path field lets you choose the application you want to launch when the command clip plays.

You can type the path in the field, or you can click the browse (...) button beside the field to locate the file.

You can create Application Launch command clips by dragging an Application Launch asset from the Command folder in the Asset browser to a Command track in the Story window.



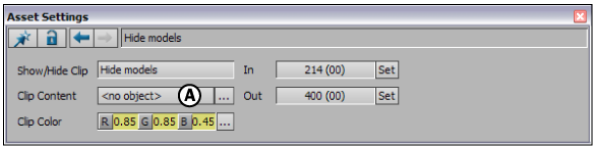
Common clip settings *A.* **File Path field**

Clip Content field

The Clip Content field lets you assign assets to Hide command and Show command clips. When you drag a Hide Models or Show Models asset from the Command folder in the Asset browser to the Story window, the new command clip that appears displays the name of the command followed by a <No models> message.

To assign a model to a Show Models or Hide Models command clip, select a model from the Viewer window and Alt-drag it into the Clip Content. You can also Alt-drag models from the Scene browser or from the Schematic view in the Viewer window.

You can Alt-drag a group of models into a single clip or its Clip content field.



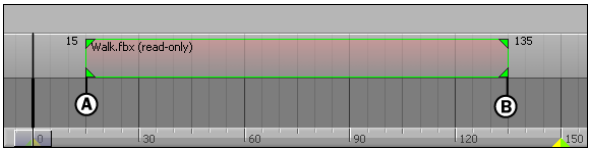
Common clip settings *A.* **Clip Content field**

Clip Color settings

The Clip Color settings let you change the color of a selected clip. You can also click the clip's Color (...) button to open the Color window.

In and Out fields

The In field lets you determine the selected clip's In point without changing the clip's Out point. The Out field lets you determine a clip's Out point without changing the clip's In point.



Clip *A.* **In point** *B.* **Out point**

The In and Out fields' Set buttons lets you change the value of the field to the current timecode.

Clip Speed field

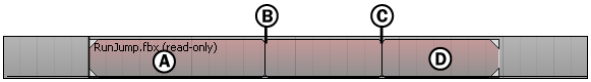
The Clip Speed field lets you change the speed of the clip's animation or video without changing the clip's In point or Out point.

First Loop field

The First Loop field lets you determine at which part of a clip the loop begins. The field uses the local time of the selected clip. You can loop every type of clip except command and constraint clips. See Looping clips on page 1804 for more information.

When you use the First Loop field, the first loop can be of a different length than the loops in the rest of the clip.

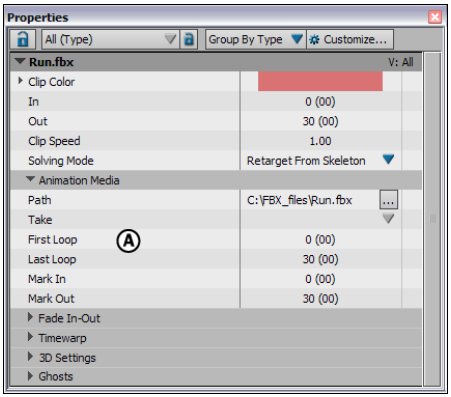
The First Loop field's Set button lets you change the value of the field to the current timecode.



Looping clip *A.* **First loop** *B.* **Mark In** *C.* **Mark Out** *D.* **Last loop**

Last Loop field

The Last Loop field in the Properties window lets you trim the end of the clip and determine at which part of the clip the last loop ends. The value uses the local time of the clip. For example, if you have a clip that loops three times, you can set the end of the third loop so that it is shorter than the previous loop.



Properties window *A.* **Last Loop field**

Mark In and Mark Out fields

The Mark In and Mark Out fields let you trim the beginning or end of a selected clip. The fields use the local time of the selected clip.The Mark In and Mark Out fields appears for selected animation, character, camera animation, video, and audio clips.

Trimming a clip lets you select a segment of the original animation, audio or video, which you can then loop or scale. Trimming does not change the length of the clip itself and does not permanently remove the ends of clip that are trimmed.

Each field's Set button lets you change the value of the field to the current timecode.

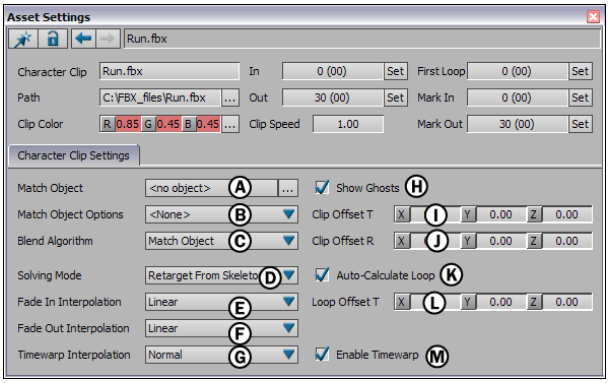
Additional clip settings

This section describes additional settings that display when animation, character, and camera animation clips are selected. These settings consist of the following:

- Match Object field on page 1836
- Match Object Options field on page 1837
- Blend Algorithm menu on page 1838
- Solving Mode menu on page 1838
- Interpolation menus on page 1839
- TimeWarp Interpolation menu on page 1840
- Enable TimeWarp option on page 1841
- Show Ghosts option on page 1841
- Clip Offset T settings on page 1842
- Clip Offset R settings on page 1842
- Auto-Calculate Loop option on page 1842
- Loop Offset T settings on page 1842

The settings that display for video and audio clips are the same settings that display when video and audio files are selected in the Scene browser.

There are no additional settings for command and constraint clips.



Additional clip settings *A.* **Match Object field** *B.* **Match Object Options menu** *C.* **Blend Algorithm menu** *D.* **Solving Mode menu** *E.* **Fade In Interpolation menu** *F.* **Fade Out Interpolation menu** *G.* **TimeWarp Interpolation menu** *H.* **Show Ghosts option** *I.* **Clip Offset T settings** *J.* **Clip Offset R settings** *K.* **Auto-Calculate Loop option** *L.* **Loop Offset T settings** *M.* **Enable TimeWarp option**

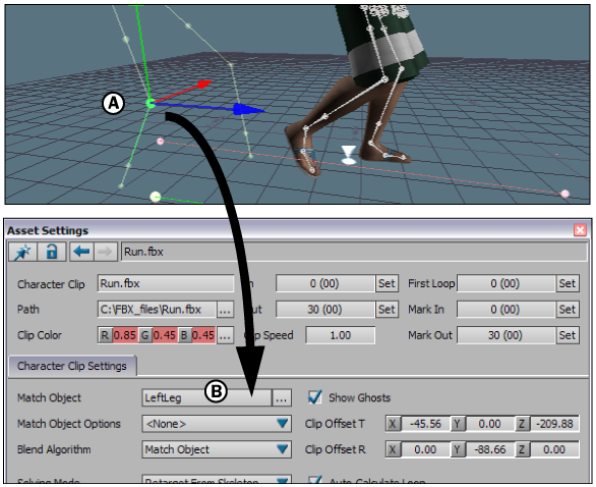
Match Object field

Double-click an animation, character, or camera animation clip in the Story window to access the Match Object field in the Asset Settings window.

The Match Object field lets you select a match object for each selected animation, character, or camera animation clip. The match object you select affects how clips match. By default, a clip has no match object and the travelling node is used to match clips.

To select a match object, Alt-drag an object into the Match Object field. You should only select a match object from part of the track contents.

The content of the Match Object field is affected by the options selected in Match Object Options menu and in the Blend Algorithm menu. See Match Object Options field on page 1837 and Blend Algorithm menu on page 1838 for more information.



Selecting a match object *A*. Drag a selected node into the Match Object field *B*. The name of the custom match object displays in the Match Object field

Match Object Options field

Double-click an animation, character, or camera animation clip in the Story window to access the Match Object Options field in the Asset Settings window.

The Match Object Options menu lets you select options that determine the position of the match object's ghost.

Match option	Ghost position
<None>	Uses the travelling node to match clips instead of a match object. A match object does not display when <None> is selected.
Project on XZ Plane	Displays match object's ghost on the floor (XZ plane). If more than one asset or bone is selected as the match object, the match object displays at an average distance between the assets or bones on the XZ plane.
Average	Displays the match object at the average distance between the assets or bones selected as the match object. When only one asset or bone is selected as the match ob-

Match option	Ghost position
	ject, the match object displays at the location of the selected asset or bone.

Blend Algorithm menu

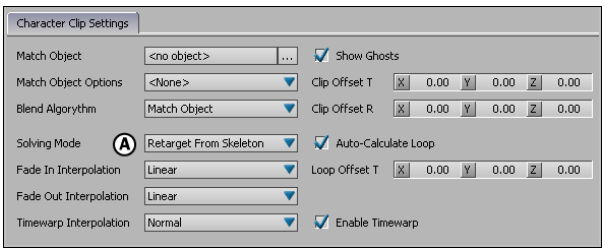
Double-click an animation, character, or camera animation clip in the Story window to access the Blend Algorithm menu in the Asset Settings window.

The Blend Algorithm menu lets you select between Normal and Match Object blend options. These options activate and disable a track's match object, which affect the way clips match.

Option	Match behavior
Normal	Does not take the match object into account when you match clips.
Match Object	Uses the match objects when you click the Match Options button.For more information on matching and match objects, see Match options dialog box on page 1813.

Solving Mode menu

The Solving Mode menu, which displays for selected character clips, displays the current solving mode.



Character clip settings *A.* **Solving Mode menu**

Solving mode	Behavior
Retarget From Skeleton	This option is automatically selected when animation is retargeted from one Character to another. Retargeting occurs when the

Solving mode	Behavior
	skeleton to which the clip's animation was plotted is different than the skeleton of the Character selected in the track's Character field.
Skeleton	This option is automatically selected when the selected clip is created using the same skeleton as the skeleton of the Character in the track.
Control Rig	This option is automatically selected when the selected clip was created using the Character's control rig.

Interpolation menus

The Fade In and Fade Out Interpolation menus (E and F) let you choose interpolation options for the In and Out points of selected animation, character, and camera animation clips.

Option	Behavior
Custom	The Custom options open panes which let you create your own interpolation using function curves. When you select the Custom option from the Fade In or Fade Out Interpolation menus, the Custom Fade In Interpolation or Custom Fade Out Interpolation panes appear. See Function curves on page 953" for more information on using the settings in these panes.
Linear	Creates Linear interpolation at the In or Out point of the clip. Linear interpolation is the default setting for both the Fade In and Fade Out menus.
Smooth	Creates smooth interpolation at the In or Out point of the clip.
Slow	Slows a clip's animation at the In or Out point of a clip.

Option	Behavior
Fast	Speeds up a clip's animation at the In or Out point of a clip.

TimeWarp Interpolation menu

Double-click an animation, character, or camera animation clip in the Story window to access the TimeWarp Interpolation menu in the Asset Settings window.

The TimeWarp Interpolation menu lets you modify the clip's animation rate, for example, you can speed up, slow down, or reverse animation without changing its length. This menu is affected by the Enable TimeWarp option (see Enable TimeWarp option on page 1841).

Option	Behavior
Custom	Opens the Custom TimeWarp pane, which lets you edit the selected clip's animation using function curves. The settings in this pane are similar to those in the FCurves window (see Function curves on page 953). Use the Enable TimeWarp option (see Enable TimeWarp option on page 1841) to disable the result of the pane without deleting it. See Custom TimeWarp interpolation on page 1843.
Normal	The clip plays normally.
Smoothed Ends	The clip's animation begins slowly, speeds up, and then ends slowly. The length of the animation does not change.
Going Faster	The clip's animation speeds up as it plays, starting very slowly and ending very fast. The length of the animation does not change.
Slowing Down	The clip's animation slows down as it plays, starting very fast and ending very slowly. The length of the animation does not change.

Option	Behavior
Reversed	The clip's animation plays backwards.
Reversed, Smoothed Ends	The clip's animation plays backward and its speed is affected. The animation begins slowly, speeds up, and then ends slowly. The length of the animation does not change.
Reversed, Going Faster	The clip's animation plays backwards and speeds up as it plays, starting very slowly and ending very fast. The length of the animation does not change.
Reversed, Slowing Down	The clip's animation plays backwards and speeds up as it plays, starting very fast and ending very slowly. The length of the animation does not change.

Enable TimeWarp option

Double-click an animation, character, or camera animation clip in the Story window to access the Enable TimeWarp option in the Asset Settings window. The Enable TimeWarp option lets you disable or activate the result of the Custom TimeWarp pane.

Show Ghosts option

Double-click an animation, character, or camera animation clip in the Story window to access the Show Ghost option in the Asset Settings window.

The Show Ghost option lets you show or hide the ghosts of a selected clip. Ghosts are hidden by default. This option displays when an animation, camera animation, or character clip is selected.

The ghosts affected by the Show Ghost option include a selected clip's model, clip vector, and match object ghosts. The Show Ghost option controls the visibility of these ghosts as a group.

Also, clip ghosts can display only if the ghost visibility options of the clip's track is active. See Ghosts options on page 1826 for more information on track ghosts.

Clip Offset T settings

Double-click a character or animation clip in the Story window to access the Clip Offset T settings in the Asset Settings window.

The Clip Offset T settings let you translate a selected clip's clip vector in the Viewer window. You can also translate a clip's clip vector by manipulating it in the Viewer window. See Moving clips on page 1798 for more information.

Clip Offset R settings

Double-click a character or animation clip in the Story window to access the Clip Offset R settings in the Asset Settings window.

The Clip Offset R settings let you rotate a selected clip's clip vector in the Viewer window. You can also rotate a clip's clip vector by manipulating it in the Viewer window. See Moving clips on page 1798 for more information.

Auto-Calculate Loop option

Double-click a character clip in the Story window to access the Auto-Calculate Loop option in the Asset Settings window.

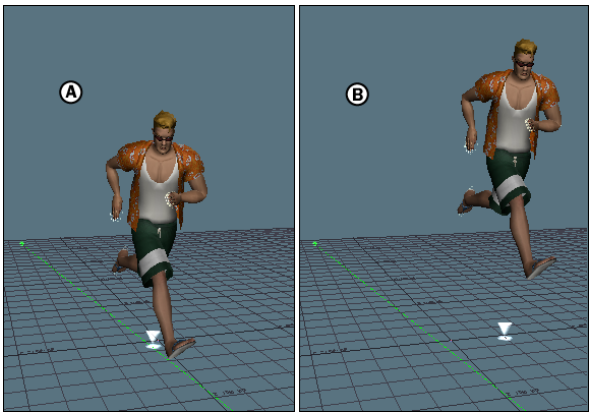
The Auto-Calculate Loop option lets you turn off or on the automatic calculation of the loop offset. To change the loop translation offset, use the Loop Offset T settings (see Loop Offset T settings on page 1842).

Loop Offset T settings

Double-click a character clip in the Story window to access the Loop Offset T settings in the Asset Settings window.

The Loop Offset T settings let you change the loop's translation offset.

The loop offset is calculated automatically by default. Changing a loop's translation offset causes the animation to jump at the beginning of each loop. For example, when you loop a basic run cycle, a Character runs forward in a straight line. If you change the loop's translation offset, the Character jumps at the beginning of each loop.



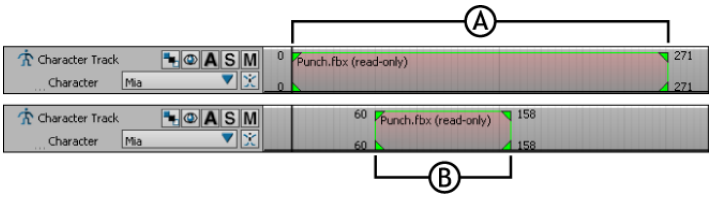
Creating loop offsets *A.* **The loop offset is calculated automatically, Surfer runs in a straight line.** *B.* **The loop is offset along the Y and X axes, causing Surfer to jump at the beginning of each loop.**

Custom TimeWarp interpolation

The Custom TimeWarp pane appears in the Asset Settings window when you select Custom from the TimeWarp Interpolation menu (see TimeWarp Interpolation menu on page 1840). The Custom TimeWarp pane lets you edit the selected clip's animation using function curves. The settings in this pane are similar to those in the FCurves window (see Function curves on page 953 and TimeWarp curves on page 965).

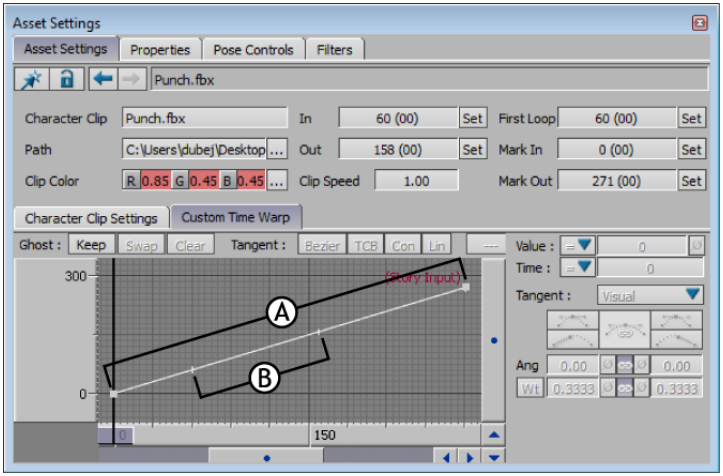
Use the Enable TimeWarp option (see Enable TimeWarp option on page 1841). To disable the result of the pane without deleting it.

MotionBuilder differentiates between the length of a clip and the original animation data it contains. When you modify a clip, such as shortening or looping, the original length of the animation data is not lost.



Clip in Story window *A.* **Original length of animation data from frames 0 to 271.** *B.* **Clip resized from frames 60 to 158 without losing original animation data**

A Story clip's TimeWarp curve indicates the full length of the animation data (A), not the current visible length of the clip. Small vertical lines (B) appear on the TimeWarp curve to indicate the start and end of the clip. Both of these lines may or may not display depending on how you have manipulated the clip.

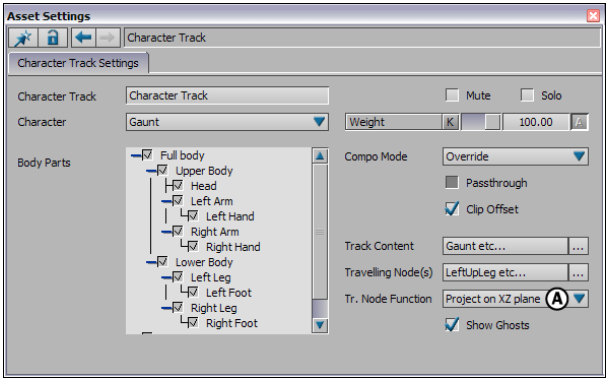


TimeWarp for Story clip *A*. Original length of animation data from frames 0 to 271. *B*. Current start and end of clip from frames 60 to 158.

When you move a clip along its track in the Story window, the TimeWarp curve slides along the timeline to reflect the change.

Tr. Node Function

The Travelling Node Function menu lets you determine where the travelling node displays for a selected Animation, Character, or Camera Animation track. See Changing the position of a travelling node on page 1829 for more information on travelling nodes.



Travelling node options in the Asset Settings window *A.* **Travelling Node Function menu**

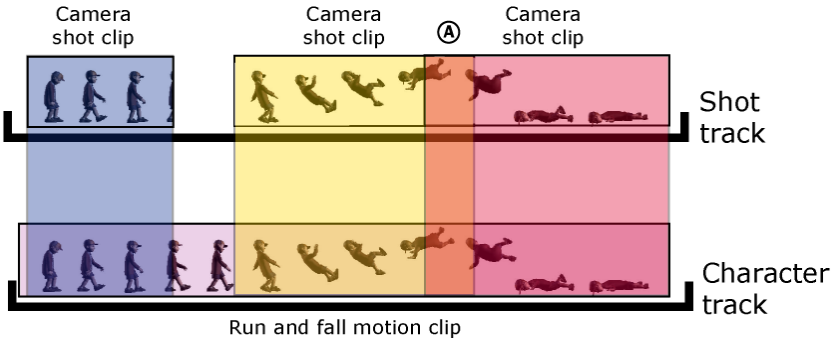
Option	Travelling node position
Project on XZ Plane	Displays the travelling node on the floor (XZ plane). If more than one asset or bone is selected in the Travelling Node menu, the travelling node displays at an average distance between the assets or bones on the XZ plane.
Average	Displays the travelling node at the average distance between the assets or bones selected in the Travelling Node field (See Changing the position of a travelling node on page 1829). When only one asset or bone is selected in the Travelling Node(s) field, the travelling node displays at the location of the selected asset or bone.

Editing with shot clips

99

Once you have built a scene using clips in the Story window, you can use camera shot clips to edit the result on the Story window's Edit timeline.

A shot clip represents action captured with a single camera. You can use multiple shot clips to create a series of camera switches on the Edit timeline, but unlike the Camera Switcher, you can also blend your shot clips to create cross dissolves as shown in the following figure.



Camera shots on the Edit timeline covering the corresponding areas of the action on the Character track on the Action timeline *A*. **Two camera shots blended creating a cross dissolve**

You can also use shot clips to create storyboards with Camera Back Plates, or edit your how scene is filmed without changing what is set up along the Action timeline.

- Creating shot clips on page 1848
- Creating a storyboard on page 1736
- Changing the order of events in a scene with Time Discontinuity on page 1855

Creating shot clips

A shot clip is a visual representation of a camera view of the action playing in the Action timeline.

NOTE You cannot create a shot clip with Producer cameras.

To create a shot clip:

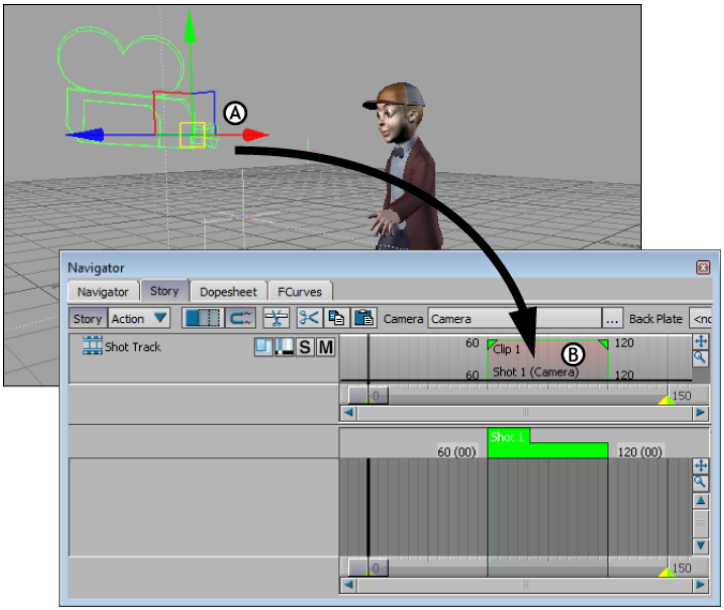
1 Add and position cameras in your scene.

2 Open the Story layout (Layout > Story).

3 *Alt*-drag cameras from the Viewer window or Scene browser into the Edit Track.

NOTE You can use one camera to create multiple shots, or use different cameras for each shot.

A Shot track appears, and a shot clip is created for each camera you drag onto the Edit track.



Shot clip *A.* **Custom camera in the Viewer window** *B.* **Shot clip created after dropping the Custom camera into a Shot track**

4 Make sure the Story mode is set to Action.

This enables the camera shots to play in order of their positions, from left to right, on the Edit timeline.

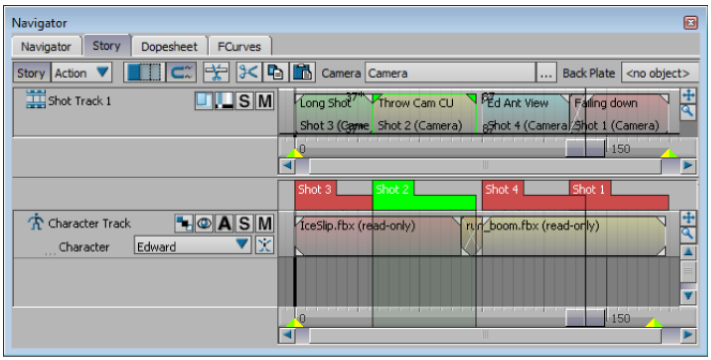
5 Right-click a shot clip and select Make Camera Switcher current from the contextual menu.

This enables you to view the results of the Edit track in the Viewer window.

6 Do any of the following to the shot clips on the Edit track:

- Drag the clips along the Edit track to arrange them.
- Stretch the beginning or end of clips to increase or decrease the duration of the camera shot.
- Overlap the clips to create a cross fade effect.

NOTE To overlap the clips, switch the Story window into Edit mode.



Three camera arranged into four shot clips on the Edit track

NOTE In the preceding figure, the first and third camera shots are the same, only the shot clips are renamed.

7 Click Play in the Transport controls to view the scene.

8 Fine-tune the camera angles so that they cover the action the way you want. If you want to reposition a camera, right-click the shot clip on the Edit track and select Make Camera Current to reposition that shot's camera view.

9 When you are satisfied with the camera set-up, you can plot the resulting camera switches from the Edit track to a take by right-clicking a shot clip and selecting Plot Shot Track To from the contextual menu.

This way, you can use the camera switches in the Camera Switcher settings.

10 To combine all animation in a scene with the take selected in the Transport controls, right-click any shot clip and select Plot Scene to Current Take.

NOTE This plotting includes the animation of the take selected in the Transport Controls window as well as the animation in the Story window.

To rearrange shots so they are out of sequence using the Time Discontinuity function, see Changing the order of events in a scene with Time Discontinuity on page 1855.

Creating a cross-fade effect with camera shots

You can blend or cross fade camera shots using camera shots in the Story window.

NOTE You cannot create a shot clip with Producer cameras.

To cross-dissolve shot clips:

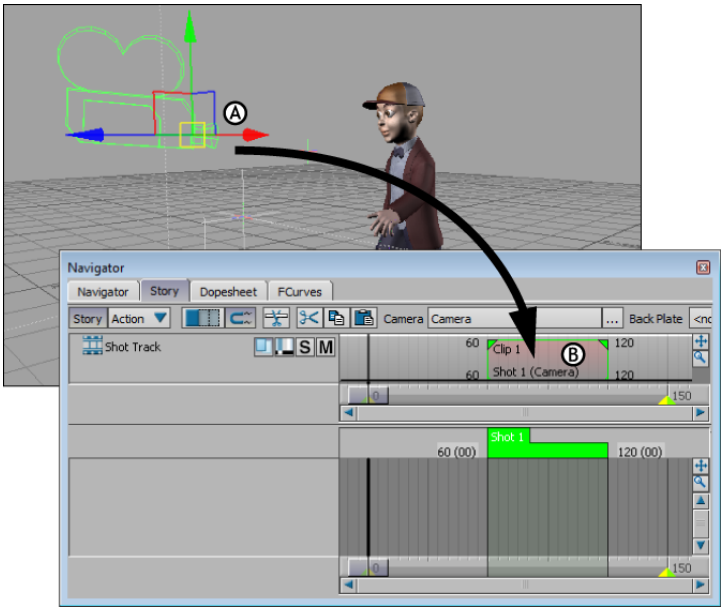
1 If you have not done so already, add cameras to your scene and position them.

2 Open the Story layout (Layout > Story).

3 *Alt*-drag cameras from the Viewer window or Scene browser into the Edit Track.

NOTE You can use one camera to create multiple shots, or use different cameras for each shot.

A Shot track appears, and a shot clip is created for each camera you drag onto the Edit track.



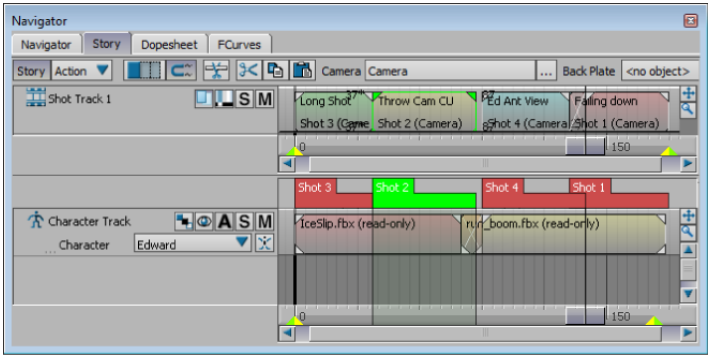
Shot clip *A.* **Custom camera in the Viewer window** *B.* **Shot clip created after dropping the Custom camera into a Shot track**

4 Switch the Story window into Edit mode.

5 Right-click a shot clip and select Make Camera Switcher current from the contextual menu.

This enables you to view the results of the Edit track in the Viewer window.

6 Overlap the clips to create a cross fade effect.



Three camera arranged into four shot clips on the Edit track

NOTE In the preceding figure, the first and third camera shots are the same, only the shot clips are renamed.

7 Click Play in the Transport controls to view the scene.

8 Fine-tune the camera angles so that they cover the action the way you want. If you want to reposition a camera, right-click the shot clip on the Edit track and select Make Camera Current to reposition that shot's camera view.

9 When you are satisfied with the camera set-up, you can plot the resulting camera switches from the Edit track to a take by right-clicking a shot clip and selecting Plot Shot Track To from the contextual menu.

This way, you can use the camera switches in the Camera Switcher settings.

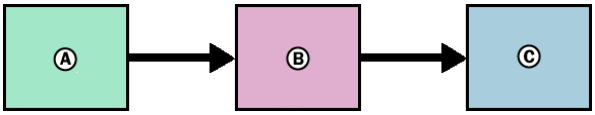
10 To combine all animation in a scene with the take selected in the Transport controls, right-click any shot clip and select Plot Scene to Current Take

NOTE This plotting includes the animation of the take selected in the Transport Controls window as well as the animation in the Story window.

To rearrange shots so they are out of sequence using the Time Discontinuity function, see Changing the order of events in a scene with Time Discontinuity on page 1855.

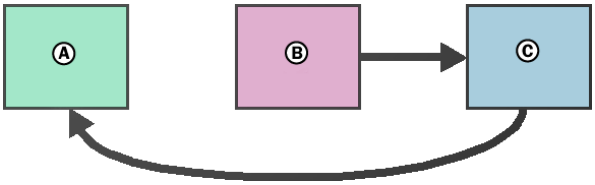
Time discontinuity

Normally, animation plays in chronological order. For example, a scene where you see character walking and then slipping is chronological. The actions in the scene unfold from start to end in a linear fashion.



Three events in chronological order

Time discontinuity happens whenever action is shown out of chronological order, for example, when you start a story with its end. The Time Discontinuity option in the Story window lets you re-order events in a scene so that they occur out of chronological sequence.



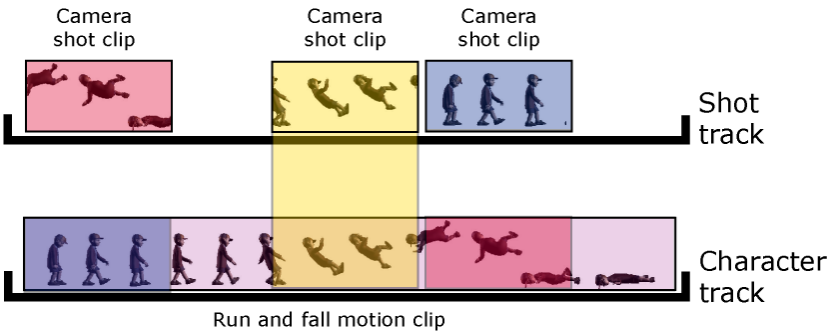
Time Discontinuity lets you edit the original sequence of events *A*. Third event (C) plays second *B*. First event (A) plays last *C*. Second event (B) plays first

Activating Time Discontinuity lets you play events in the animation in a different order, edit out parts, or loop the same segment more than once, without altering your source animation. For example, you could take the scene of the character walking and slipping and have the character slip first, followed by a shot of him walking.

Once you have edited the sequence of events in your scene, you can plot it for export.

When you activate Time Discontinuity, the shot clips and Shot slider tabs disconnect so you can move them individually to rearrange the sequence of events. You can drag a shot clip to a different time in the scene, or resize a Slider tab so that the segment of action repeats itself.

In the following figure, the scene of the character walking and slipping is shown in regular sequence. Each shot clip covers part of the action on the Character track below: the character starting to walk is covered by the first Camera shot clip, the character slipping by the second Camera shot clip and the character falling is covered by the third Camera shot clip.



Shot track showing three Camera shot clips and Character track showing an action of a character slipping

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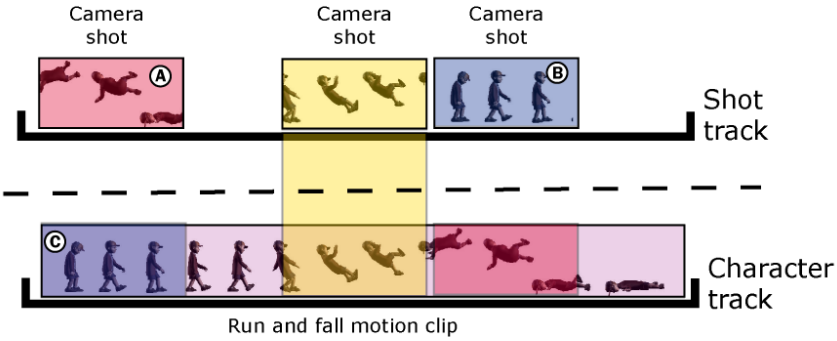
NOTE

The Timeline indicators for both the Shot track and Character tracks play from left to right simultaneously to show that the Camera shots are reading the Character track's motion in order.

In the next figure, Time Discontinuity is activated in the same scene. Now, the position of the first and last shot clips have been swapped. Even though the action on the character track has not changed, because the shot clips that have been moved with Time DIscontinuity activated, the first shot refers to the end of the action and the last shot refers to the beginning of the action.



A. **Last shot clip of character falling is at the beginning of the take** *B.* **First shot of the character walking is at the end of the action** *C.* **Action in Character track remains unchanged**

NOTE

When Time Discontinuity is active, the Timeline indicator for both the Shot track and Character tracks play from left to right on the Shot track, but the Character track indicator jumps back and forth through the Character track animation.

■ Changing the order of events in a scene with Time Discontinuity on page 1855

Changing the order of events in a scene with Time Discontinuity

Once you build your scene with clips and tracks along the Action timeline, you can rearrange the sequence that actions occur in your scene using the Time Discontinuity option.

Activating the Time Discontinuity option splits shot clips so you can set a camera shot's duration and content separately.

To use Time Discontinuity:

1 In the Story window, assemble a group of shot clips on the Edit track.

NOTE To create shot clips, see Creating shot clips on page 1848.

2 Select Edit mode from the Story mode menu.

This enables you to read the events from the order of shot clips on the Edit track instead of the Action track.

3 Right-click a shot clip and select Make Camera Switcher current from the contextual menu.

This enables you to view the results of the Edit track in the Viewer window.

4 **NOTE** The effects of activating Time Discontinuity cannot be undone.

Right-click a shot clip and select Time Discontinuity from the contextual menu.

5 Switch to Edit mode.

This enable you to move the shot clips and slider tabs independently.

6 Do either of the following:

- Rearrange the order of events in the scene by moving the shot clips on the Edit Track. For example, you can drag the shot clip of a character falling before they slip.
- Move and resize the Slider Tabs to create looped or edited versions of the shot clips. For example, resize a slider tab so that it only captures a small moment of animation; if the resized clip is shorter than the duration of the original shot clip on the Edit track, the action loops. For more on Looping Shot clips, see Looping clips with the Time Discontinuity option on page 1856.

Looping clips with the Time Discontinuity option

Once you have built your scene with clips and tracks along the Action timeline, you can create looped sequences in your scene using the Time Discontinuity option.

To loop clips:

1 In the Story window, assemble a group of shot clips on the Edit timeline. See Creating shot clips on page 1848.

2 Right-click a shot clip and select Make Camera Switcher current from the contextual menu.

This enables you to view the results of the Edit track in the Viewer window.

3 **NOTE** he effects of activating Time Discontinuity cannot be undone.

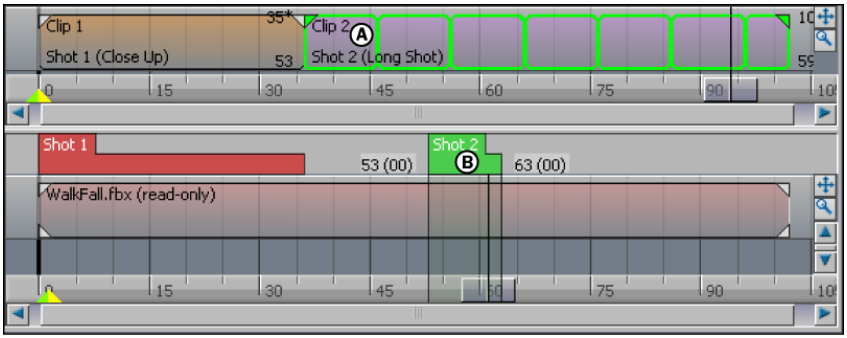
Right-click a shot clip and select Time Discontinuity from the contextual menu.

4 Switch to Edit mode.

This enable you to move the shot clips and slider tabs independently.

5 Resize a shot Slider tab so that it only captures a small moment of animation.

If the resized clip is shorter than the duration of the original shot clip on the Edit track, the action loops.



Looped shot clip *A.* **Looped clip playing six and half times** *B.* **Resized shot Slider tab**

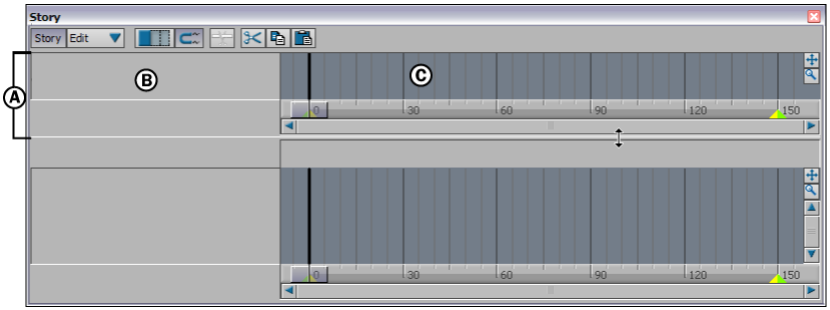
When you play the take, watch the two timeline indicators play. The Action track plays normally through the looped action while the Edit track's timeline indicator plays the resized Shot slider tab repeatedly, showing that the segment is looped.

Edit Track list

The Edit Track list is where you create camera switches along the timeline using tracks and camera shots. The Edit timeline works with scenes built along the Action timeline. When you create a shot clip, a shot slider is also created.

The Edit Track list consists of the controls for the tracks it contains and the Edit timeline. See:

- Edit timeline on page 1858
- Shot track controls on page 1859



Story window *A.* **Edit Track list** *B.* **Edit Track controls** *C.* **Edit timeline**

To play the results of the Edit Track list, select the Edit option from the Story Mode menu. See Story Mode option and menu on page 801 for more information.

You can insert three different types of tracks in the Edit Track list: Shot, Audio and Video. The Shot track is unique to the Edit Track list. (See Story clips on page 1777 for information on other types of tracks and clips.)

A Shot track lets you create camera switches using a series of camera shots. To use a Shot track, you need to create shot clips. See Changing the order of events in a scene with Time Discontinuity on page 1855 for information on creating shots.

You can change the order of shots from the Edit Track list and play them in a different order than the animation. See Changing the order of events in a scene with Time Discontinuity on page 1855 for more information.

Edit timeline

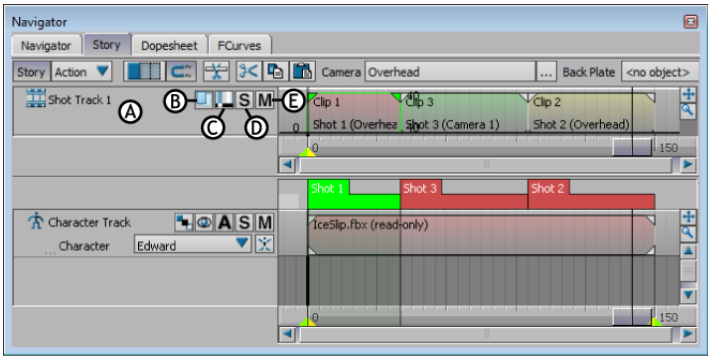
The Edit timeline displays the shot, audio, or video clips that you create and manipulate. You can add, schedule, and blend these clips along the Edit timeline.

To navigate the Edit timeline, *Ctrl*-drag to zoom and Shift-drag to scroll. You can also click in the Edit timeline and press A to frame all clips. See Story window time range on page 1740 for information on changing the time range.

NOTE Shot clips are unique to the Edit timeline.

Shot track controls

In the Edit Track list, the Shot track controls let you move, stretch, and activate or disable tracks. Selecting a Shot track using its track controls lets you view additional track options in the Asset Settings window and Properties window.



Story window *A.* **Shot track** *B.* **Show Front Plate option** *C.* **Show Back Plate option** *D.* **Solo option** *E.* **Mute option**

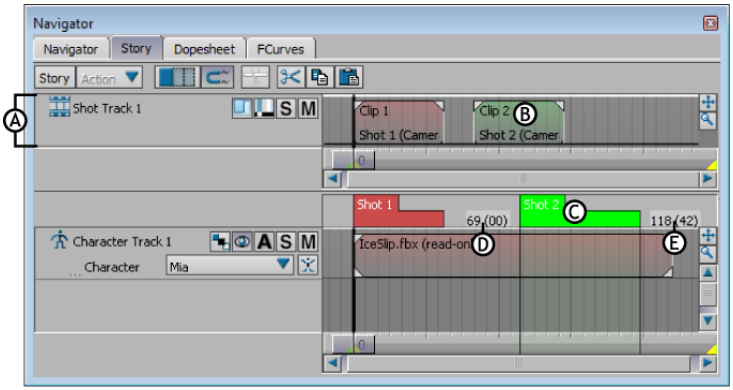
The Track controls of a Shot track consist of the following:

Option	Function
Show Front Plates	When the Show Front Plates option is active, the back plates of all shot clips on the selected track do not display. See Front Plate menu on page 1862.
Show Back Plates	When the Show Back Plates option is active, the back plates of all shot clips on the selected track do not display. See Back Plate menu on page 1861.
Solo	Use the Solo (S) option to activate or disable tracks. When a track's Solo option is active, only that track plays.
Mute	Use the Mute (M) option to activate or disable tracks.When a track's Mute option is active, the track is muted when you play a take. This means that any animation, video, audio, command, or constraint clip on a muted track is disabled.

NOTE All these options also appear in the Asset settings window if you double-click an empty area of the Shot track.

Shot settings

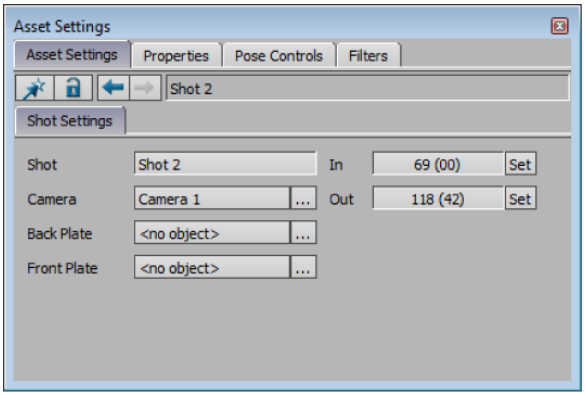
Each Shot clip (B) you create has a shot (C), which is represented by a slider that resembles a colored tab that sits above the Action timeline.



Story window *A.* **Shot track** *B.* **Shot clip** *C.* **Shot** *D.* **In field** *E.* **Out field**

This section describes the settings that display when a shot is selected. When you double-click a shot, its settings appear in the Asset Settings window. In the Story layout (Ctrl-Shift-5), the Asset Settings window displays to the right of the Story window.

NOTE The Shot settings also display when a shot clip is selected in the Edit Track list.



Shot settings display in Asset Settings window

Shot field

The Shot field lets you rename a shot. The shot's name also displays on the shot slider and at the bottom of the corresponding shot clip.

Camera menu

The Camera menu indicates which custom camera is associated with the shot and lets you select a different custom camera for each shot. Click the Camera button [...] next to the menu to select from a list of custom cameras in the scene.

Click the Remove or Remove All button at the bottom of the menu to remove the camera from the list.

The Camera menu also appears at the top of the Story window when you select a shot clip in the Edit Track list. The corresponding shot clip also displays the name of the selected custom camera.

Back Plate menu

The Back Plate menu lets you select a back plate image for each shot. Click the Back Plate button [...] next to the menu to select from a list of media in the scene.

The back plate is attached to the shot clip, not the camera, so you can assign different back plates to multiple shot clips even when the clips use the same camera.

The Back Plate menu also appears at the top of the Story window when you select a shot clip.

You can choose to show or hide the Back plate images without detaching them from the shots. See Shot track controls on page 1859.

Front Plate menu

The Front Plate menu lets you select a back plate image for each shot. Click the Front Plate button [...] next to the menu to select from a list of media in the scene.

The front plate is attached to the shot clip, not the camera, so you can assign different front plates to multiple shot clips even when the clips use the same camera.

The Front Plate menu also appears at the top of the Story window when you select a shot clip.

You can choose to show or hide the Front plate images without detaching them from the shots. See Shot track controls on page 1859

In field and Out field

The In field lets you change a shot's In point. The Out point field lets you change the Out point of a shot.

A shot's In and Out points can be different than its shot clip's In and Out points when the Time Discontinuity option is active. See Time Discontinuity on page 1751.

Edit track contextual menus

Right-click on a shot clip or shot track in the Edit Track list to access contextual menu options. These contextual menu options are similar to those that appear when you right-click on a clip or track in the Action track list.

NOTE This topic includes only the contextual menu items that appear only for the Edit Track list. For information on the contextual menu options such as Insert, Make Camera Switcher Current, and Plot Shot Tracks, see Story contextual menu on page 1745.

The Import Camera Switcher From and Export To Camera Switcher contextual menu items appear when you right-click a selected Shot track.

The Select Camera and Make Camera Current contextual menu items appear when a clip is selected in the Story window.

Option	Function
Import Camera Switcher From	The Import Camera Switcher From menu lets you move these camera switches created with the Camera Switcher from the takes in the Transport Controls window to the Story window, where they appear as camera shots on a selected Shot track in the Edit Track list. This option is active when a Shot track is selected.
Export to Camera Switcher	The Export to Camera Switcher menu lets you plot camera switches from a single Shot track to a take. This lets you use the camera switches in the Camera Switcher settings. See Camera switcher on page 483 for more information. This option is active when a Shot track is selected.
Select Camera	Select Camera lets you select a shot clip's camera. This option is active when you select a shot in the Edit Track list.
Make Camera Current	Make Camera Current switches the camera view in the Viewer window to a camera that can be used by a camera shot. The Make Camera Current option is available when a shot is selected in the Edit Track list.

Reusing camera clips

You can modify and reuse camera animation clips for use in other projects.

To save a camera clip so you can reuse it:

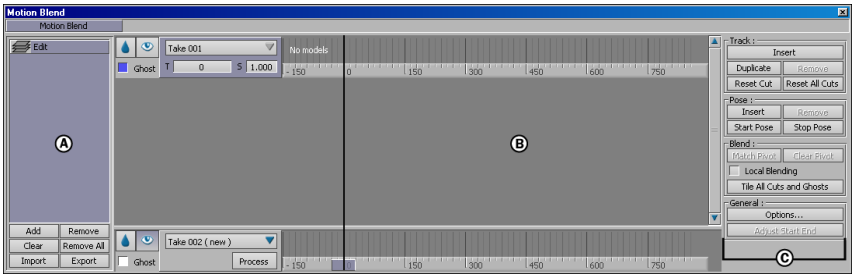
1. Activate the track's Animate option.
2. Right-click the camera clip and select Make Writeable. Black stripes appear on the clip.
3. Make modifications to the camera animation.
4. When you are finished, right-click the clip and select the Make Clip Read-Only option from the contextual menu. You can also select Export Clip.

A Save Clip dialog box appears so you can save your clip.

- Make Clip Writable on page 1792

Part 14: Blending Takes

The Motion Blend window lets you blend two or more takes of the same character to create a take. You can also blend sections of the same take to create an animation cycle that you can use later in the Trigger window.



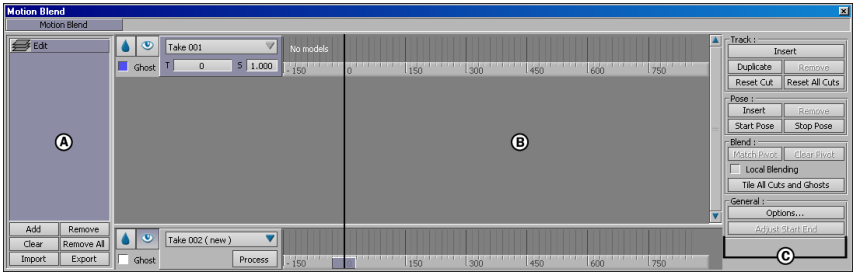
During blending, the Motion Blend window also lets you alter the timing of takes. This is useful if you want to match the speed of movements over different takes.

Before you use the Motion Blend window, you need a model, a skeleton, or a Control rig on which at least one take is plotted.

NOTE

Before using the Motion Blend window, disable all constraints driving the animation. Otherwise, the movement you view may not accurately reflect the raw data you are blending.

To display the Motion Blend window, select Window > Motion Blend in the menu bar.



Motion Blend window *A.* **Edits pane** *B.* **Track list** *C.* **Motion Blend Options pane**

When you open the Motion Blend window, an edit containing a single track set to Take 001 is automatically added. The track contains no models, sensors, or Control rigs, as indicated by the "No models" text in the first track of the Track list.

The Motion Blend window does not support shapes or morph targets. You can only blend translation, rotation, and scaling.

The Motion Blend window consists of the following:

- Edits Pane on page 1871
- Track list on page 1872
- Motion Blend Options pane on page 1878
- Blend Editor on page 1885

See Motion Blend shortcuts on page 1886 for information on using shortcuts with this window.

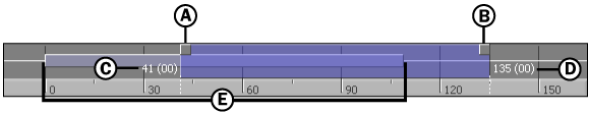
Cuts

In the Motion Blend window, a cut is a section of a take's animation. You can edit and blend cuts to create a take.

Each cut has its own color that corresponds to the color of its ghost, pose, and root. If a preceding cut blocks a cut on another track entirely, the cut displays in gray. Gray cuts are not included in the Result track and no blending occurs. When blends are created in the Result track, the colors of the blending cuts merge.

By default, cuts have the same length as the track's take, which is represented by the blue bar on each track. There are two ways to change the length of your selected cut:

- Drag the Start and End Cut handles (A and B).
- Double-click the Start and End Cut time codes to enter a specific number (C and D).

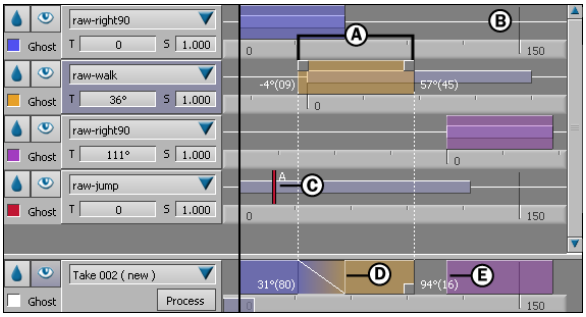


A. **Start Cut handle** *B.* **End Cut handle** *C.* **Start Cut time code** *D.* **End Cut time code** *E.* **Blue bar representing the length of the take**

You can also move a cut independently of the take in one of the following ways:

- Drag the cut left or right.
- Translate the track using the T field in the Take box. See Producing an exact translation on page 1869.

A standard blend is created when two cuts partly overlap, creating an area where the animation of both cuts is mixed. Blends appear in the Result track.



A. **A cut** *B.* **White line representing the blending object** *C.* **A pose** *D.* **A blend** *E.* **A gap where interpolation occurs**

Interpolation occurs in a gap between two cuts in the Result track. The data in the space between the cuts is interpolated from the last position of a cut to the first position of the next cut.

To move the cut back to its default length and location over the take's track, click Reset Cut or Reset All Cuts.

Result track

Every edit has a Result track where all the cuts in an edit are combined to create blends, gap interpolations, speed changes, and other edits. You can use the Result track to create a take by clicking Process. See Resizing the Result take on page 1870.

Creating a blending object

Before you can create a blend, you must *Alt*-drag the blending object into the empty track in the Cut area.

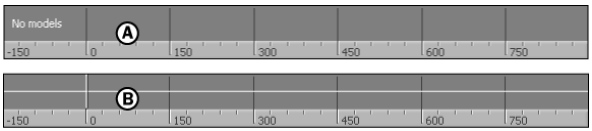
The blending object can be any selection of nodes or sensors with captured data, a part or complete hierarchy of models with plotted data, or a Control rig. Only these objects are modified when you create blends in the Motion Blend window.

Each track in an edit uses the same models, sensors, or skeleton for its blending object.

To select a blending object, *Alt*-drag the selected nodes into an empty track. The blending object appears as a white line in each track, representing the animation data you want to blend.

You must select the blending object before you can create an interpolation, standard blend, local blend, or pose blend in your edit.

You can change the blending object at any time by *Alt*-dragging a set of models, sensors, or skeleton joints into the Cut area of any track.



A. **A track without a selected blending object (No models)**
B. **A track with a defined blending object**

Changing the speed of a track

To change a track's speed in the Motion Blend window, do one of the following:

- Double-click the S field in the selected track's Take box. Type in the exact speed (time scale) increment, and press Enter.
- Click the S field in the selected track's Take box. Drag right or left to increase or decrease the speed.
- Press and hold S while dragging right or left inside the selected track.

For information on changing the scale of the Result track, see Resizing the Result take on page 1870.

Producing an exact translation

To produce an exact translation in the Motion Blend window, do one of the following:

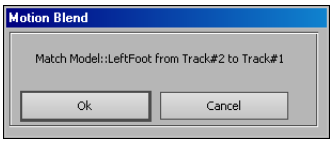
- Double-click the T field in the selected track's Take box. Type in the translation increment, and press Enter.
- Click the T field in the selected track's Take box. Drag right or left to increase or decrease the translation value.
- Press and hold T while dragging right or left inside the selected track.

Match Selection

When you use the Motion Blend window, you can blend takes with Match Selection. Match Selection matches the position and rotation of two ghosts based on their positions in a specific frame.

Use Match Selection to blend two tracks together when the blending object is in a different location, or facing a different direction on each track. You can also use it to blend together different parts of the same take, in which the character is in the same location for both tracks.

Match Selection matches the ghost whose node you select in the Viewer window to the corresponding node of the ghost whose Take box is selected. A dialog box appears asking if you want to match the selection.



Match Selection dialog box

You can match any ghosts in your scene, regardless of the order in which they appear in the Cut area. Match selection works with both poses and cuts.

Match Selection is always performed on the current frame and can be located anywhere on the Result track. It does not have to be within a blend.

Match Selection is not limited to using the blending object. It can use any part of a character, such as a bone, node, or sensor, to match the position and rotation of the character on each track.

You can override a Match Selection by performing another Match Selection using the same tracks. Since Match Selection can be done once per Result track, any other matching on the same Result track overrides the previous ones. If you need to match the position of ghosts more than once per result track, see Match Pivot on page 1882 for more information.

MotionBuilder rotates the character in the second track on the Y-axis and translates it along the X and Z-axes until the reference points of both characters match. The Match Selection is constrained to rotation in Y and translation on the XZ grid so that the matched character respects the floor. This ensures that the character does not end up diagonal to the floor.

Once the Match Selection is finished, you can fine-tune the match by translating or rotating the character using its root.

Resizing the Result take

If you scale a track so that the Result take is longer than the current take's duration (shown in the Action timeline), the Result track may not play the entire take. It may start playing in the middle of the track or end before the entire edit finishes playing. This happens because the timeline only plays between the Start and End time codes on the Action timeline.

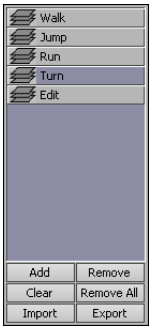
To correct this problem, resize the Result take by changing the values in the Start and End time code fields in the Transport Controls window. You can also click Adjust Take Start & End in the Motion Blend Options pane, or F-click in the Action timeline.

Changing the duration of the Action timeline adjusts the Result take's Start time code to where its data or animation begins, and its End time code to where the take's data or animation ends.

You can also automatically resize the Result track by selecting Tile All Cuts and Ghosts, though this also moves the cuts. See Tile All Cuts and Ghosts on page 1884.

Edits Pane

Use the Edits pane to add, remove, clear, rename, import, or export edits.



Edits pane

The Edits pane contains the following buttons:

Add

Adds an edit. An edit is a collection of tracks and their corresponding takes, cuts, and blends. Each edit has its own Result track and an independent memory of its start and end times.

A MotionBuilder scene can have any number of edits. By default, a new edit is named "Edit". To rename an edit, double-click it, type in the name, and press Enter.

By adding more than one edit, you can have several versions of the same blends, which use different stabilizing, match selection, match pivot, and cut settings.

Remove

Deletes a selected edit.

Clear

Removes all tracks, cuts, and animation from the selected edit.

Import and Export

Let you import or export all selected edits as a *.nle* file. You can only import a *.nle* file that was exported using the Export button in the Edits pane.

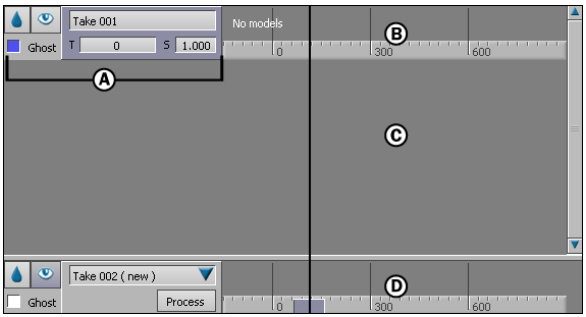
When you export edits, all edits for your current scene are exported in one *.nle* file. You cannot export only one edit at a time if there is more than one edit in your scene.

Remove All

Deletes all edits except for the default edit, which it clears.

Track list

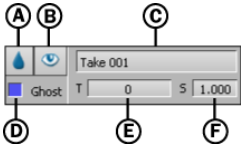
Use the Track list to manipulate each track's take, translation, speed, and ghost. The Track list also lets you select the parts of each take, known as *cuts*, that you want to blend.



Track list *A.* **Take box** *B.* **Track** *C.* **Cut area** *D.* **Result track**

Take Box

To select a track, click in the track's Take box. The Take box displays in blue.



Take box *A.* **Ghost Root selector** *B.* **Viewer Focus button** *C.* **Take menu** *D.* **Ghost option** *E.* **Time Offset (T)** *F.* **Time Scale (S)**

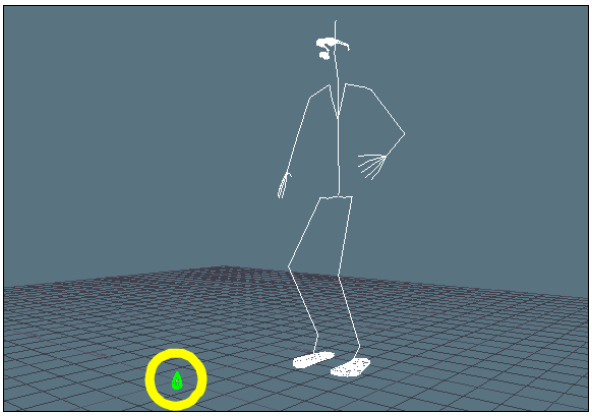
When the Take box is selected, you can duplicate and remove tracks, insert and remove poses, and perform Match Selection on the selected track. A Take box has the following options that let you select and modify ghosts and tracks to create blends in your scene:

- Ghost Root selector on page 1873
- Viewer Focus button on page 1874
- Ghost option on page 1875
- Take menu on page 1876
- Time Offset (T field) on page 1876
- Time Scale (S field) on page 1876
- Process button on page 1877

Ghost Root selector

The Ghost Root selector selects the corresponding track's root. You can also double-click the root in the Viewer window to select it, though this method may cause you to select the wrong root. When you select the root of the ghost for a given track, everything else is deselected.

In the following figure, the root displays green in the Viewer window because it is selected using the Ghost Root selector.



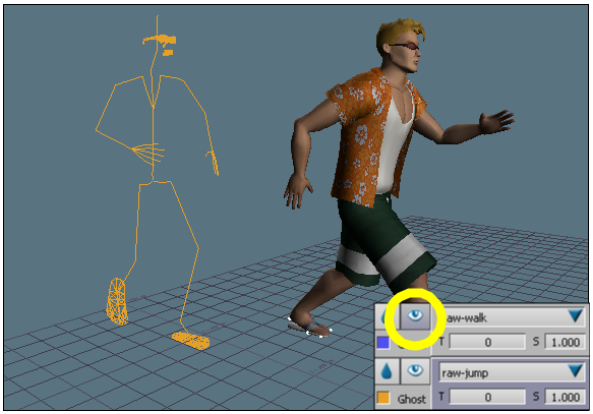
Root displayed in green

Roots are used to apply transformations to a ghost, pose, or model in the Viewer window.

Viewer Focus button

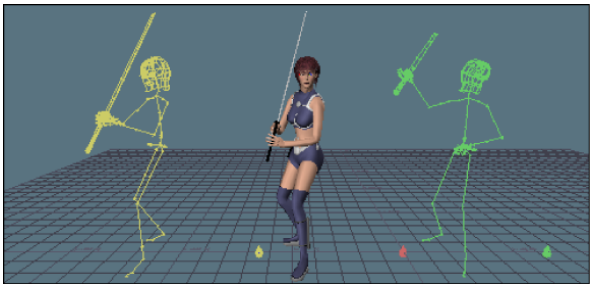
The Viewer Focus button renders the current track's blending object in the Viewer window. Only one track can be rendered in the Viewer window at a time.

In the following figure, the Viewer Focus button is selected in the second track's Take box, so the skeleton for this track displays fully rendered. The blue skeleton is the active ghost from the first track's Take box.

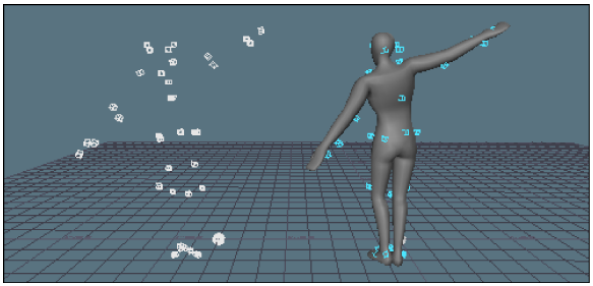


Viewer Focus button selected in the second track's Take box

When a blending object is not rendered, it appears as a ghost. For example, the following figure shows animation on three tracks, one of which is rendered. The blending object is a character's skeleton. The same example is shown in the following figure, but the blending object is a set of optical sensors.



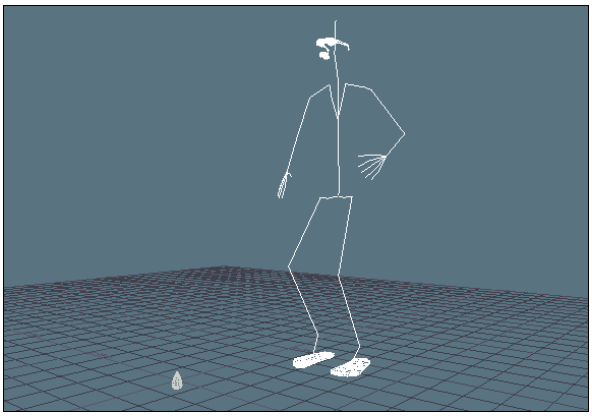
Ghost tracks and rendered track (model's skeleton)



Ghost tracks and rendered track (sensors)

Ghost option

The Ghost option lets you show and hide ghosts in the Viewer window. A ghost is a simple wireframe representation of the blending object. There is a separate ghost for each track, including the Result track.



Motion Blend ghost in the Viewer window

NOTE Motion Blend ghosts only display when the Motion Blend window is open. You can only see ghosts in the X-Ray or Normal viewing mode.

You can also activate Show All Ghosts in the General options to display all the ghosts in your scene. See Show All Ghosts on page 1884.

Take menu

Use the Take menu to select the take for each corresponding track.

If the track's take contains data, a blue bar appears in the corresponding track showing the total length of the take. A cut of the same length is automatically added.

Time Offset (T field)

After you position or resize a cut, you must translate the track to create the proper blend or interpolation. When you translate a track, the track's cut moves with the take.

Time Scale (S field)

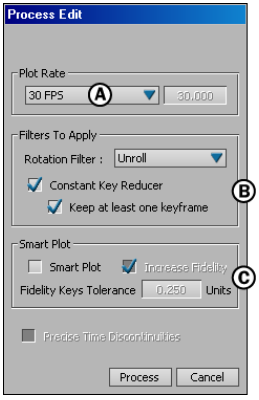
You can alter the scale of each track to speed up or slow down its cut. For example, this is useful if you want to speed up a walk cycle or slow down a few steps in a run cycle.

Process button

Click the Process button in the Result track to create a take based on the information in your Result track.

When you click Process, a Process Edit dialog box appears, letting you specify a frame rate and select filters.

See Plotting character animation on page 1888 for more information.



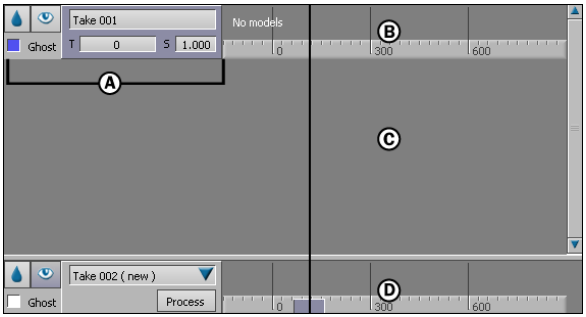
Process Edit dialog box *A.* **Plot Rate menu** *B.* **Filters To Apply area** *C.* **Smart Plot area**

Cut area

The Cut area is where all of the tracks for your edit are stored. Each track contains your blending object, a cut or a pose, and values that define when your character uses specific motion data.

The result of your edit depends on the placement and the size of the cuts and poses on each track.

To navigate in the Cut area, *Ctrl*-drag to zoom and Shift-drag to scroll. The Force Time option affects navigation in the Cut area. See Force Time on page 1884.



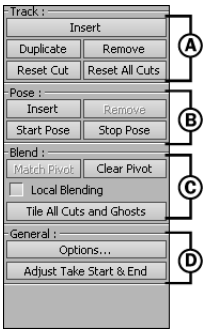
Track list *A.* **Take box** *B.* **Track** *C.* **Cut area** *D.* **Result track**

Result track

Every edit has a Result track where all the cuts in an edit are combined to create blends, gap interpolations, speed changes, and other edits. You can use the Result track to create a take by clicking Process.

Motion Blend Options pane

Using the Motion Blend Options pane, you can insert, remove, and control tracks and poses, as well as edit cuts. Each series of buttons is organized by the interface item it affects.



Motion Blend Options pane *A.* **Track options** *B.* **Pose options** *C.* **Blend options** *D.* **General options**

Track options

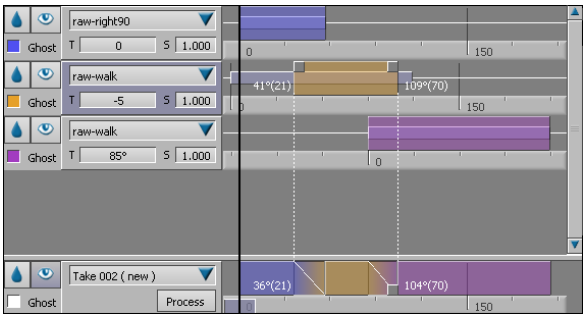
The Track options affect tracks in your edit as follows:

Insert

Adds a track in the Track list. The new track automatically contains the same take and blending object as the selected track, whose Take box displays in blue. The new cut is automatically the full length of the selected take's animation.

You should add one track for each take you want to blend. For example, if you are blending two parts of the same take, add one track for each part. Both tracks use the same take.

For example, if you are blending two takes using one cut from the "raw-right90" take and two cuts from the "raw-walk" take, you should have three tracks in total: one track for "raw-right90" and two tracks for "raw-walk".



Two takes blended using three tracks

Duplicate

Inserts a copy of the selected track at the end of the Track list.

Remove

Removes the selected track from the Track list.

Reset Cut

Moves the cut of the selected track back to its default length and location over the take's blue bar.

Reset All Cuts

Moves all cuts in the Track list back to the default length and location over each take's blue bar.

Pose options

A pose is a stationary character position set on a specific frame. To create motion cycles, you can insert poses on tracks to determine the start or end positions of characters. If you want the beginning of a cut to start at one pose and the end of the cut to finish at another pose, you need a track for each pose. The ghost of a pose appears in the Viewer window and does not move when the take plays.

Each pose has a letter to distinguish it, and a frame number that appears when you select it. When a pose is selected in the Result track, a handle appears in the middle of your cut. Adjust this handle to select when you want the blending between your cut and the pose to begin.

The Pose options affect poses and cuts within tracks.

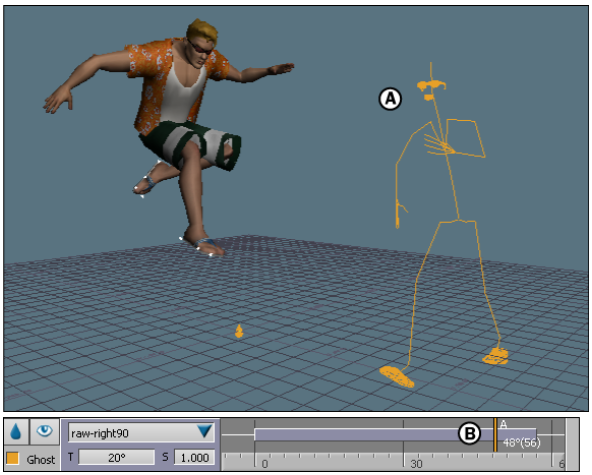
Insert

Sets a pose on the selected track at the position of the Timeline indicator. You can change the position by click-dragging the pose right or left, or double-clicking its value and typing in a frame number.

A pose is selected when its frame number is visible. The ghost of the pose displays in a static position in the Viewer window. You can no longer see the ghost's movement when you play the take.

The line representing your pose in the Cut area displays in the same color as the corresponding ghost, root, and cuts for its track.

In the following figure, the track's ghost (A) displays for Pose A beside the rendered figure of another track. The frame number on Pose A indicates that the pose is selected. The line of the pose is the same color as its ghost.



A. **Track's ghost displays for Pose A** *B.* **Frame number on Pose A indicates the pose is selected**

You can use multiple poses, which are differentiated by sequential alphabetical tagging, in an edit.

For pose blending to work properly, you must translate and rotate the location of the pose's ghost before you set the Start or Stop Pose. This prevents jumps and slides that occur if the ghost of the pose is not standing in the same location or facing the same direction as the character at the start of the cut.

NOTE

You can only use poses on skeletons with plotted animation.

Remove

Removes the selected pose and renames remaining poses. For example, if you remove Pose A and there is a Pose B and a Pose C, the last two poses are renamed A and B.

Start Pose

Defines a pose for the beginning of the Result track. If there is more than one pose, click Start Pose repeatedly to cycle through the available poses. Start Pose can also remove the defined pose from the beginning of the cut in the Result track.

Stop Pose

Defines a pose for the end of the Result track. If there is more than one pose, click Stop Pose repeatedly to cycle through the available poses. Stop Pose can also remove the defined pose from the end of the cut in the Result, and create loops.

Blend options

The Blend options affect blends that occur when two cuts from different tracks overlap.

Match Pivot

Match Pivot matches the position and rotation of two ghosts based on a specific pivot point, called a stabilizing object. This process creates a smooth blend without jumps or other anomalies in the animation sequence.

A stabilizing object is a sensor, a node from a skeleton, or a model from a hierarchy of models that stabilizes the entire blending object and corrects problems such as foot sliding. The stabilizing object must be part of the blending object.

Alt-drag the stabilizing object into a blend or interpolation in the Result track during the Match Pivot process. Match Pivot rotates the character along the Y-axis and translates the character along the X- and Z-axes so that the location of both characters match.

Match Pivot is only available when the Timeline indicator is over a blend or interpolation containing a pivot.

It is best to use Match Pivot for an edit that has many blends in need of stabilizing. Match Pivot always matches the first part of the last cut to the last part of the first cut that frames your blend or interpolation.

To use Match Pivot, you must define a stabilizing object (which must be part of the blending object) and the Timeline indicator must be within a blend or interpolation. Match Pivot updates automatically if you drag a stabilizing object into the blend or interpolation in your Result track.

You can perform one Match Pivot per blend or interpolation in your Result track. You cannot use Match Pivot with poses. See Match Selection on page 1869” if you are using poses.

Clear Pivot

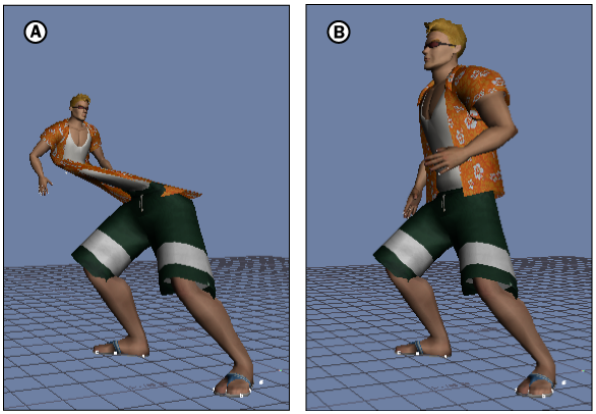
Removes the pivot point from the current blend. This button is only available when the Timeline indicator is over a blend or interpolation containing a pivot.

Local Blending

Snaps the blending object to the take of the skeleton in the Current Take field.

NOTE Local blending only works on skeletons with plotted animation.

Local blending is a special method of blending takes. It creates blends by replacing the motion plotted to part of a hierarchy in one take with motion from another take. Local blending lets you blend part of the body, such as an arm or the torso, with the rest of the body.



A. **Local Blending option disabled** *B.* **Local Blending option activated**

For example, the previous figure shows a character before and after the Local Blending option is active. One cut animates the character's lower body, while another cut animates the character's upper body. When the Local Blending option is disabled, the animation of the upper body and the lower body do not blend properly. When the Local Blending option is active, the animation blends without distorting the character.

All the takes you use during a Local blend must contain motion data plotted to the same skeleton. For best results, the take in the Current Take field should be the same as the take in the Result track's Take menu. You should select a stabilizing object for your local blend if the blending object is made up of the bones or nodes of a character's leg.

Local blending can occur only when the Local Blending option is active.

Tile All Cuts and Ghosts

Offsets all tracks in the Cut area so that there are no blends or interpolations between your cuts. Tile All Cuts and Ghosts automatically triggers the Adjust Take Start & End feature to adjust the start and end times of the Result take and of the Current take.

After you create an animation cycle, you should test it to make sure that the last pose matches the first pose. You can accomplish this by creating an edit and using the Tile All Cuts and Ghosts feature.

General options

The General options work with many different elements in the Motion Blend window.

Show All Ghosts

Displays all of the ghosts for the selected edit in the Viewer window. All ghosts are visible when the Show All Ghosts option is active; all ghosts are hidden when this option is disabled.

You can still select the ghosts of individual tracks that you want to display or hide by activating and disabling the Ghost options in their respective Take boxes. For more about viewing ghosts, see Ghost Root selector on page 1873 and Ghost option on page 1875.

Snap On Frames

Forces the start and end times of all cuts and poses to snap to the nearest frame.

Force Time

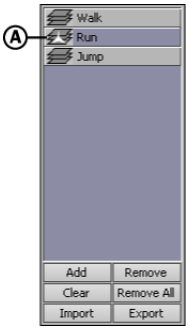
Snaps the Timeline indicator in place so that it cannot be moved by dragging.

When you activate Force Time, you must navigate in the Motion Blend window by Shift-dragging (translating) and *Ctrl*-dragging (scaling).

Keep Edit Active

Allows the result of an edit to be shown while you are working on other edits. This is helpful when you want to see the animation of one edit while working on another.

When Keep Edit Active is enabled, a white icon displays in the Edits pane to show that it is active.



Edit pane *A.* **Keep Edit Active applied**

Keep Edit Active does not show its effects outside of the Motion Blend window, and you can only have one active edit at a time.

Adjust Take Start & End

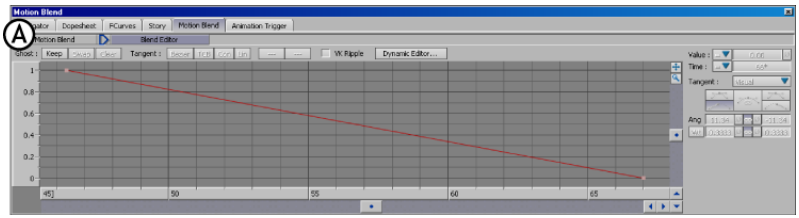
Adjusts the start and end times of the take to match the beginning time of the first cut and the end time of the last cut in the Result track.

NOTE

Be careful when using Adjust Take Start & End since it also changes the start and end times of the current take shown in the Current take field.

Blend Editor

When blending two or more tracks, the Result track shows each blend. By default, this blend is linear. Using the Blend editor, you can change the interpolation of the blend to create a custom blending curve.



Blend editor

To access the Blend editor, double-click a blend in the Result track. When you set keyframes in the Blend editor, the keys appear on the Action timeline.

To exit the Blend editor, click the Motion Blend button in the top-left corner of the Blend editor pane.

Motion Blend shortcuts

You can use the following shortcuts in the Cut area of the Motion Blend window:

Shortcut	Description
T-drag	Translates a selected track.
S-drag	Changes the scale or speed of a selected track.
Ctrl-drag	Zooms the view in and out.
Shift-drag	Scrolls the view left and right.
Ctrl-*Shift*-click	If the Timeline indicator is not in the Cut area, you can make it reappear by *Ctrl*-*Shift*-clicking on the timeline. The Timeline indicator jumps to where you *Ctrl*-*Shift*-click. This short-cut only works when Force Time is disabled in the Motion Blend Options pane.
A-click	Frames all active cuts in the Cut area.

Part 15: Plotting Animation

After creating the animation, you need to plot the animation if you want to import it into other compatible 3D software. Plotting is sometimes referred to as 'baking' or 'transferring', because it transfers all animation in your scene to selected models.

When you have keyframes on multiple layers, you can also plot to merge the animation from all layers to the Base Layer. Smart Plot options let you determine the number of keyframes that are added during the plotting process, to simplify editing the plotted animation.

Plotting animation also lets you create motion clips you can use in the Story window and in the Animation Trigger window.

In MotionBuilder, there are many different plotting options, depending on what you are doing, and what type of animation you are working with.

For more information on plotting, refer to the following topics:

- The plotting process on page 1887
- Plotting character animation on page 1888
- Plot for export from the Story window on page 1889
- Plotting animation to a character's skeleton on page 1890
- Plotting animation to a Control rig on page 1890
- Plotting facial animation on page 1891
- Plotting in the Story window on page 1892
- Plot Properties window on page 1893

The plotting process

The plotting process transfers all animation data from your take to a selected model. When working with multiple layers, plotting also merges the animation

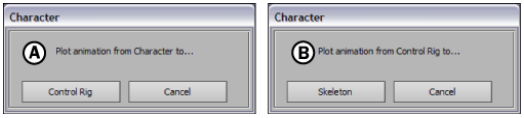
from all layers to the Base Layer. Plotting can let you simplify keyframing as well as export animation to other software.

You can choose to plot selected properties or all properties using the Key Controls window and the menu bar.

Plotting from other areas

You can plot from a number of different areas while you work, such as the Character, Actor Face, and Character Face settings, depending on what you are doing.

For example, clicking Plot Character in the Character settings opens the Character dialog box, letting you plot to a Character's Control rig. After you plot to a Control rig, you can then click Plot Character once more to plot to a skeleton. Using the Plot Character option lets you access additional options, such as the Plot Translation On Root Only option on page 1905 and the Plot Extensions option on page 1904.



Plotting Character *A.* **Plot to Control rig** *B.* **Plot to Skeleton**

To plot all properties, select Plot Selected (All Properties) from the Animation menu in the menu bar or in the Key Controls window. In the window that appears, select your plotting options, then click Plot.

To plot selected properties, select Plot Selected (Selected Properties) from the Animation menu in the menu bar or in the Key Controls window, select your plotting options from the window that appears, then click Plot.

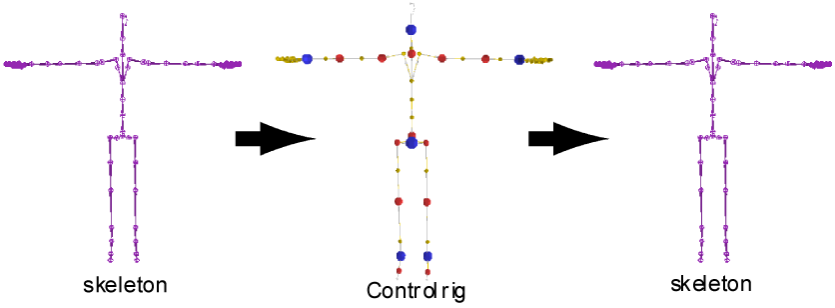
- Key Controls window on page 843
- MotionBuilder menu bar on page 13

Plotting character animation

When you first import an animated model into MotionBuilder, all of the animation data for that model is contained in the skeleton's bones. To edit the animation, you must first plot the animation to a Control rig.

When you are finished creating or modifying the animation on the Control rig, before you save, you can plot the animation back to the model's skeleton

as shown in the following figure. This prepares your animation data to be exported so you can work with it in other software packages.



Plotting animation for export

- Setting up a character on page 1269
- Control rigs on page 1431
- Plotting animation to a Control rig on page 1890
- Plot Extensions option on page 1904

Plot for export from the Story window

After creating and editing a scene using the Story window, you can save the entire result to export it to other software by plotting it to the current take.

Until you plot, a scene built in the Story window is separate from the animation outside of the Story window. Plotting merges the contents of the Story window with the current take.

When the Story window is active, its contents can be included in the final scene when you plot. To plot the scene without including the contents of the Story window, you must disable the Story window. See Animating within the Story Window on page 1733 for more information.

You can plot the scene in the Story window using any plot option that appears in various MotionBuilder windows. See Plot Properties window on page 1893 for more information.

Plotting animation to a character's skeleton

Once you have a Control rig with keyframe animation or plotted animation, you can plot that data from the Control rig to your character model's skeleton. This prepares your character to be exported for use in the rest of your production pipeline.

1. In the Scene browser, make sure that the Control rig you want to transfer data from is attached to the selected character.
2. Ensure that the Active option is activated in the Character settings, enabling the link between your model and the Control rig.
3. In the Input Type field, select Control Rig Input.
4. Click Plot Character, then click Skeleton in the Character dialog box that appears.

The animation from your character's Control rig is transferred to the skeleton, and you can export the character and its animation.

- Plotting character animation on page 1888
- Plotting animation to a Control rig on page 1890

Plotting animation to a Control rig

When you first characterize a character and create a Control rig, you can plot animation from the character's skeleton to the Control rig. This lets you use the Control rig to edit the character's animation.

1. Make sure that the Control rig you want to transfer data to is attached to the selected character.
2. In the Character Settings pane, select Control Rig Output in the Input Type field.
3. Click Plot Character.
4. Click Control Rig in the Character dialog box that appears.

   The animation from your character's skeleton is transferred to the Control rig, and you can use the Control rig to edit the animation. When you are

finished editing the animation, you can plot the animation back to the character.

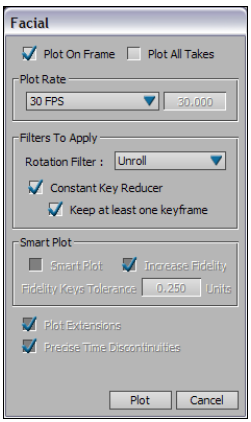
- Plotting character animation on page 1888
- Control rigs on page 1431
- Characterizing on page 1275
- Plotting animation to a character's skeleton on page 1890

Plotting facial animation

After you created your facial animation, you need to plot the animation if you want to import it into other compatible 3D software.

To plot facial animation:

1. Select the model and all its shapes.
2. In the Character Face Animation pane, click Plot Animation. (See Character Face Animation pane on page 1654.)
3. In the Facial dialog box that appears, select the plotting options you want to use.



Facial plotting dialog box

4 Select one of the two plotting options in the Facial dialog box:

Option	Function
Plot on Frame	Activate Plot On Frame to resample the data based on the specified frame rate, and ensure that data is plotted on exact frames. Key-frames are set on each frame of the animation. This is the default setting.
Plot All Takes	Activate Plot All Takes to plot the data from all takes to a selected model. Plot all takes to your model if you intend to export the anim-ation to other software.

5 Set any filtering options you might need.

6 Click Plot. Once all the animation is plotted to the model, you can save your *.fbx* file and import it into other compatible 3D software, or reuse it in MotionBuilder.

- Animating Faces on page 1587
- Character Face settings on page 1645

Plotting in the Story window

You can combine all the animation in the Story window with the take selected in the Transport Controls window. You can also plot the camera switches from the Edit Track list to a take, letting you use the camera switcher in the Camera Switcher settings.

To plot clip animation to the current take:

1 Right-click anywhere in the Action Track list.

2 Select Plot Whole Scene To Current Take in the contextual menu.

3 Select plotting options in the Plot Properties window that appears, then click Plot.

The animation is merged with the current take.

To plot shot clips to the current take:

1 Right-click anywhere in the Edit Track list.

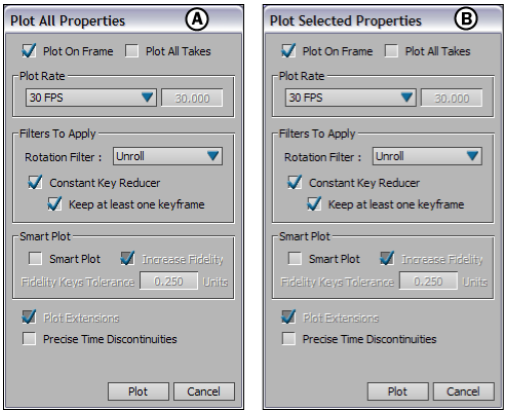
2 Select Plot Shot Track To in the contextual menu, then select either Camera Switcher - Take 001 or Camera Switcher - Take 002 (new).

3 If you select Camera Switcher - Take 001, you are asked if you want to overwrite the current take. If you select Camera Switcher - Take 002 (new), the camera switches are plotted to a new take.

- Plot Properties window on page 1893
- Camera switcher on page 483

Plot Properties window

The general plotting options are in the Plot All Properties and Plot Selected Properties windows.



Plot Properties windows *A.* **Plot All Properties** *B.* **Plot Selected Properties**

The Plot All Properties and Plot Selected Properties windows enable you to do the following:

- Plot all properties or selected properties to selected models and Character Extensions
- Plot all takes or the current take only
- Specify a frame rate to use when plotting
- Select filters to apply while plotting

NOTE The plotting options in both the Plot All Properties and Plot Selected Properties windows are identical. However, using the Plot Selected Properties dialog box plots only the selected properties, and the Plot All Properties dialog box plots all the properties in a take.

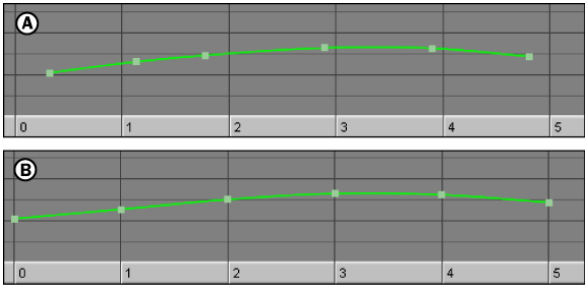
The Plot All Properties and Plot Selected Properties windows include the following options.

Plot On Frame option

Activate Plot On Frame to resample the data based on the specified frame rate, and ensure that data is plotted on exact frames. Keyframes are set on each frame of the animation.

If your take does not start or end on an exact frame, samples are taken from the frame before the beginning or after the end of the take. Plotting starts and ends on the closest exact frame.

For example, in an animation curve displays before (A) and after (B) plotting when Plot On Frames was active. The Start time code is 0 and the End time code is 5. After plotting, the keyframes are set exactly on each frame in the animation.



Plot on Frames *A.* **Original curve before plotting** *B.* **Curve after plotting with Plot on Frame**

Plot All Takes option

When activated, the Plot All Takes option lets you plot the data from all takes to a selected model. Plot all takes to your model if you intend to export the animation to other software. After you plot your data, you can disable its constraints.

When Plot All Takes is disabled, only the data from the current take is plotted to the selected model. For example, if you plot a take to a marker's Translation properties on Take 3, the marker's translation properties only contain function curves when Take 3 is the current take. If you switch to Take 2, the marker's translation properties contain no function curves.

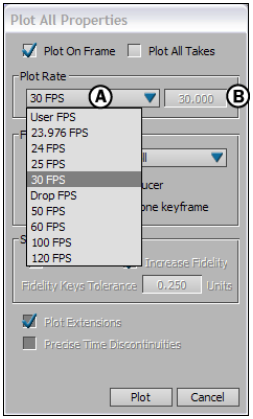
To plot the data from all takes, select the model to which you want to plot the animation, activate Plot All Takes, set other plotting options, and click Plot.

Plot Rate area

The options in the Plot Rate menu let you specify what plot rate to use when plotting the take to a selected model. Plot rate is measured in frames per second (FPS). The number to the right of the Plot Rate menu shows the frames per second of the current take.

To select a preset plot rate, choose a preset plot rate between 24 and 120 FPS in the Plot Rate menu.

To set your own plot rate, select User FPS in the Plot Rate menu, drag in the number field, or double-click in the field and type the frame rate number you want to use.

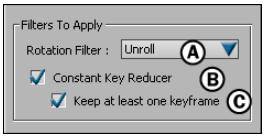


Plot All Properties *A.* **Plot Rate menu** *B.* **Plot Rate field**

NOTE Select the FPS setting in the Transport Controls window that is selected in the Plot window to see keyframes display on the selected frame rate.

Filters to Apply area

The Filters To Apply area enables you to select filters to apply when plotting. The Unroll and Constant Key Reducer filters are applied by default, but you can select your own options.



Filters To Apply area *A.* **Rotation Filter menu** *B.* **Constant Key Reducer option** *C.* **Keep at Least One Keyframe option**

The filters you can apply are:

- None
- Gimbal Killer
- Unroll
- Constant Key Reducer
- Keep At Least One Keyframe

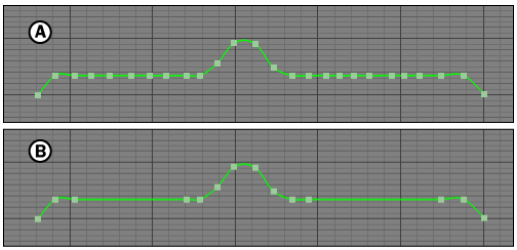
Rotation Filter menu

The Rotation Filter menu lets you to select a filtering option for rotation animation, including compensating for gimbal locking and Euler rotation. See Rotation Filter menu options on page 1897 for descriptions of each option.

Constant Key Reducer

The Constant Key Reducer filter reduces the number of keyframes by eliminating redundant keyframes. Reducing the number of keyframes reduces the file size. This filter is active by default.

For example, the following figure shows a function curve before (A) and after (B) the Constant Key Reducer filter is applied, reducing the number of redundant keyframes used by the function curve.



Constant key reducer *A.* **Original curve** *B.* **Constant Key applied**

For more information about filters, see Filtering on page 1009.

Keep At Least One Keyframe

The Keep At Least One Keyframe option lets you retain at least one keyframe when the Constant Key Reducer option is active.

When your animation contains keyframes that have the same value, using the Constant Key Reducer may remove all of these keyframes. Enabling the Keep At Least One Keyframe option prevents this from happening.

Rotation Filter menu options

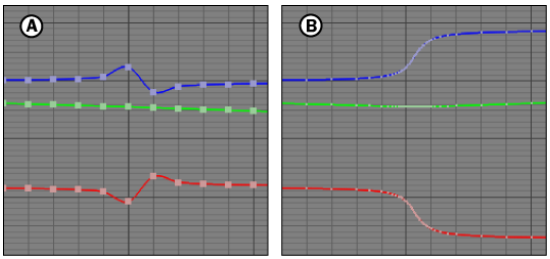
Select one of the three filtering options from the Rotation Filter menu.

None

Select None in the Rotation Filter menu if you do not want to apply any rotation filters.

Gimbal Killer

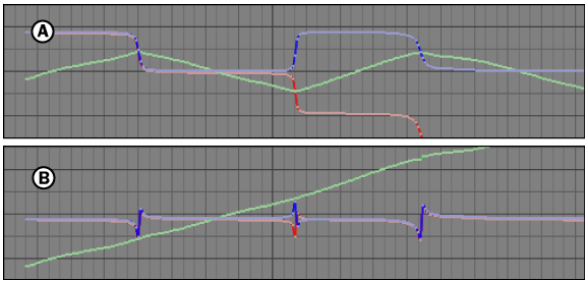
Select the Gimbal Killer option to compensate for gimbal locking effects by adding additional keyframes to your rotation function curves. These additional keyframes compensate for sudden flipping or shaking caused by the interpolation between keyframes during large rotational changes. Gimbal lock is most often encountered when you plot animation onto the skeleton of your model.



Gimbal Killer *A.* **Original curves** *B.* **Gimbal Killer applied**

Unroll

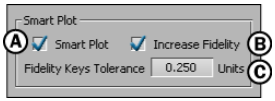
Select the Unroll option to unroll equivalent Euler rotations, making the curves continuous.



Unroll *A.* **Original curves** *B.* **Unroll applied**

Smart Plot area

The Smart Plot area contains options that let you plot keyframe animation without adding unnecessary keyframes.

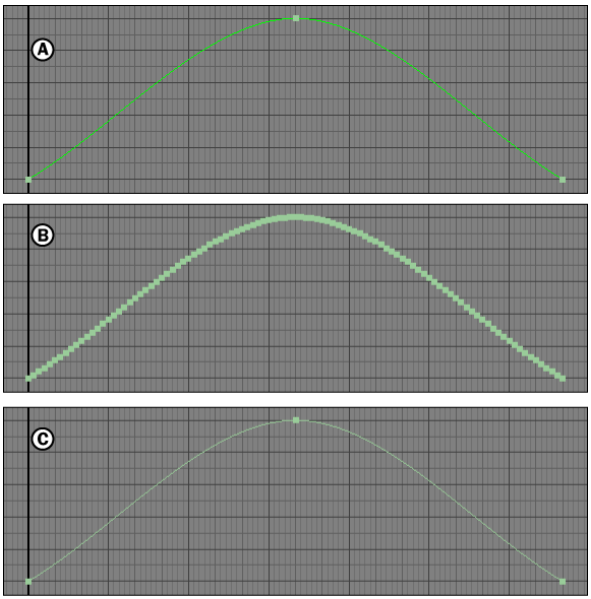


Smart Plot area *A.* **Smart Plot option** *B.* **Increase Fidelity option** *C.* **Fidelity Keys Tolerance field**

Smart Plot option

The Smart Plot option lets you plot keyframe animation without adding extra keyframes. For example, this option is useful when you want to merge the keyframes you set on many layers. Using Smart Plot, you can merge the keyframe layers without adding more keyframes, letting you continue to edit your original keyframe animation easily.

For example, plotting a function curve that has three keyframes without using Smart Plot creates many keyframes, which are too numerous to edit easily. However, when plotted using Smart Plot, the resulting animation still has only three keyframes.



Keyframe animation *A.* **Original keyframes** *B.* **Keyframes plotted without Smart Plot** *C.* **Keyframes plotted with Smart Plot**

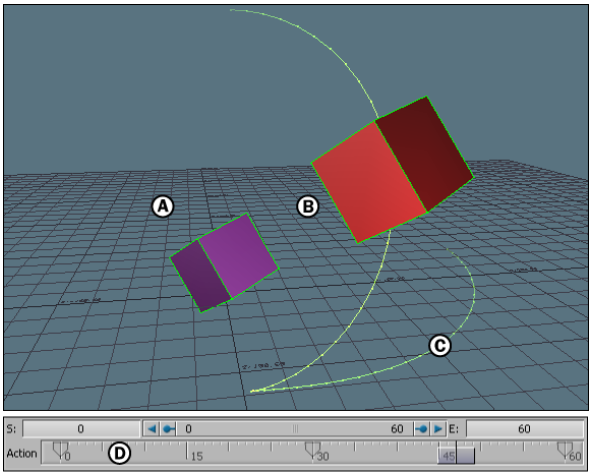
Increase Fidelity

The Increase Fidelity option lets you add the number of keyframes necessary to keep your original animation. Keyframes are added to the three curves (translation, rotation, and scaling) of each vector, making the plotted animation closer to the original animation.

There are some situations in which plotting using Smart Plot alone does not reproduce the original animation. In these cases, you can activate the Increase Fidelity option to add keyframes and correct the function curves.

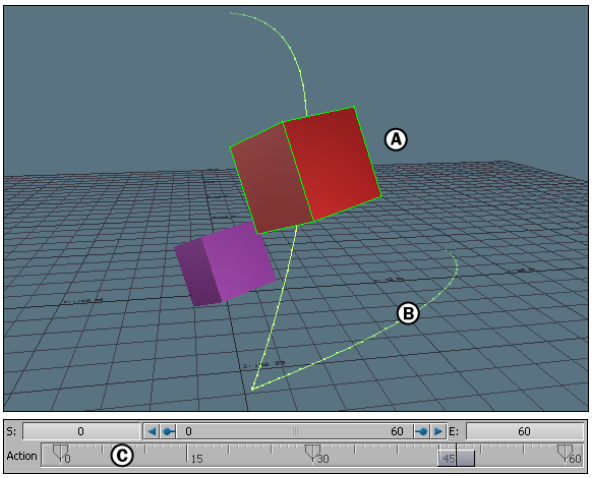
For example, Cube_source rotates to the left, then upwards. Its animation consists of three keyframes at frames 0, 30, and 60.

Cube1 is connected to Cube_source by a Parent-Child constraint, and moves beside Cube_source in two arc-like movements. No keyframes are set on Cube1, only on Cube_source.



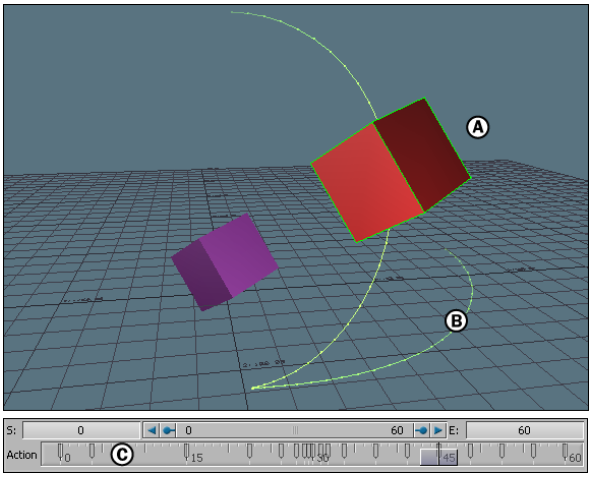
Animation using a Parent-Child constraint *A.* **Cube_source** *B.* **Cube1** *C.* **Animation Trajectory of Cube1 is curved** *D.* **Keyframes set on Cube_source at frames 0, 30, and 60**

If you plot this animation using Smart Plot without Increase Fidelity, the keyframes at frame 0, 30, and 60 are plotted to both cubes, but the animation's trajectory changes (see B in the following figure) because Cube1 needs more keyframes to retain its original animation.



Animation plotted without Increase Fidelity *A.* **Cube1** *B.* **Cube1 trajectory altered** *C.* **Three few keyframes plotted to Cube1**

If the Increase Fidelity option is active when the animation is plotted, keyframes with translation values are set to correct the function curve and retain the original animation (see B in the following figure).



Animation plotted using Increase Fidelity *A.* **Cube1** *B.* **Cube1 trajectory similar to the original animation** *C.* **Keyframes plotted to Cube1 recreate original animation**

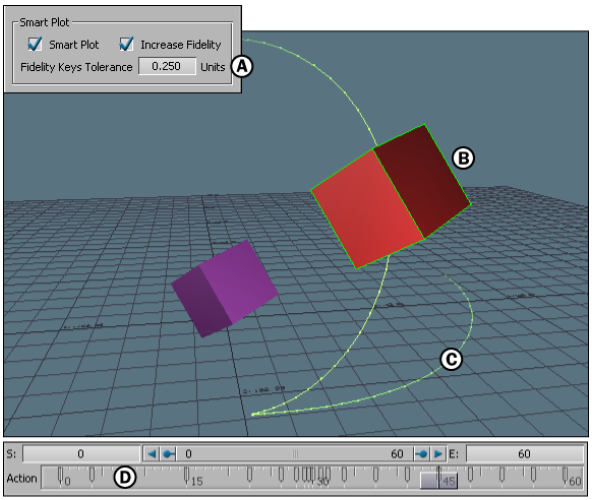
To determine the number of keyframes that are set, use the Fidelity Keys Tolerance field.

Fidelity Keys Tolerance

The Fidelity Keys Tolerance field lets you determine the plotted animation's accuracy compared to its original animation. Depending on the field's value, extra keyframes are set to duplicate the original animation.

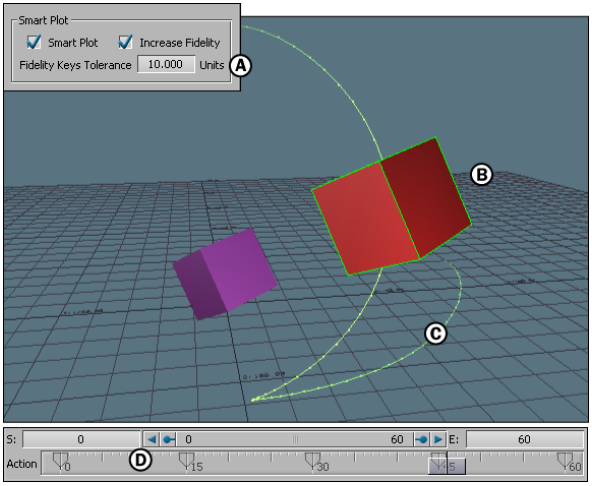
The value in the Fidelity Keys Tolerance field is a unit of measurement which represents how far, or to what degree, the plotted animation diverges from the original animation. The lower the field's value is, the more keyframes are set when plotting, correcting differences between the original animation and the plotted animation.

For example, in the following figure, the Fidelity Keys Tolerance field is set to 0.25, which is the default setting. Plotting sets many keyframes to Cube1, recreating the original animation path. However, you may not want so many keyframes.



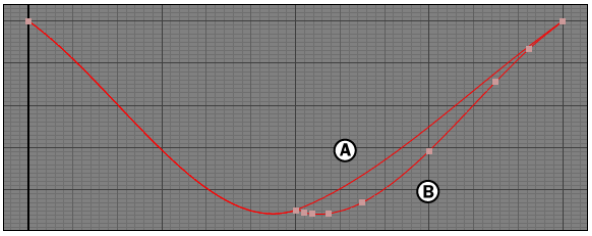
Plotting *A.* **Fidelity Keys Tolerance field** *B.* **Cube1** *C.* **Cube1 trajectory similar to the original animation** *D.* **Keyframes plotted to Cube1 recreate original animation**

When the Fidelity Keys Tolerance field is set to a higher value, plotting sets fewer keyframes, but the animation path can change depending the number of keyframes.



Plotting *A.* **Fidelity Keys Tolerance field** *B.* **Cube1** *C.* **Cube1 trajectory different than the original animation** *D.* **Five keyframes plotted to Cube1**

You can also use the FCurves window to compare the animation. For example, compare the X-axis Rotation function curves of the animation shown in the following figure A and B.



FCurves window *A.* **Rotation function curve of Cube1 with Fidelity Keys Tolerance field set to default value (0.25).** **Rotation function curve of Cube1 with Fidelity Keys Tolerance field set to default value (10.0)**

Additional plot options

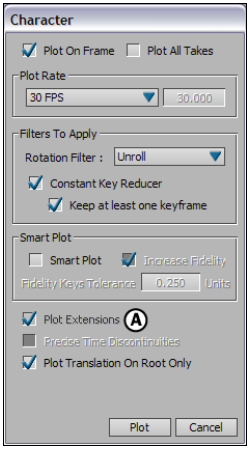
The following plot options are available in the Plot Properties window depending on what is selected in MotionBuilder and which plot option you select:

- Plot Extensions option on page 1904

- Precise Time Discontinuities on page 1905
- Plot Translation On Root Only option on page 1905

Plot Extensions option

The Plot Extension option is available in the Plot Properties window when you are plotting animation from the Control rig to the skeleton on a character that has a Character Extension. This option is only available when you plot the animation by clicking Plot Character in the Character Settings, then select Skeleton in the dialog box that follows.



Plot Properties window *A.*
Plot Extensions option

When the Plot Extensions option is active, the animation on all Character Extensions is plotted along with the rest of the character's animation. When the Plot Extensions option is disabled, Character Extension animation is not plotted.

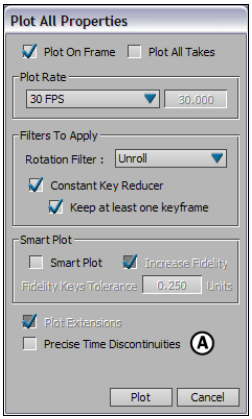
If you plot animation using an option other than Plot Character, the option is grayed out and Character Extension animation is not plotted.

In the Story window, if you want to plot Character Extension animation to the current take (see Plot Whole Scene To Current Take on page 1747), make sure that the Character Extensions option is selected in the Character track's Body Parts menu before you plot (see Body Parts menu on page 1763). If you do not want to include Character Extension animation, disable the option.

Precise Time Discontinuities

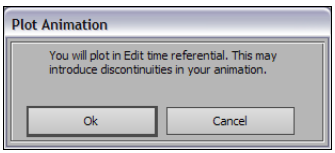
The Precise Time Discontinuities option is available when the Story Mode is set to Edit and the Time Discontinuity option is activated in the Story window.

When active, Precise Time Discontinuities plots changes in data caused by shot discontinuity. See Edit Track list on page 1857.



Plot All Properties *A.* **Precise Time Discontinuities option**

When the Story Mode is set to Edit, the Time Discontinuity option is active in the Story window, and you select an option to open a Plot window, a dialog box appears to warn you that you are about to plot animation that may be discontinuous. For more information on discontinuous animation and the Story window, see Edit Track list on page 1857.



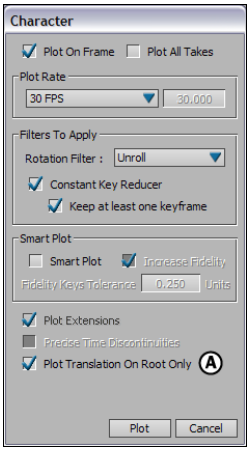
Plot Animation dialog box

Plot Translation On Root Only option

This option is available in the Plot Properties window after you click Plot Character in the Character settings and click Skeleton in the dialog box that appears. You can also access the Plot Character option in the Edit menu of the Character Controls.

This option is also available when you click Plot Options in the Batch window.

Activate the Plot Translation on Root Only option to make sure that translation animation is plotted only to the Hips of the character.



Plot Properties window *A.* **Plot Translation to Root Only option**

Plot and Cancel buttons

The Cancel button closes the dialog box without applying any options or plotting.

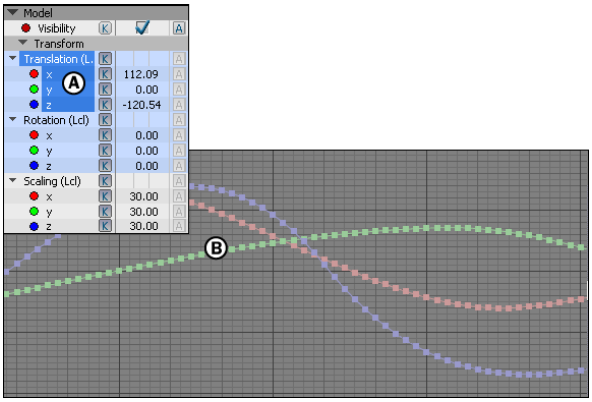
The Plot button plots the selected models and properties with the options that are set and closes the window.

Depending on your plot settings, the message "Too Many Keyframes to Edit" may appear on the Action timeline. This happens because plotting can create keyframes than can be visually represented and edited on the Action timeline. You can still edit the plotted data in the FCurves window, and you can zoom on sections of the timeline to see all keyframes.

When you plot, the data from the take (source) is applied to the selected objects (destination). When the current take is finished plotting, the data from the take is recorded to the model.

You can view your plotted data by selecting your model and viewing the function curves in the FCurves window. When you select a property on which the take was plotted, the function curve displays the plotted data. Also, these function curves display in pastel colors.

For example, the following figure shows the result of plotting a take to a cube's translation function curves in the FCurves window.



Take plotted to a marker's translation function curves *A.* **Translation function curves selected** *B.* **Animation function curves displayed**

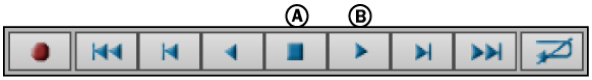
1908

Part 16: Playing Animation

The main controls for playing animation in MotionBuilder are found in the Transport Controls.

To play animation, use one of the following methods:

- In the Transport Controls, click Play to play the animation, and Stop to stop the animation.



Play Controls found in the Transport Controls *A.* **Stop** *B.* **Play**

- Press *Ctrl-Spacebar* to play the animation, and press *Ctrl-Spacebar* again to stop the animation.
- J-drag in the Viewer window or along a timeline to jog the animation. See Jogging animation on page 1909.
- Transport Controls on page 801

Jogging animation

Jogging is the easiest way to move backward and forward along the timeline at the play speed you want. Jogging also affects any audio on the timeline when the Enable Scrubbing option is active in the Audio settings.

To jog through the current take:

➤ J-drag in the Viewer window, or on a timeline.

Drag left to jog backward, or right to jog forward. The further you move the mouse pointer relative to the location in which you J-click, the faster the take plays.

■ Playing Animation on page 1909

Changing the play speed

To change the speed at which your take plays in MotionBuilder:

➤ Select a play speed in the Play speed field in the Transport Controls window.

By slowing down the play speed, you can analyze model and camera movements more easily. You can also speed up play or draw every frame.

NOTE To compensate for computer speed, frames may be dropped for playing in real time in all play speeds, excluding the ALL FR option.

■ Transport Controls on page 801

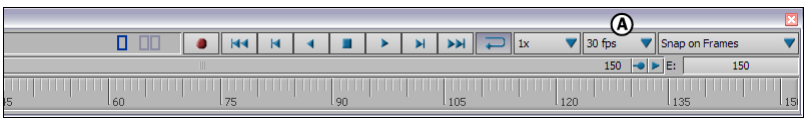
Selecting a frame rate

You can change the frame rate at which the take plays. You can select frames-per-second (fps), NTSC, or PAL formats from the menu, or use the Custom option to enter a custom frame rate. The default time format is 30 fps.

NOTE For information on changing the time display, see Selecting a time format on page 790.

To select one of the main frame rates:

➤ In the Transport Controls, select one of the options in the Time Format field.

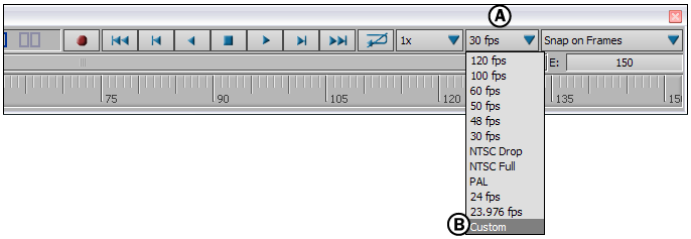


Transport Controls *A.* **Time Format field**

The frame rate is selected in the Time Format field, and the unit of measurement is changed. See Time Format menu on page 815 for more information.

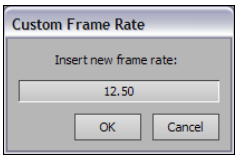
To select a custom frame rate:

1 Click the Time Format field in the Transport Controls, then select Custom from the menu.



Transport Controls *A.* **Time Format field** *B.* **Custom option**

The Custom Frame Rate dialog box appears.



Custom Frame Rate dialog box

2 Enter one of the following frame rates in the field:

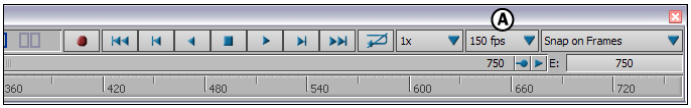
1	16	75	300
2	20	80	375
3	24	85	400
4	25	86	500
5	30	100	600
6	40	120	750
8	43	125	1200

10	44	150	1500
12	48	200	2000
12.5	50	240	2000
15	60	250	6000

NOTE If you enter a value other than one of these supported frame rates, the next highest supported frame rate is selected.

3 Click Ok or press Enter.

The custom frame rate is selected in the Time Format field.



Transport Controls *A.* **A custom frame rate is selected.**

When you save your scene, the selected frame rate is also saved.

■ Transport Controls on page 801

Using marks

You can set marks on the Action timeline in the Transport Controls to indicate areas for filtering, blending, duplicating, or looping.

To set a mark:

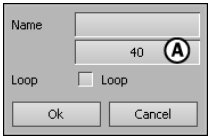
1 Right-click on the Action timeline in the Transport Controls.

2 Select Add Mark from the contextual menu.

To move a mark:

1 Double-click the mark to open the Mark dialog box.

2 Enter a frame number in the Timecode field.



Mark dialog box *A.*
Timecode field

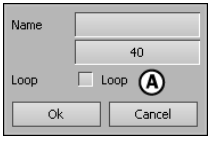
3 Click OK.

The mark moves to the frame you specify. You can also drag the mark left or right along the Action timeline.

To create a loop between marks:

1 Double-click the mark to open the Mark dialog box.

2 Activate the Loop option and click OK.



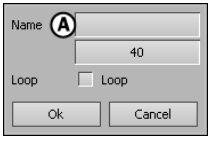
Mark dialog box *A.*
Loop option

3 Play the animation. The take loops from the beginning of the take to the current mark. If there is a previous mark, the take loops between the current and previous mark.

To name a mark:

1 Double-click the mark to open the Mark dialog box.

2 Type in the Name field to assign a name.



Mark dialog box *A.*
Name field

3 Click Ok to confirm the name.

- Transport Controls on page 801

Part 17: Triggering Animation

Characters in computer games not only walk, they also run, jump, climb, and perform a series of other realistic actions necessary to the action in the game.

You can create each of these actions as a motion clip with keyframe or motion capture data, then plot them to a character's skeleton, save them as individual *.fbx* files, and test them in the Animation Trigger window. The Animation Trigger window supports shape animation as well as character animation.

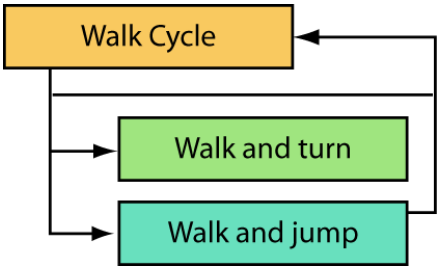
When you use the Animation Trigger window to test motion clips, you can make sure that they flow seamlessly to simulate realistic action. You can test motion clips that are continuous, such as walk cycles or run cycles and you can also test motion clips that are not continuous, such as jumps, to make sure that they blend into other motion clips.

- Planning and creating motion clips on page 1915
- Trigger groups on page 1918
- Setting up a device as a trigger on page 1918
- Recording triggered animation on page 1919
- Creating a trigger tree on page 1920
- Animation Trigger window on page 1920

Planning and creating motion clips

Planning your motion clips before creating them helps to produce smooth transitions between motion clips. It is important to blend the right clips together so that the beginning and end of each motion clip blends with the previous or next triggered motion clip.

For example, when creating the “walk and turn” motion cycle, you must make sure its start and end match the “walk” cycle and “walk and jump” cycle. Each cycle can continually trigger itself before playing the triggered motion clip. In the following graphic, the “walk cycle” continues to loop until the “walk and turn” or “walk and jump” clips are triggered.

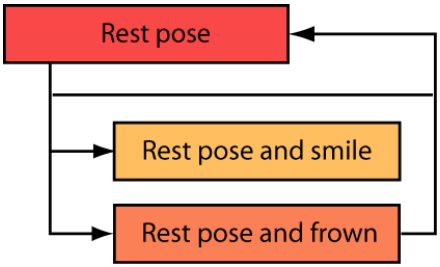


Trigger sequence with three motion cycles

A good walk cycle has no slides or jumps that mark the start and end of the motion clip. As the motion clip loops, a character walks forward without a hitch.

The transitions between these three motion clips are smooth because the start and end of each clip matches the start and end of the other clips. In fact, the walk cycle serves as the main looping cycle, or base motion cycle. The other two animation cycles are created so that their start and end match the start and end of the walk cycle.

Similarly, in the following graphic, the “rest pose” motion clip is the base motion cycle for the other two facial motion clips. The “rest pose and smile” clip and “rest pose and frown” clip both start and end with the same rest pose as the “rest pose” cycle, to create smooth transitions.



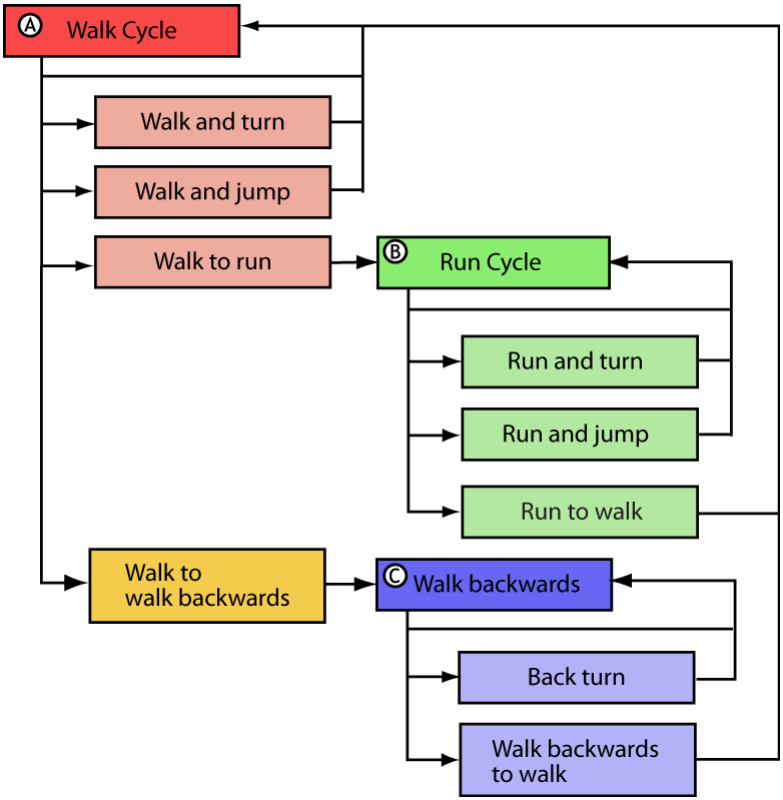
Trigger sequence for facial animation

When you create a series of animation cycles, the first cycle you create should serve as the base motion cycle for other animation cycles.

The more motion clips you use, the more useful base motion cycles become. When you plan to use a larger series of motion clips, with run cycles and other types of animation, it is helpful to use more than one base motion cycle.

For example, the following graphic shows an expanded set of motion clips, or trigger hierarchy, that includes motion clips for running and walking backwards, as well as walking forwards. The base motion cycles in this example are the walk, run, and walk backwards cycles (A, B, and C).

The start and end of the "run and turn" and "run and jump" motion clips match the start and end of the base motion clip "run cycle". The "run to walk" motion clip is a transition clip whose start matches the "run" cycle, and whose end matches the "walk" cycle. All these factors must be considered when creating motion clips.



Trigger hierarchy for a set of motion clips *A.* **Base walk cycle** *B.* **Base run cycle** *C.* **Base walk backwards cycle**

The easiest way to create animation cycles is to use the Story window. To use them as motion clips in the Animation Trigger window, you then need to plot them to a character and save each animation cycle as a separate *.fbx* file.

- Triggering Animation on page 1915
- Trigger groups on page 1918
- Setting up a device as a trigger on page 1918
- Recording triggered animation on page 1919
- Creating a trigger tree on page 1920
- Animation Trigger window on page 1920

Trigger groups

A Trigger Group is an organizational tool, like a folder, which contains the Links settings and a trigger tree you create. You cannot trigger motion clips in the Animation Trigger window until you create and select a Trigger Group.

A Trigger Group also lets you link a character, a device, and motion clips. You can trigger motion clips only when these three elements are selected or present in the Trigger Group. Once you have done this, you can create and activate a trigger tree.

- Triggering Animation on page 1915
- Planning and creating motion clips on page 1915
- Setting up a device as a trigger on page 1918
- Recording triggered animation on page 1919
- Creating a trigger tree on page 1920
- Animation Trigger window on page 1920

Setting up a device as a trigger

You can use a device, such as a keyboard or joystick, to trigger motion clips. Once you have added a device to the scene, you can select it in the Animation

Trigger window and determine which triggers, such as keyboard keys, can execute motion clips.

- Triggering Animation on page 1915
- Planning and creating motion clips on page 1915
- Trigger groups on page 1918
- Recording triggered animation on page 1919
- Creating a trigger tree on page 1920
- Animation Trigger window on page 1920

Recording triggered animation

Once you created a trigger tree, you can record the motion clips you play and trigger.

To record animation triggering, make sure Active is selected in the Links pane, then click Record and Play in the Transport Controls window.

As the motion clips play, the Activity Progress bar shows the progress of each motion clip, and the Timeline indicator moves across the Action timeline. Use the triggers during recording to record a sequence of movements, then click Stop to finish recording.

NOTE Activating a trigger takes effect only when the current motion clip has finished playing. It does not interrupt the current motion clip.

- Triggering Animation on page 1915
- Planning and creating motion clips on page 1915
- Trigger groups on page 1918
- Setting up a device as a trigger on page 1918
- Creating a trigger tree on page 1920
- Animation Trigger window on page 1920

Trigger trees

A trigger tree connects a motion clip to a device trigger.

Creating a trigger tree

You create a trigger tree to connect the motion clips and the device triggers. A trigger tree determines which motion clip is executed by which trigger. You can also set up the trigger tree so that some motion clips trigger other motion clips.

- Triggering Animation on page 1915
- Planning and creating motion clips on page 1915
- Trigger groups on page 1918
- Setting up a device as a trigger on page 1918
- Recording triggered animation on page 1919
- Animation Trigger window on page 1920

Animation Trigger window

The Animation Trigger window lets you set up a series of motion clips that you can execute using triggers. You can use the Animation Trigger window to define triggers, trigger motion clips, and record animation triggering.

The Animation Trigger window is most commonly used to test transitions between motion clips. For example, video game designers can use the Animation Trigger window to test the different actions, or motion clips, that a player may perform.

A motion clip can consist of Character animation and shape animation. See Triggering Animation on page 1915 for more information on creating motion clips.

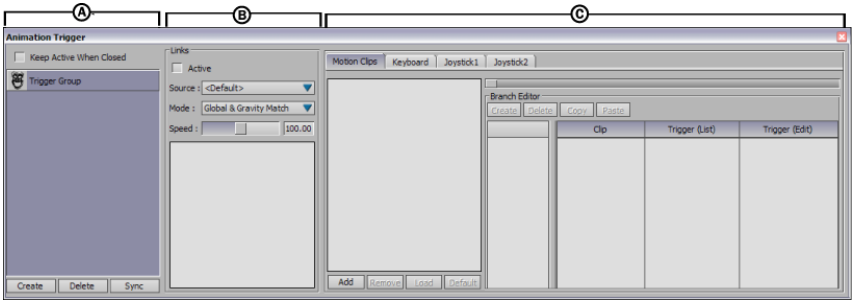
You can trigger motion clips using a keyboard or a joystick. Before using the Animation Trigger window, you must add and activate one of these devices. See Adding a device on page 1212.

There should be a smooth transition of motion between motion clips. For example, a motion clip in which the Character rolls on the floor followed by another clip in which the Character jumps does not produce a realistic

transition. To create a smooth transition, you can create base motion clips. A base motion clip loops, and other motion clips start and end with the same animation as the base clip. See Triggering Animation on page 1915 for more information on creating motion clips.

The Animation Trigger window consists of the following:

- Groups pane on page 1921
- Links pane on page 1922
- Triggering Options area on page 1924



Animation Trigger window *A.* **Groups pane** *B.* **Links pane** *C.* **Triggering Options pane**

- Triggering Animation on page 1915

Groups pane

In the Animation Trigger window, the Groups pane lets you create, delete, and synchronize a triggering group. A triggering group is a collection of motion clips and triggers. The Groups pane consists of the following options:

Keep Active When Closed

The Keep Active When Closed option lets you trigger motion clips in the Animation Trigger window even when this window is closed.

When the Keep Active When Closed option is enabled in the Animation Trigger window, the equivalent Animation Trigger option is enabled in the Viewer window and all keyframe animation features are disabled.

Create button

Creates a triggering group. The Animation Trigger window must contain at least one triggering group for the other features in the Groups pane to be available.

Delete button

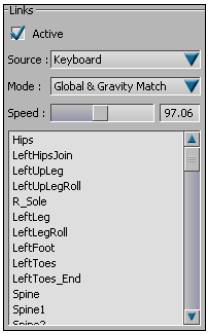
Deletes the selected triggering group.

Sync button

The Sync button lets you continue playing from the first motion clip of the triggering group.

Links pane

In the Animation Trigger window, the Links pane lets you play motion clips and define various parameters. The Links pane also contains a list of the animated nodes of the selected triggering group in the Groups pane.



Links pane

The Links pane contains the following options:

Active option

The Active option plays the motion clips in the Motion Clips pane (see Motion Clips pane on page 1924), starting with the first branch of the selected motion clip in the Motion Clips list. When disabled, the motion clips stop playing.

Select Active to view the Activity Progress bar, and to record animation triggering.

Source menu

Lets you choose the source of the triggers, which is the device that is used to start motion clips. The source can be a keyboard or one of 16 joysticks. See Keyboard and Joystick panes on page 1926.

Mode menu

Displays the playing mode of motion clips. There are four modes:

Mode	Function
Local	Animates the models according to their parenting definition. This mode is usually selected to animate parts of models, such as an arm or leg, without animating the rest of the body.
Global	Animates the models in a loop according to the global axis of the scene. The animation loops at the first branch of the first motion clip.
Global & Match	Animates the models in a loop according to the global axis of the scene. The animation loops at the current location of the scene and the beginning of the new loop is matched to the end of the last loop.
Global & Gravity Match	Animates the models as in Global & Match mode with the addition of gravity, which links the models to the floor (or Y-axis).

Speed setting

Lets you set the percentage of the original speed used to play the motion clips. The values range from 50% to 400% (100% plays the motion clips using the original speed). The value can by changed by double-clicking in the field to write a value, or by dragging its slider left or right.

Nodes list

The Nodes list displays all of the nodes of your model that you want to animate with triggers, usually the hips and skeleton of a model. *Alt*-drag the selection nodes from your Viewer window into the Nodes list.

You can define a list by *Alt*-dragging a selection into the Nodes list. All previous nodes are replaced.

NOTE Do not drag the model's reference into the Nodes list.

Triggering Options area

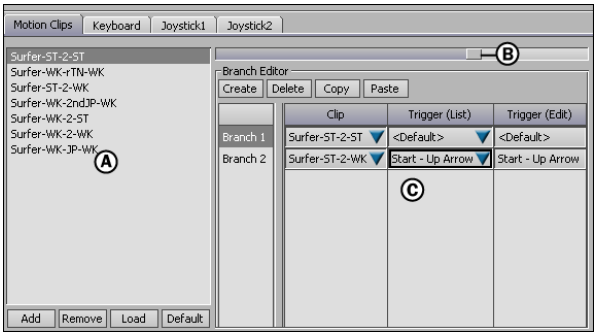
The Triggering Options area lets you select the motion clips of the triggering group and define triggers.

The Triggering Options area can be divided into two parts:

- Motion Clips pane on page 1924
- Keyboard and Joystick panes on page 1926

Motion Clips pane

The Motion Clips pane lets you add motion clips to the triggering group and select the triggers that initiate their execution.



Motion Clips pane *A.* **Motion Clips list** *B.* **Activity Progress bar** *C.* **Branch editor**

The Motion Clips list displays all of the motion clips for the selected trigger group and provides the following buttons:

Button	Description
Add	Adds a motion clip to the triggering group. You can use **.fbx** or **.bvh** files as motion clips in the Animation Trigger window. You can load all motion clips in a folder at the same time by entering `*.fbx` (or `*.bvh`) in the File Name field of the Open directory dialog box. These files must contain data matching the models. For example, if you are animating a bipedal model, you select a clip that has a compatible set of nodes.

Button	Description
Remove	Deletes the selected motion clip from the Motion Clips list, and also deletes the branches that use this motion clip.
Load	Loads the content of a motion clip into a selected motion clip whose link has been broken. The name of the selected motion clip remains unchanged.
Default	Positions the selected motion clip at the top of the Motion Clips list, which makes it the motion clip that is played when no other clip is selected for playing. Default also deselects all motion clips so that the Branch editor is empty.
Activity Progress bar	Shows the progress of each motion clip and is only active when the Active option in the Links pane is selected.
Branch Editor	The Branch editor lets you create branches of motion clips that can be triggered using the source device. Only one motion clip of a given branch can be triggered at a time. For a description of each Branch Editor column, see Branch Editor on page 1925.

Branch Editor

The Branch editor lets you create branches of motion clips that can be triggered using the source device.

NOTE Only one motion clip of a given branch can be triggered at a time.

The following columns and options make up the Branch editor:

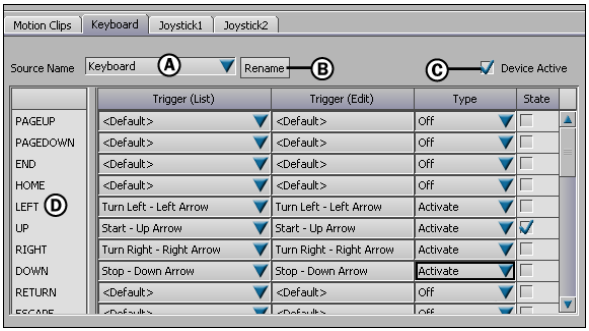
Column/Option	Description
Create button	Adds a branch. By default, the clip of a new branch is set to the selected motion clip and is named consecutively Branch 1, Branch 2, and so on. You cannot rename branches.
Delete button	Deletes the selected branch.
Copy button	Copies the entire list of branches associated with the selected motion clip. You can paste this list onto another motion clip using the Paste button.

Column/Option	Description
Paste button	Pastes the list of branches onto the selected motion clip and replaces the previous list.
Clip column	Selects the motion clip to execute from the Motion Clips list. If the Active option in the Links pane is selected when you modify the Clip column, the current motion clip in the Motion Clips list switches to the clip you just selected.
Trigger (List) column	Specifies the trigger that executes the branch. Triggers are defined in the Keyboard, Joystick1, or Joystick2 panes depending on the device. See Keyboard and Joystick panes.
Trigger (Edit) column	Edits the name of the trigger selected in the Trigger (List) column. To edit the name, double-click the field, type the name, and press Enter. **NOTE** This option is useful only when you are creating branches for your motion clips before you define the triggers in the Keyboard/Joystick panes.

NOTE Be careful when changing the name of a trigger in the Branch editor. The corresponding name is changed in the Keyboard or Joystick pane. The triggers that are not defined in the Keyboard or Joystick panes are deleted when you exit MotionBuilder.

Keyboard and Joystick panes

The Keyboard and Joystick panes define the triggers used by the Branch editor. You must define keyboard or joystick triggers before you can trigger motion clips.



Keyboard pane *A.* **Source Name field** *B.* **Rename button** *C.* **Device Active option** *D.* **Controls list**

NOTE MotionBuilder is compatible with all the joysticks supported by the operating system on which MotionBuilder is installed.

The Joystick panes are almost identical to the Keyboard pane, except that they have different trigger options. The contents of the Keyboard, Joystick1, and Joystick2 panes are as follows:

Option	Description
Source Name	Displays the device for which the triggers are defined. The Rename button lets you enter a name for the source.
Rename	Lets you rename the Source Name.
Device Active	When activated, it indicates that the Animation Trigger window is set to receive data from the source.
Controls List	Lists the controls available with the selected source. In the Keyboard pane, the keyboard keys are listed. In the Joystick panes, the joystick directions and buttons are listed.

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Part 18: Keyboard Shortcuts

MotionBuilder has keyboard configurations that simulate the keyboard shortcuts from four popular 3D software applications. This lets you switch between those applications and MotionBuilder without having to learn a new set of keyboard shortcuts. See Settings > Keyboard Configuration on page 35.

The following keyboard shortcuts are available:

Keyboard shortcuts

NOTE MotionBuilder is the default keyboard shortcut.

Activating keyboard shortcuts

Activate a keyboard shortcut configuration by selecting Settings > Keyboard Configuration and choosing one of the configurations listed. The keyboard shortcut configuration change comes into effect immediately to simulate the

keyboard shortcuts of the selected 3D software application. See Settings > Keyboard Configuration on page 35.

MotionBuilder keyboard shortcuts

The following keyboard shortcuts represent the MotionBuilder default keyboard shortcut commands. The left column describes the desired actions and the right column lists which keyboard shortcuts you need to press to trigger the actions.

General keyboard shortcuts

You can use the following keyboard shortcuts for performing general actions in MotionBuilder.

Action	Keyboard Shortcut
Undo last action	Ctrl-Z
Redo last action	Ctrl-Y
Cut	Ctrl-X
Copy	Ctrl-C
Paste	Ctrl-V
Paste special	Ctrl-B
Delete selection	Delete
Global accept	Enter
Global cancel	Escape
New scene	Ctrl-N
Open scene	Ctrl-O
Save scene	Ctrl-S
Pan window	Shift-drag

Action	Keyboard Shortcut
Zoom In/Out	Ctrl-drag
Select a range of assets in the Navigator window	Shift-click
Position timeline indicator	Ctrl-Shift-click
Drag and drop asset	Alt-drag

Transport Controls keyboard shortcuts

You can use the following keyboard shortcuts for Transport Control window actions in MotionBuilder.

Action	Keyboard Shortcut
Snap Timeline indicator to frame	Ctrl-Shift-click
Play/stop	Ctrl-Spacebar or Ctrl-Up arrow
Play backwards/stop	Ctrl-Down arrow
Forward one frame	Ctrl-Right arrow
Back one frame	Ctrl-Left arrow
Go to start	Ctrl-Home
Go to end	Ctrl-End
Jog/audio shuttle	J-drag
Frame zoom bar on Start and End (full-size Zoom bar)	A
Frame Zoom bar on selected keyframe region	F
Frame Start and End of all animation (“Frame Take” function)	Ctrl-Shift-A

Action	Keyboard Shortcut
Frame Start and End of a selected keyframe region	Ctrl-Shift-F

Keyframing keyboard shortcuts

You can use the following keyboard shortcuts for keyframing in MotionBuilder.

Action	Keyboard Shortcut
Add keyframe	K
Add Zero keyframe	Shift-K
Add Flat keyframe	Ctrl-K
Go to next keyframe	Right arrow
Go to previous keyframe	Left arrow
Add Key at time x	Ctrl-Shift-K
Add FK key	, (comma)
Add IK key	. (period)

FCurves keyboard shortcuts

You can use the following keyboard shortcuts for FCurves window actions in MotionBuilder.

Action	Keyboard Shortcut
Select keyframe	Click
Select keyframe region	Spacebar-drag
Add keyframe to selection	Ctrl-click
Select range of keyframes	Shift-click

Action	Keyboard Shortcut
Zoom rectangular	Z-drag
Frame all keyframes	A
Frame selected keyframes	F
Add keyframe on a curve	I-click

Motion blend keyboard shortcuts

You can use the following keyboard shortcuts for Motion Blend actions.

Action	Keyboard Shortcut
Scale/change speed of a track	S-drag
Translate a track	T-drag

Layout keyboard shortcuts

You can use the following keyboard shortcuts for working with Layouts.

Action	Keyboard Shortcut
Select Creation layout	Ctrl-Shift-1
Select Animation layout	Ctrl-Shift-2
Select Editing layout	Ctrl-Shift-3
Select Preview layout	Ctrl-Shift-4
Select Story layout	Ctrl-Shift-5
Select User layouts 1-5	Ctrl-Shift-6 - 0

Character keyboard shortcuts

You can use the following keyboard shortcuts for working with Characters.

Action	Keyboard Shortcut
Pin Rotation	W
Pin Translation	E
Activate/Disable effector release	Q

Pose keyboard shortcuts

You can use the following keyboard shortcuts for working with Pose controls.

Action	Keyboard Shortcut
Copy pose	Ctrl-F12
Paste pose	Alt-F12

Viewer window keyboard shortcuts

You can use the following keyboard shortcuts for working with the Viewer window.

Action	Keyboard Shortcut
Select number of views	Ctrl-1, 2, 3, or 4
Switch to full screen mode	Alt-Enter
Switch to Perspective/Custom	Ctrl-E
Switch/cycle to front/back	Ctrl-F
Switch/cycle to right/left	Ctrl-R
Switch/cycle to top/bottom	Ctrl-T
Switch to/from Schematic view	Ctrl-W

Action	Keyboard Shortcut
Camera switcher	Ctrl-I
Frame selected objects	F
Frame all objects	A
Cycle Normal/Models Only/X-Ray mode	Ctrl-A
Display performance statistics	Shift-F
Display memory statistics	Shift-M
Switch to Object selection	O
Switch to Vertex selection (When Skins window is open)	V
Switch to Pivot Selection	Shift-O
Switch to Parenting mode	P
Find models by name	Shift-N
Pan camera	Shift-drag
Slide camera	Shift-right-drag
Dolly camera	Ctrl-drag
Dolly camera with interest	Ctrl-right-drag
Orbit camera around interest	Ctrl-Shift-drag
Orbit interest around camera	Ctrl-Shift-right-drag
Zoom camera	Z-drag
Roll custom camera	R-drag
Roll custom camera (15 degree increments)	R-right-drag

Viewer window manipulation keyboard shortcuts

You can use the following keyboard shortcuts to manipulate objects in the Viewer window.

Action	Keyboard Shortcut
Parenting mode	P
Translate selection	T
Selection mode	F3
Drag mode	F1
Local mode	F5
Global mode	F6
Rotate selection	R
Rotate additive	F7
Rotate axis	F8
Rotate around	Shift-R
Scale uniform	S
Scale volumic	Shift-S
Drag mode	F1, then Up arrow
Manipulator drag	F2
Switch to wireframe	1
Switch to flat shaded	2
Switch to lighted	3
Switch to textured	4
Switch to shaded	5

Action	Keyboard Shortcut
Switch to textured and shaded	6

Viewer window selection keyboard shortcuts

You can use the following keyboard shortcuts to select objects in the Viewer window.

Action	Keyboard Shortcut
Select (exclusive)	Click or drag
Append to selection	Middle-click or drag
Remove from selection	Right-click or drag
Toggle selection	Spacebar-click or drag
Select range	Click, then Shift-select
Hide selection	Shift-H
Hide all	Shift-H with no selection
Show selection	Shift-S
Show all	Shift-S with no selection
Select and show in Navigator	Double-click
Add to/remove from selection	Ctrl-click, or Spacebar-drag
Select all in group	G-click
Add group to selection	G-middle-click
Select object and children	Spacebar-right click
Select root of hierarchy	Ctrl-right-click
Select object and parents	Shift-right-click

Action	Keyboard Shortcut
Select whole hierarchy	Ctrl-Shift-right-click
Go up the hierarchy (parent)	Alt-Up arrow
Go down the hierarchy (first child)	Alt-Down arrow
Go sideways in the hierarchy (left sibling, same level)	Alt-Left-arrow
Go sideways in the hierarchy (right sibling, same level)	Alt-Right-arrow

Optical keyboard shortcuts

You can use the following keyboard shortcuts for working with Optical tools.

Action	keyboard Shortcut
Navigate marker list (Label pane)	Up/Down arrow keys
Navigate marker list within same Rigid body (Label pane)	Shift-Up/Down arrow keys
Go to previous/next segment or gap	Shift-Left/Right arrow keys
Frame all segments	A
Zoom rectangular	Z-drag
Move start/end of current segment	M-drag segment edge
Move Timeline indicator	T-click or Ctrl-Shift-click
Insert a gap key (in gap only)	K

Story window keyboard shortcuts

You can use the following keyboard shortcuts for working with the Story window.

Action	Keyboard Shortcut
Select next clip	Shift-right arrow
Select previous clip	Shift-left arrow
Go to first clip	Shift-Home
Go to last clip	Shift-End
Razor clip	Alt-R
Scale track	Alt-S

MotionBuilder Classic keyboard shortcuts

The following keyboard shortcuts represent the MotionBuilder Classic default keyboard shortcut commands. The left column describes the desired actions and the right column lists which keyboard shortcuts you need to press to trigger the actions.

General keyboard shortcuts

You can use the following keyboard shortcuts for performing general actions in MotionBuilder.

Action	Keyboard Shortcut
Undo last action	Ctrl-Z
Redo last action	Ctrl-Y
Cut	Ctrl-X
Copy	Ctrl-C
Paste	Ctrl-V

Action	Keyboard Shortcut
Paste special	Ctrl-B
Delete selection	Delete
Global accept	Enter
Global cancel	Escape
New scene	Ctrl-N
Open scene	Ctrl-O
Save scene	Ctrl-S
Pan window	Shift-drag
Zoom In/Out	Ctrl-drag
Select a range of assets in the Navigator window	Shift-click
Position timeline indicator	Ctrl-Shift-click
Drag and drop asset	Alt-drag

Transport Controls keyboard shortcuts

You can use the following keyboard shortcuts for Transport Control window actions in MotionBuilder.

Action	Keyboard Shortcut
Snap Timeline indicator to frame	Ctrl-Shift-click
Play/stop	Ctrl-Spacebar or Ctrl-Up arrow
Play backwards/stop	Ctrl-Down arrow
Forward one frame	Ctrl-Right arrow
Back one frame	Ctrl-Left arrow

Action	Keyboard Shortcut
Go to start	Ctrl-Home
Go to end	Ctrl-End
Jog/audio shuttle	J-drag
Frame zoom bar on Start and End (full-size Zoom bar)	A
Frame Zoom bar on selected keyframe region	F
Frame Start and End of all animation (“Frame Take” function)	Ctrl-Shift-A
Frame Start and End of a selected keyframe region	Ctrl-Shift-F

Keyframing keyboard shortcuts

You can use the following keyboard shortcuts for keyframing in MotionBuilder.

Action	Keyboard Shortcut
Add keyframe	K
Add Zero keyframe	Shift-K
Add Flat keyframe	Ctrl-K
Go to next keyframe	Right arrow
Go to previous keyframe	Left arrow
Add Key at time x	X

FCurves keyboard shortcuts

You can use the following keyboard shortcuts for FCurves window actions in MotionBuilder.

Action	Keyboard Shortcut
Select keyframe	Click
Select keyframe region	Spacebar-drag
Add keyframe to selection	Ctrl-click
Select range of keyframes	Shift-click
Zoom rectangular	Z-drag
Frame all keyframes	A
Frame selected keyframes	F
Add keyframe on a curve	I-click

Motion blend keyboard shortcuts

You can use the following keyboard shortcuts for Motion Blend actions.

Action	Keyboard Shortcut
Scale/change speed of a track	S-drag
Translate a track	T-drag

Layout keyboard shortcuts

You can use the following keyboard shortcuts for working with Layouts.

Action	Keyboard Shortcut
Select Creation layout	Ctrl-Shift-1
Select Animation layout	Ctrl-Shift-2

Action	Keyboard Shortcut
Select Editing layout	Ctrl-Shift-3
Select Preview layout	Ctrl-Shift-4
Select Story layout	Ctrl-Shift-5
Select User layouts 1-5	Ctrl-Shift-6 - 0

Character keyboard shortcuts

You can use the following keyboard shortcuts for working with Characters.

Action	Keyboard Shortcut
Pin Rotation	W
Pin Translation	E
Activate/Disable effector release	Q
Use IK Pivot option	D

Pose keyboard shortcuts

You can use the following keyboard shortcuts for working with Pose controls.

Action	Keyboard Shortcut
Copy pose	Ctrl-F12
Paste pose	Alt-F12

Viewer window keyboard shortcuts

You can use the following keyboard shortcuts for working with the Viewer window.

Action	Keyboard Shortcut
Select number of views	Ctrl-1, 2, 3, or 4
Switch to full screen mode	Alt-Enter
Switch to Perspective/Custom	Ctrl-E
Switch/cycle to front/back	Ctrl-F
Switch/cycle to right/left	Ctrl-R
Switch/cycle to top/bottom	Ctrl-T
Switch to/from Schematic view	Ctrl-W
Camera switcher	Ctrl-I
Frame selected objects	F
Frame all objects	A
Cycle Normal/Models Only/X-Ray mode	Ctrl-A
Display performance statistics	Shift-F
Display memory statistics	Shift-M
Display cycle statistics	Shift-D
Switch to Object selection	O
Switch to Vertex selection (When Skins window is open)	V
Switch to Pivot Selection	Shift-O
Switch to Parenting mode	P

Action	Keyboard Shortcut
Find models by name	Shift-N
Pan camera	Shift-drag
Slide camera	Shift-right-drag
Dolly camera	Ctrl-drag
Dolly camera with interest	Ctrl-right-drag
Orbit camera around interest	Ctrl-Shift-drag
Orbit interest around camera	Ctrl-Shift-right-drag
Zoom camera	Z-drag
Roll custom camera	R-drag
Roll custom camera (15 degree increments)	R-right-drag

Viewer window manipulation keyboard shortcuts

You can use the following keyboard shortcuts to manipulate objects in the Viewer window.

Action	Keyboard Shortcut
Parenting mode	P
Translate selection	T
Drag	F1
Rotate selection	R
Rotate additive	F4
Rotate axis	F5
Rotate around	C

Action	Keyboard Shortcut
Scale uniform	S
Switch to wireframe	Shift-W
Switch to lighted	Shift-E
Switch to textured	Shift-R
Switch to textured and shaded	Shift-T

Viewer window selection keyboard shortcuts

You can use the following keyboard shortcuts to select objects in the Viewer window.

Action	Keyboard Shortcut
Select (exclusive)	Spacebar-click in an empty part of the Viewer window.
Append to selection	Spacebar-middle-click or drag
Remove from selection	Spacebar-Right-click or drag
Toggle selection	Spacebar-click or drag
Select range	Click, then Shift-select
Hide selection	Shift-H
Hide all	Shift-H with no selection
Show selection	Shift-S
Show all	Shift-S with no selection
Select and show in Navigator	Double-click
Add to/remove from selection	Spacebar-Ctrl-click, or Spacebar-Ctrl-drag
Select all in group	G-click

Action	Keyboard Shortcut
Add group to selection	G-click
Select object and children	Spacebar-right click
Select root of hierarchy	Ctrl-right-click
Select object and parents	Shift-right-click
Select whole hierarchy	Ctrl-Shift-right-click
Go up the hierarchy (parent)	Alt-Up arrow
Go down the hierarchy (first child)	Alt-Down arrow
Go sideways in the hierarchy (left sibling, same level)	Alt-Left-arrow
Go sideways in the hierarchy (right sibling, same level)	Alt-Right-arrow

Optical keyboard shortcuts

You can use the following keyboard shortcuts for working with Optical tools.

Action	Keyboard Shortcut
Navigate marker list (Label pane)	Up/Down arrow keys
Navigate marker list within same Rigid body (Label pane)	Shift-Up/Down arrow keys
Go to previous/next segment or gap	Shift-Left/Right arrow keys
Frame all segments	A
Zoom rectangular	Z-drag
Move start/end of current segment	M-drag segment edge
Move Timeline indicator	T-click or Ctrl-Shift-click

Action	Keyboard Shortcut
Insert a gap key (in gap only)	K

Story window keyboard shortcuts

You can use the following keyboard shortcuts for working with the Story window.

Action	Keyboard Shortcut
Select next clip	Shift-right arrow
Select previous clip	Shift-left arrow
Go to first clip	Shift-Home
Go to last clip	Shift-End
Razor clip	Alt-R
Scale track	Alt-S

3ds Max keyboard shortcuts

The following keyboard shortcuts are familiar to users of the 3ds Max software product. The left column describes the desired actions and the right column lists which keyboard shortcuts you need to press to trigger the actions.

General keyboard shortcuts

You can use the following keyboard shortcuts for performing general actions in MotionBuilder.

Action	keyboard Shortcut
Undo last action	Ctrl-Z
Redo last action	Ctrl-Y
Cut	Ctrl-X

Action	keyboard Shortcut
Copy	Ctrl-C
Paste	Ctrl-V
Paste Special	Ctrl-B
Delete selection	Delete
New scene	Ctrl-N
Open scene	Ctrl-O
Save scene	Ctrl-S
Pan window	(Middle-drag) Shift-drag
Zoom in/out	(Alt-Ctrl-middle-drag) Ctrl-drag
Select a range of assets in the Navigator	Shift-click
Position Time cursor	Ctrl-Shift-click
Drag and drop asset	Alt-drag

Transport Controls keyboard shortcuts

You can use the following keyboard shortcuts for working with the Transport Controls.

Action	Keyboard Shortcut
Play/stop	/ (slash)
Play Backwards/Stop	Shift-/ (slash)
Forward one frame	. (period)
Back one frame	, (comma)
Go to start	Home

Action	Keyboard Shortcut
Go to end	End
Jog	J-drag
Frame Zoom bar on Start and End (Full-size Zoom bar)	Ctrl-Shift-Z
Frame Zoom bar on selected keyframe region	Z
Frame Start and End of all animation (“Frame Take” function)	Ctrl-Shift-A
Frame Start and End of a selected keyframe region	A

Keyframing keyboard shortcuts

You can use the following keyboard shortcuts for working with the keyframes.

Action	Keyboard Shortcut
Select a keyframe	Click
Select range of keyframes	Shift-click
Frame all keyframes	Ctrl-Shift-Z
Frame selected keyframes	Z
Add keyframe on an FCurve	A-middle-click

FCurves keyboard shortcuts

You can use the following keyboard shortcuts for FCurves window actions in MotionBuilder.

Action	Keyboard Shortcut
Add a keyframe on a curve	Alt-I

Motion Blend keyboard shortcuts

You can use the following keyboard shortcuts for working with the Motion Blend window.

Action	Keyboard Shortcut
Scale/change speed of a track	S-drag
Translate a track	T-drag

Character keyboard shortcuts

You can use the following keyboard shortcuts for working with Characters.

Action	Keyboard Shortcut
Pin Rotation	U
Pin Translation	Y
Activate/Disable effector release	Q
Use IK Pivot option	D

Pose keyboard shortcuts

You can use the following keyboard shortcuts for working with Pose controls.

Action	Keyboard Shortcut
Copy pose	Ctrl-F12
Paste pose	Alt-F12

Viewer keyboard shortcuts

Certain 3ds Max keyboard shortcuts used in MotionBuilder for camera navigation and Viewer window display modes are mapped incorrectly.

You can use the following keyboard shortcuts for working with the Viewer window.

Action	Keyboard Shortcut
Select number of views	Ctrl-1, 2, 3, or 4
Switch to full screen mode	Alt-Enter
Cycle/Switch to Perspective/Camera	P
Cycle/Switch to Front/Back	F
Cycle/Switch to left/right	L
Cycle/Switch to Top/Bottom	T
Switch to/from Schematic view	Ctrl-W
Camera switcher	Ctrl-I
Frame selected objects	Z
Frame all objects	Ctrl-Shift-Z
Cycle Normal/Models Only/X-Ray displays	Ctrl-A
Display performance statistics	Shift-F
Display memory statistics	Shift-M
Find models by name	Shift-N
Switch object selection	O
Switch object vertex	V
Switch object pivot	Shift-O
Pan camera	Middle-drag
Slide camera	Shift-right-drag
Dolly camera	Alt-Ctrl-middle-drag

Action	Keyboard Shortcut
Dolly camera with interest	Ctrl-right-drag
Orbit camera around interest	Alt-middle-drag
Orbit interest around camera	Ctrl-Shift-right-drag
Roll custom camera	R-middle-drag

Viewer window model display keyboard shortcuts

You can use the following keyboard shortcuts for manipulating objects in the Viewer window.

Action	Keyboard Shortcut
Switch to wireframe	F1
Switch to textures/shaders	F2

Viewer window selection keyboard shortcuts

You can use the following keyboard shortcuts for selecting objects in the Viewer window.

Action	Keyboard Shortcut
Hide selection	H
Hide all	H with no selection
Show selection	S
Show all	S
Toggle selection	Spacebar-click or drag
Select and show in Navigator	Double-click
Add to/remove from selection	Ctrl-click, or Spacebar-drag

Action	Keyboard Shortcut
Select and show in Navigator	Double-click
Add to/remove from selection	Ctrl-click
Select all in group	G-click
Add group to selection	G-right-click
Select object and children	Spacebar-right-click
Select root of hierarchy	Ctrl-right-click
Select object and parents	Shift-right-click
Select whole hierarchy	Ctrl-Shift-right-click
Go up the hierarchy (parent)	Page Up
Go down the hierarchy (first child)	Page Down

Optical keyboard shortcuts

You can use the following keyboard shortcuts for working with Optical tools in MotionBuilder.

Action	Keyboard Shortcut
Navigate marker list (Label pane)	Up/Down arrow keys
Navigate marker list within same Rigid body (Label pane)	Shift-Up/Down arrow keys
Go to previous/next segment or gap	Shift-Left/Right arrow keys
Frame all segments	A
Move start/end of current segment	M-drag segment edge
Move Timeline indicator	T-click or Ctrl-Shift-click
Insert a gap key (in gap only)	K

Story window keyboard shortcuts

You can use the following keyboard shortcuts for working with the Story window.

Action	Keyboard Shortcut
Select next clip	Shift-right arrow
Select previous clip	Shift-left arrow
Go to first clip	Shift-Home
Go to last clip	Shift-End
Razor clip	Alt-R
Scale track	Alt-S

Maya keyboard shortcuts

The following keyboard shortcuts are familiar to users of the Maya software product. The left column describes the desired actions and the right column lists which keyboard shortcuts you need to press to trigger the actions.

General keyboard shortcuts

You can use the following keyboard shortcuts for performing general actions in MotionBuilder.

Action	Keyboard Shortcut
Undo last action	Z
Redo last action	Ctrl-Z
Cut	Ctrl-X
Copy	Ctrl-C
Paste	Ctrl-V

Action	Keyboard Shortcut
Paste special	Ctrl-B
Delete selection	Delete
Global accept	Enter
Global cancel	Escape
Save scene	Ctrl-S
Pan window	Alt-middle-drag
Zoom in/out	Alt-right-drag
Zoom rectangular	Z-drag
Select a range of assets in the navigator	Shift-click
Drag and drop asset	X-select and drag

Transport controls keyboard shortcuts

You can use the following keyboard shortcuts for working with the Transport controls.

Action	Keyboard Shortcut
Snap Timeline indicator to frame	Middle-click
Play/stop	Ctrl-Spacebar or Ctrl-Up-arrow
Play backwards/stop	Ctrl-Down-arrow
Forward one frame	Ctrl-right-arrow
Back one frame	Ctrl-Left-arrow
Go to start	Ctrl-Home
Go to end	Ctrl-End

Action	Keyboard Shortcut
Frame zoom bar on Start and End (full-size Zoom bar)	A
Frame Zoom bar on selected keyframe region	F
Frame Start and End of all animation (“Frame Take” function)	Ctrl-Shift-A
Frame Start and End of selected keyframe region	Ctrl-Shift-F

Keyframing keyboard shortcuts

You can use the following keyboard shortcuts for keyframing in MotionBuilder.

Action	Keyboard Shortcut
Add keyframe	S
Add Zero keyframe	Shift-S
Add Flat keyframe	Alt-S
Go to next keyframe	. (period)
Go to previous keyframe	, (comma)
Key at Time x	Ctrl-Shift-S

FCurves keyboard shortcuts

You can use the following keyboard shortcuts for working in the FCurves window.

Action	Keyboard Shortcut
Select a keyframe	Click
Add keyframe to selection	Ctrl-Shift-click

Action	Keyboard Shortcut
Select range of keyframes	Shift-click
Frame all keyframes	A
Frame selected keyframes	F
Add keyframe on a curve	M-middle-click

Motion Blend keyboard shortcuts

You can use the following keyboard shortcuts for working in the Motion Blend window.

Action	Shortcut
Scale/change speed of a track	R-drag
Translate a track	W-drag

Pose keyboard shortcuts

You can use the following keyboard shortcuts for working with Pose controls.

Action	Keyboard Shortcut
Copy pose	Ctrl-F12
Paste pose	Alt-F12

Layout shortcuts

You can use the following shortcuts for working with Layouts.

Action	Keyboard Shortcut
Select Creation layout	Ctrl-Shift-1
Select Animation layout	Ctrl-Shift-2

Action	Keyboard Shortcut
Select Editing layout	Ctrl-Shift-3
Select Preview layout	Ctrl-Shift-4
Select Story layout	Ctrl-Shift-5
Select User layouts 1-5	Ctrl-Shift-6 - 0

Character keyboard shortcuts

You can use the following keyboard shortcuts when working with Characters in MotionBuilder.

Action	Keyboard Shortcut
Pin Rotation	Y
Pin Translation	T
Activate/Disable effector release	O

Pose keyboard shortcuts

You can use the following keyboard shortcuts for working with Pose controls.

Viewer window keyboard shortcuts

You can use the following keyboard shortcuts for working in the Viewer window.

Action	Keyboard Shortcut
Select number of views	Ctrl-1, 2, 3, or 4
Switch to full screen mode	Alt-Enter
Switch to Perspective/Custom	Ctrl-E
Switch/cycle to front/back	Ctrl-F

Action	Keyboard Shortcut
Switch/cycle to right/left	Ctrl-R
Switch/cycle to top/bottom	Ctrl-T
Switch to/from Schematic view	Ctrl-W
Camera switcher	Ctrl-I
Frame selected objects	F
Frame all objects	A
Cycle Normal/Models Only/X-Ray displays	Ctrl-A
Display performance statistics	Shift-F
Display memory statistics	Shift-M
Switch to object selection	O
Switch to vertex selection (When Skins window is open)	V
Switch to Pivot Selection	Shift-O
Switch to Parenting mode	P
Find models by name	Shift-N
Pan camera	Alt-middle-drag
Zoom camera	Z-drag

Viewer window manipulation keyboard shortcuts

You can use the following keyboard shortcuts to manipulate objects in the Viewer window.

Action	Keyboard Shortcut
Parenting mode	P

Action	Keyboard Shortcut
Translate selection	W
Selection mode	F3
Drag mode	F1
Local mode	F5
Global mode	F6
Rotate selection	E
Rotate additive	F7
Rotate axis	F8
Rotate around	Shift-E
Scale uniform	R
Scale volumic	Shift-R
Drag mode	F1, then Up arrow
XYZ mode	F2
Switch to wireframe	4
Switch to flat shaded	2
Switch to lighted	5
Switch to textured	6
Switch to shaded	3
Switch to textured and shaded	7
Selection mode	F3

Viewer window selection keyboard shortcuts

You can use the following keyboard shortcuts for selecting objects in the Viewer window.

Action	Keyboard Shortcut
Hide selection	Shift-H
Hide all	Shift-H with no selection
Show selection	Ctrl-H
Show all	Ctrl-H with no selection
Select/deselect	Spacebar-click
Toggle selection	Spacebar-click and drag
Select	Click
Add to selection	Ctrl-Shift-click
Remove from selection	Ctrl-click
Select all in group	G-click
Add group to selection	Ctrl-Shift-G
Select object and children	Spacebar-right-click
Select root of hierarchy	Ctrl-right-click
Select object and parents	Shift-right-click
Select whole hierarchy	Ctrl-Shift-right-click
Go up the hierarchy (parent)	Up arrow
Go down the hierarchy (first child)	Down arrow
Go sideways in the hierarchy (left sibling, same level)	Left arrow

Action	Keyboard Shortcut
Go sideways in the hierarchy (right sibling, same level)	Right arrow

Optical keyboard shortcuts

You can use the following keyboard shortcuts for working with Optical tools.

Action	Keyboard Shortcut
Navigate marker list (Label pane)	Up/Down arrow keys
Navigate marker list within same Rigid body (Label pane)	Shift-Up/Down arrow keys
Go to previous/next segment or gap	Shift-Left/Right arrow keys
Frame all segments	A
Move start/end of current segment	M-drag segment edge
Move Timeline indicator	T-click or Ctrl-Shift-click
Insert a gap key (in gap only)	K

Softimage keyboard shortcuts

The following keyboard shortcuts are familiar to users of the Softimage software product. The left column describes the desired actions and the right column lists which keyboard shortcuts you need to press to trigger the actions.

General keyboard shortcuts

You can use the following keyboard shortcuts for performing general actions in MotionBuilder.

Action	Keyboard Shortcut
Undo last action	Ctrl-Z

Action	Keyboard Shortcut
Redo last action	Ctrl-Y
Cut	Ctrl-X
Copy	Ctrl-C
Paste	Ctrl-V
Paste Special	Ctrl-B
Delete selection	Delete
Global accept	Enter
Global cancel	Escape
Save scene	Ctrl-S
Pan window	I-click-drag
Zoom in/out	P
Zoom rectangular	Middle-click
Select a range of assets in the Navigator	Shift-click
Position Time cursor	Ctrl-Shift-click
Drag and drop asset	Alt-drag
Open scene	Ctrl-O

Transport controls keyboard shortcuts

You can use the following keyboard shortcuts for working with the Transport controls.

Action	Keyboard Shortcut
Play/stop	Up arrow

Action	Keyboard Shortcut
Play backwards/stop	Shift-Up arrow
Forward one frame	Right arrow
Back one frame	Left arrow
Go to start	Home
Go to end	End
Jog/Audio shuttle	J-drag
Frame Zoom bar on Start and End (Full-size Zoom bar)	A
Frame Zoom bar on selected keyframe region	F
Frame Start and End of all animation (“Frame Take” function)	Ctrl-Shift-A
Frame Start and End of a selected keyframe region	Ctrl-Shift-F

Keyframing keyboard shortcuts

You can use the following keyboard shortcuts when you are keyframing.

Action	Keyboard Shortcut
Add keyframe	K
Add Zero keyframe	Shift-K
Add Flat keyframe	Ctrl-K
Go to next keyframe	. (period)
Go to previous keyframe	, (comma)

FCurves keyboard shortcuts

You can use the following keyboard shortcuts for working in the FCurves window.

Action	Keyboard Shortcut
Select a keyframe	Click
Select a keyframe region	Spacebar-drag
Add keyframe to selection	Ctrl-click
Select range of keyframes	Shift-click
Frame all keyframes	A
Frame selected keyframes	F
Add keyframe on a curve	I-click

Motion Blend keyboard shortcuts

You can use the following keyboard shortcuts to work with the Motion Blend window.

Action	Keyboard Shortcut
Scale/change speed of a track	X-drag
Translate a track	V-drag

Pose keyboard shortcuts

You can use the following keyboard shortcuts for working with Pose controls.

Action	Keyboard Shortcut
Copy pose	Ctrl-F12

Viewer keyboard shortcuts

You can use the following keyboard shortcuts for working in the Viewer window.

Action	Keyboard Shortcut
Select number of views	Ctrl-1, 2, 3, or 4
Switch to full screen mode	Alt-Enter
Switch to Perspective/Custom	Ctrl-E
Switch/cycle to front/back	Ctrl-F
Switch/cycle to right/left	Ctrl-R
Switch/cycle to top/bottom	Ctrl-T
Switch to/from Schematic view	9
Camera switcher	Ctrl-I
Frame selected objects	F
Frame all objects	A
Cycle Normal/Models Only/X-Ray displays	Ctrl-A
Display performance statistics	Shift-F
Display memory statistics	Shift-M
Switch to Parenting mode /Find models by name	Shift-N
Pan Camera	Z-click-drag
Slide camera	Z-right-drag
Dolly camera	P-click-drag
Dolly camera with interest	P-right-drag

Action	Keyboard Shortcut
Orbit camera around interest	O-click-drag
Orbit interest around camera	O-right-drag
Zoom camera	Z-middle-click drag
Roll custom camera	L-click-drag
Roll angle	L-right-drag

Viewer window manipulation keyboard shortcuts

You can use the following keyboard shortcuts for manipulating objects in the Viewer window.

Action	Keyboard Shortcut
Translate selection	V
Translate object's Pivot	Shift-V
Rotate mode	C
Selection mode	F3
Rotate additive	F7
Rotate axis	F8
Rotate around	Shift-C
Scale mode	X
Scale volumic	Shift-X
Switch to wireframe	1
Switch to flat shaded	2
Switch to lighted/shaded	3

Action	Keyboard Shortcut
Switch to textured/shaded and textured	4

Viewer window selection keyboard shortcuts

You can use the following keyboard shortcuts for selecting objects in the Viewer window.

Action	Keyboard Shortcut
Hide selection	H
Hide all	H with no selection
Show selection	S
Show all	S with no selection
Select exclusive	Spacebar-click or drag
Select and show in Navigator	Double-click
Add to/Remove from selection	Ctrl-click
Select all in group	G-click
Add/remove group to selection	G-Ctrl-click
Select object and children	Spacebar-right-click
Select root of hierarchy	Ctrl-right-click
Select object and parents and children	Shift-right-click
Select whole hierarchy	Ctrl-Shift-right-click
Go up the hierarchy (parent)	Alt-Up arrow
Go down the hierarchy (first child)	Alt-Down arrow
Go sideways in the hierarchy (left sibling, same level)	Alt-Left arrow

Action	Keyboard Shortcut
Go sideways in the hierarchy (right sibling, same level)	Alt-Right arrow

Optical keyboard shortcuts

You can use the following keyboard shortcuts for working with Optical tools.

Action	Keyboard Shortcut
Navigate marker list (Label pane)	Up/Down arrow keys
Navigate marker list within same Rigid body (Label pane)	Shift-Up/Down arrow keys
Go to previous/next segment or gap	Shift-Left/Right arrow keys
Frame all segments	A
Move start/end of current segment	M-drag segment edge
Move Timeline indicator	T-click or Ctrl-Shift-click
Insert a gap key (in gap only)	K

Glossary

The Glossary describes terms specific to the MotionBuilder software product as well as some of the most common computer graphics and software terms used in the 3D world.

The Glossary also includes acronyms used in the MotionBuilder software product and the most common acronyms used in the 2D/3D world.

Acronyms

Following is a list of acronyms used in theMotionBuilder User's Guide.

- BCC on page 1987
- BCS on page 1988
- BVH on page 1990
- FK on page 1999
- fps on page 1999
- HSB on page 2002
- HUD on page 2002
- IK on page 2002
- NTSC on page 2010
- NURBS on page 2010
- PAL on page 2012
- Qt on page 2014
- SMPTE on page 2019
- TCB on page 2021

- UCS on page 2023
- UV on page 2024
- VTR on page 2025
- WCS on page 2026

Terms

Following is a list and description of terms specific to the MotionBuilder software product and of some of the most common computer graphics and software terms used in the 3D world.

List of terms

The following provides a list of terms specific to the MotionBuilder software product as well as some of the most common computer graphics and software terms used in the 3D world.

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- 3D coordinate space on page 1984
- 3D matte on page 1984

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- Actor Face on page 1984
- aliasing on page 1984
- alpha channel on page 1985
- alpha-blend on page 1985
- animation on page 1985
- anti-aliasing on page 1985
- artifact on page 1985
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- Auxiliary effector on page 1986
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B

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Term Definitions

The following provides a description of terms specific to the MotionBuilder software product and of some of the most common computer graphics and software terms used in the 3D world.

0-9

3D coordinate space

The Euclidian/Cartesian environment that defines three dimensions by X-, Y-, and Z-axes, and their corresponding coordinate values.

See also X-axis on page 2027, Y-axis on page 2027, and Z-axis on page 2028.

3D matte

A color signal that is used to fill areas of keys and borders. Unlike a regular matte, a 3D matte has depth and is respected by all other 3D objects in the scene, letting you block out parts of a scene and replace it with video footage.

A

Actor

In MotionBuilder, a humanoid model used to link captured optical or magnetic motion data to a character.

Actor Face

In MotionBuilder, a set of magnetic or optical motion data captured from a performer's face, which can be mapped to a Character Face asset.

aliasing

A defect or distortion in a television picture caused by interference between two frequencies, for example the luminance and chrominance frequencies. Aliasing appears as moire or herringbone patterns, straight lines that become wavy, or rainbow colors.

See also anti-aliasing on page 1985.

alpha channel

The portion of each pixel's data reserved for transparency information. 32-bit graphics systems contain four channels: three 8-bit channels for red, green, and blue (RGB) and one 8-bit alpha channel.

alpha-blend

An effect in which you assign pixel values that are solid, invisible, or partially transparent. Alpha-blending is often used in games for special effects such as explosions and weapons discharge. When mapped onto polygons, Alpha-blending simulates semi-transparent objects, such as water and glass.

animation

The process of creating the illusion of moving images by displaying sequential images in rapid succession. In each successive image, two or more values are changed over time, and the items drawn or recorded in the images appear to move.

anti-aliasing

A technique that corrects aliasing by smoothing the edges of diagonal lines on the screen. Without Anti-aliasing, diagonal lines often have a “jaggy” appearance caused by the stair-step effect of the pixels. Anti-aliasing blurs the edges of the lines.

See also aliasing on page 1984.

artifact

An undesirable element or defect in motion capture data. These may occur naturally and can be eliminated in order to achieve a better-quality capture.

asset

In MotionBuilder, any element used to create animation, such as models, textures, and shaders.

attribute

See property on page 2014.

Auxiliary effector

In MotionBuilder, a supplementary effector in a Control rig that corresponds to an existing IK effector. Auxiliary effectors provide additional IK control for a character's reach, and display as a cube on the corresponding IK effector.

See also effector on page 1996.

Auxiliary pivot

In MotionBuilder, a sub-control that lets you translate and rotate an IK Control rig effector from a point other than its current location.

See also pivot on page 2013.

B

back plate

A background image, video clip, or video feed to be displayed on the background plane in a scene.

Back plate can also be spelled as one word in other software products.

Background Color Cancellation (BCC)

A chroma key feature that senses the color of the chroma key backing and replaces it with a complementary color. As a result, the two colors cancel each other. This eliminates the halo or fringing effect surrounding the foreground object in the chroma key.

Background Color Suppression (BCS)

A chroma key feature that senses the color of the chroma key backing and replaces it with an adjustable luminance level. This prevents the backing color from appearing in the chroma key.

Background generator

A video generator that produces a solid-color output which can be adjusted for hue, chroma, and luminance.

background plane

A plane in a scene on which images, video clips, or video feeds are projected.

BaseAnimation layer

The default animation layer to which all other layers are merged when you plot an animation.

See also layer on page 2005.

batch

The process of automating a frequently performed task by storing commands in a script or “batch file”.

For example, batch load refers to the process of loading or processing more than one file with a single command.

Baud rate

The bits per second (bps) rate at which the information carrying capacity of a communication channel is measured.

BCC

See Background Color Cancellation (BCC) on page 1986.

BCS

See Background Color Suppression (BCS) on page 1987.

bind pose

In MotionBuilder, the position in which a character is weighted, wherein all of the character's limbs should be in neutral positions, neither fully extended nor fully contracted.

Biovision Hierarchical Data (BVH)

A character animation file format that contains skeleton hierarchy information and motion data.

BVH, one of the most popular motion capture data file formats, is mainly used as a standard representation of motion capture of humanoid structures.

biped

In MotionBuilder, a humanoid skeleton that stands on two legs, making contact with the floor using only the feet.

bitplane

The memory in a graphic display device that holds a complete one-bit-per-pixel image.

Black level

The lowest transmittable luminance level that can occur during the active picture portion of a video signal. When viewed on a monitor this signal level is seen as black.

blending object

In MotionBuilder, any selection of nodes or sensors with captured data, a part or complete hierarchy of models with plotted data, or a Control rig that can be used to perform a motion blend.

bone

In MotionBuilder, the connecting lines between the joints that compose an Actor skeleton.

bound model

In MotionBuilder, a 3D model that has a rigid skeleton and is covered by a mesh. The mesh contains a texture and body features that give the model a distinct appearance.

bounding box

Rigid bodies that limit the area in which the eyes, eyebrows, and mouth of a face model can move in an Actor Face.

branch

A part of a hierarchy or tree-based data structure where there is only one route between any pair of nodes. A node on a branch has only one parent.

brightness

Along with contrast, a property that determines the luminance of an object.

buffer

An area of memory used for storing messages.

bump map

Textures that contain two direction vectors, and are used to convey relief in a texture.

See also texture on page 2021.

burst

See color burst on page 1993.

BVH

See Biovision Hierarchical Data (BVH) on page 1988.

C

camera

A device for viewing and recording scenes. Each camera sees the scene from a different angle or “vantage point”.

camera interest

Also referred to as a look at point, the focal point of a camera, represented by a null.

channel

A digital effects processing path for video.

A particular signal path.

MotionBuilder uses channels to connect Actor Face assets with Character Face assets to create expressions for 3D models.

Character

See Character asset on page 1991.

character animation

The process of animating objects or models to give the illusion of personality, life, and character. In contrast to other types of animation, objects are meant to appear alive and to appear to act on their own accord rather than to move randomly.

Character asset

In MotionBuilder, also referred to as the Character. The link between a motion source on page 2008 (such as an Actor on page 1984, a Control rig on page 1994, or another character) and a character model on page 1991.

See also model on page 2008.

Character Face

In MotionBuilder, the shapes on a face model which can be driven with live input, recorded motion capture data, devices, and constraints.

See also shape on page 2018.

Character mapping

The process of creating a link between a data source and a 3D model with a skeleton.

See also Character asset on page 1991.

character model

In MotionBuilder, a 3D object composed of a skinned model with a skeleton.

You can animate a character model by linking it to a motion source via a Character asset.

See also model on page 2008, skeleton on page 2019, motion source on page 2008, and Character asset on page 1991.

child

A model or element that is placed below another in a hierarchical structure. For example: Marker2 is parented by Marker1. In the hierarchical structure, Marker2 is the child and Marker1 is the parent.

See also hierarchy on page 2002 and parent on page 2012.

chroma key

An effect that lets you sample out a colored background, and replace it with something else, such as a video layer.

chrominance

A portion of the video signal that contains color information (hue and saturation). Video picture information contains two components: luminance and chrominance.

See also luminance on page 2006.

clip

Each individual instance of animation, audio, commands, constraints, videos, or camera shots in the Story settings.

A portion of data cut off at a defined boundary.

cluster

A collection of vertices that can be linked to objects.

cluster shapes

A shape made of cluster groups by translating, rotating, and scaling the clusters for use in the Shapes Mapping pane.

See also Character Face on page 1991and cluster on page 1992.

color burst

Also referred to as a burst, a reference for establishing the picture color (hue).

color timing

The synchronization of the color burst phase of two or more video signals. Ensures that no color shifts occur in the picture when the signals are mixed in a switcher or another video device.

COM port

Also referred to as a communications port, a connector for a communications interface.

combiner

A device that controls the way two or more channels work together. It determines the priority of the channels (which picture appears in front and which ones in back) and the types of transitions that can take place between them.

See also channel on page 1990.

command clip

A clip that lets you show and hide models at specific frames in your track. You can also use the Command clip to launch an external application.

communications port

See COM port on page 1993.

constrained object

An object whose movement is determined by the behavior of another object, using a constraint.

See also constraint on page 1994.

constraint

A restriction of the behavior of one object (constrained object) based on the behavior of another object (source object).

See also constrained object on page 1994 and source object on page 2019.

constraint clip

A clip that lets you select, blend, and fade constraints throughout your track in the Story window. To obtain the correct result, the Constraint track must be placed *below* the animation the constraint is meant to affect.

contrast

Along with brightness, a property that determines the luminance of an object.

Control rig

A data source that allows you to create and alter character animation using a combination of an IK rig and an FK rig.

cross chrominance

Also referred to as cross color, moire or rainbow effects in encoded video pictures created when the video encoder misinterprets luminance detail as color information. For example, moire effects on pin-striped clothing.

cross color

See cross chrominance on page 1994.

current segment

The segment of optical data that is currently selected in the Optical editor. When a segment is selected and active (not set to Done in the Label pane), it is colored green.

See also segment on page 2017.

custom keying group

Also referred as custom keying mode. A set of user-defined properties that define a character's effector (or an object) in 3d space which will be captured when a keyframe is created.

A custom keying group can be either: global (can be applied to any character or object in a scene); local (only ever applies to the object(s) that are selected at the time the keying group is created); or object (can be applied to any object in a scene).

cut

A section of a take's animation.

D

deck

A video cassette recorder (VCR).

deformation

A method of modeling object surfaces based on a geometric mesh of control points.

dense data

Animation that displays as many keyframes, such as motion capture data or plotted animation.

device

Any hardware instrument with a specific functionality. In MotionBuilder, you can use input devices such as a mouse, or a MIDI device.

Done state

A possible state of a marker in the optical system. When set to Done, the marker is no longer an active optical marker and cannot be used within the Optical settings. Done optical markers can be filtered and modified in the FCurves window.

dopesheet

A visual representation, similar to a traditional cell-animation timing sheet, that provides you with a way of moving keys, modifying timings, and activating and disabling effects over time.

In MotionBuilder, the Dopesheet window is an exploded view of the Action timeline in the Transport Controls window.

Distribution Factor

A slider that lets you adjust how the gradient is distributed between the Shadow and Highlight colors.

dummy node

A node that contains no geometric data that is used as a parent node.

See also node on page 2009.

E

effector

The markers on a Control rig that represent a character's joints. Effectors are visually represented by the cells on the character representation in the

Character settings and can be selected to transform the character's corresponding body parts. There are two types of effectors: FK effectors and IK effectors.

See FK on page 1999 and IK on page 2002.

See also Auxiliary effector on page 1986.

Effects send

A video switcher feature that lets you select a key source to be sent to a digital picture manipulator. The manipulated key and fill video are then returned to the Switcher's keyer for keying ("flying" a key) over background video.

element

A node. All of the objects that make up your scene.

Environment mapping

A form of reflection mapping best suited for situations when you are filming a model from a single point of view.

Expression

A mathematical formula that you use to animate properties and elements.

expressions constraint

Also referred to as Expressions, constraints created using data entered in the Expressions pane.

See also constraint on page 1994.

extrapolation

The method of using a mathematical algorithm to estimate how a curve logically continues, based on the currently known values.

F

.fbx

The generic 3D data packager file format. FBX files can be unpacked, read, and used by all major 3D software packages, regardless of which package the data came from, or how it is converted.

FCurve

See function curve on page 2000.

fill

In video keying, the video signal that is inserted into the “hole” cut in the background video by a key signal.

filter

A tool used to clean, manipulate, or modify captured motion data. You can use filters and filtering options to manipulate captured data according to your own specifications and to correct noisy or distorted motion capture data.

filtering

The process of cleaning, manipulating, modifying or otherwise tweaking captured motion data.

See also filter on page 1998.

First Contact balloon

The interactive graphical tooltip that is displayed when the SteeringWheel is pinned during startup.

FK

See Forward Kinematics (FK) on page 1999.

FK effector

See effector on page 1996.

See also Forward Kinematics (FK) on page 1999.

FK rig

A Forward Kinematics system that lets you control individual pivot points on a model's skeleton.

Forward Kinematics (FK)

A method of moving a hierarchy (such as a limb) in which the lower elements of the hierarchy follow the motion of parent elements. For example, if you rotate the shoulder using forward kinematics, the upper arm, forearm, hands and fingers follow.

See also Inverse Kinematics (IK) on page 2003.

fps

Frames per second.

See frame rate on page 2000.

frame

A single image at a specific point in time within an animation.

The individual picture image on a strip of film or a complete television picture made up of two fields.

A frame can be used as a unit of measurement.

frame rate

The rate at which sequences of images are captured or displayed. The frame rate is usually measured in frames per second (fps).

function curve

Also referred to as an FCurve, a graphic depiction of an animated value. The time and value of the animated value displays on two axes: the vertical axis representing the value, and the horizontal axis representing the time.

G

gap

The space before, after, or between a marker's segments that does not contain sensor data.

generic channel

A channel that is a preset facial expression.

See also Actor Face on page 1984 and channel on page 1990.

ghost

A wireframe representation of an unrendered blending object in the Viewer window. Ghosts only display when the Motion Blend or Story windows are open.

See also blending object on page 1989.

Ghost curve

A visual representation of the original curve that displays in the FCurves window as you edit the curve.

global coordinates

Values that define a location relative to the origin of a scene, in the format (X, Y, Z).

See also local coordinates on page 2005, X-coordinate on page 2027, Y-coordinate on page 2028, and Z-coordinate on page 2028.

global keying group

Also referred to as global keying mode. A custom keying group that can be applied to any character or object in an animated scene. A global keying group describes a set of properties (for example, scale and translation properties) for a character or an object that will be captured when a keyframe is created in an animated scene. Global keying groups can be assigned to any object or character in a scene, but only the keying group's properties that map directly to properties the object or character already has defined for it will be affected.

gobo

A filter placed over a light to make it project patterns.

Guide pose

A representation of a Character pose used in Ragdoll solves when you want the character to attempt to conform to a pose. With a Guide pose, the character does not perform unrealistic contortions to ensure that the pose is assumed. Guide poses appear in the Viewer window as a green stick figure.

A Guide pose is a less-exacting version of the Match pose. See also Match pose on page 2007.

H

Hardware FC

Hardware Full Control. A special data transfer protocol that controls the flow of data between specific hardware devices.

Head-up Display (HUD)

See HUD on page 2002.

hierarchy

An organization structure that visually describes the relationship between elements. A hierarchy looks like an inverted tree structure, with an element at the top (referred to as a parent) and with several elements below its predecessor (referred to as children).

See also parent on page 2012 and child on page 1992.

HSB

Three numerical values, where “H” refers to Hue, “S” refers to Saturation, and “B” refers to Brightness.

HUD

Information that is visually relayed to the user without requiring the user to look away from the usual viewpoint.

HUD (Head-up Display) takes its name from the head-up displays used in modern aircraft. The origin of HUD stems from the users being able to view information with their heads “up” and looking forward, instead of angled down looking at lower instruments.

hue

A specific color. For example, you can use the Hue slider in the Color window to set an object’s hue to “green”.

I

IK

See Inverse Kinematics (IK) on page 2003.

IK effector

See effector on page 1996.

See also Inverse Kinematics (IK) on page 2003.

IK rig

An Inverse Kinematics system that lets you transform hierarchies of bones using IK effectors.

See Inverse Kinematics (IK) on page 2003.

interpolation

The process in which a computer program automatically fills in the action between keyframes with in-between frames, creating the illusion of smooth, continuous motion when the animation is played.

In MotionBuilder, in the FCurves window, the interpolation is shown by the shape of the function curve drawn between keyframes of an animation.

Inverse Kinematics (IK)

A method of transforming a group of connected joints (such as a limb) where the movement of the end joint influences all the preceding joints in the chain.

For example, when you transform the wrist joint of an arm, the elbow and shoulder joints are also transformed.

See also Forward Kinematics (FK) on page 1999.

IP address

The 32-bit host address defined by the Internet Protocol (IP).

J

jogging

The action of smoothly moving forward and backward through time in a take by J-clicking and dragging in the Viewer window.

joint

The points on a skeleton connected by bones.

K

key

The process of setting a keyframe.

keyframe

A reference point, or key point, that marks the position of an important action or change in a scene at a specific point in time.

keyframing

The action of creating keyframe animation by transforming an object in a scene at a specific point in time and setting a keyframe.

keying group

Also referred to as keying mode. A set of properties for a character's effector or for an object recorded when you create keyframes.

L

latency

The time during which the read/write heads wait for data to rotate into position after the controller starts looking for a particular data track.

layer

A level of animation in a scene, on top of the original function curve data. You can have multiple layers in a scene and make changes to one layer without affecting the others.

See also BaseAnimation layer on page 1987.

Linear key

A luminance key effect in which the gain of the key is approximately one. This preserves the shaping of the key source edges produced by anti-aliased character generators and digital video effects devices.

See also luminance key on page 2006.

local blend

The process of replacing the motion in one track with motion from another track on only part of a hierarchy.

local coordinates

Values that define a location relative to the origin of a selected object, in the format (X, Y, Z).

See also global coordinates on page 2001, X-coordinate on page 2027, Y-coordinate on page 2028, and Z-coordinate on page 2028.

local keying group

A custom keying group that describes the set of properties for an object in 3d space that will be captured when a keyframe is created for that object in an animated scene. Local keying groups can only be assigned to the object(s) selected at the time the keying group was created.

look at point

See camera interest on page 1990.

loop

The area of a take that is designated to continuously play when you click Play in the Transport Controls.

luminance

The luminous intensity of a video signal. The color picture information contains two components: luminance (brightness and contrast) and chrominance (hue and saturation). Probably should remove reference to luminance within definition.

See also chrominance on page 1992.

luminance key

A key effect in which the portions of a key source that are greater in luminance than the clip level cut a hole, or key, in the background video.

M

magnetic mapping

The process of mapping magnetic motion data to an Actor.

marker

Objects used to identify segments. One or more segments, after being labelled or identified, combine to create a marker of continuous data.

In the Optical tool, marker is another term for sensor.

See also sensor on page 2017.

Marker set

A set of markers that map objects containing motion data (such as magnetic markers or optical sensors) to an Actor. This association is then used to drive the Actor. In the Viewer window, a Marker set displays as a group of white markers attached to an Actor.

Match pose

A representation of a Character pose used in Ragdoll solves as a goal stance that the Character must assume during a specified time. Match poses appear in the Viewer window as a red stick figure.

A Match pose is more definitive than a Guide pose. See also Guide pose on page 2001.

material

Material assets are a set of properties that let you change a model's color and simulate how the model's surface reacts to light. These properties may include color, shininess, transparency, reflectivity, and bump. Use materials with textures and shaders for the best results.

Mipmap

A version of an original texture that has been reduced in size to 1 x 1 pixel. This solves the problem of textures with small objects "flickering" as the viewer gets further away.

See also texture on page 2021.

model

The mathematical description of a three dimensional object that is placed in a scene.

moire

A wavy pattern.

morph target

Operators for use with models that have shape animations, also referred to as shape operators.

motion capture

A method of collecting motion data based on the movement of a performer wearing special sensors or markers.

motion source

An asset such as an Actor, character, or Control rig that is linked to a character model through the Character asset to drive the movement of a character model.

N

Namespace

A namespace is a unique path. Each item in a namespace is identified by its own name along with the namespace to which it belongs.

For example, Moon:Alien is a path, but Galaxy:Moon:Alien is a separate path because it does not reference Moon:Alien in the Galaxy but it does increments Moon. Moon:Alien and Galaxy:Moon:Alien are two separate and cooperative elements that do not require renaming.

naming template

An *.fbx* file containing the customized naming conventions used to define a skeleton.

National Television System Committee (NTSC)

See NTSC on page 2010.

node

The individual objects (such as joints, bones, or nulls) that are linked to a model's skeleton structure. Nodes allow you to map between a source and a model.

In the Schematic view, the variously colored tiles that visually represent each asset of a hierarchy.

See also reference node on page 2015 and dummy node on page 1996.

noise

Irregular jumps in a segment of optical data caused by partial occlusion of a sensor on a performer's body during a capture session.

Noticeable distortion in magnetic capture data caused by metallic objects such as aluminium heating ducts interfering with the capture session area.

Non Uniform Rational B-splines (NURBS)

See NURBS on page 2010.

normal

A perpendicular or vector that defines the orientation of something.

normal map

Textures that contain three direction vectors: an X, Y and Z. Unlike a bump map's two vectors, the normal map's three vectors convey height and lighting detail with greater precision, providing heightened realism.

See also bump map on page 1990 and texture on page 2021.

NTSC

Stands for the National Television System Committee (NTSC) as well as for the standard for color television in the United States and other countries established by this Committee.

NTSC is defined by the frame size, a frame rate of 29.97 fps, as well as by the frame aspect ratio and pixel aspect ratio. Although there are various divisions within the NTSC standard format which determine what frame size is used and what pixel and frame aspect ratios are used, the standard frame aspect ratio used by the NTSC standard format is 4:3 (1.333). This format uses a 640 by 480 resolution.

null

An object that you can parent to other objects for additional transformation flexibility. nulls have no specific properties and are simply used to help you build your scene. In the Viewer window, a null is visually represented as a small axis.

NURBS

Non Uniform Rational B-splines. Surfaces and curves that visually represent complex geometric information, used for modeling.

O

object keying group

A custom keying group for objects only (not characters) that describes a user-defined set of properties for object in 3d space in an animated scene when

a keyframe is set. Object keying groups can be assigned to any object in a scene (as opposed to “local keying groups” which are restricted to the object(s) selected at the time the local keying group is created.).

occlusion

A problem with optical motion capture, wherein a sensor is hidden from all but three cameras. This may occur when a performer passes by an obstructing object, or when the performer’s body comes between the sensor and the camera.

opacity

The extent to which an object is transparent. If an object’s opacity is set to 100%, the object displays opaque. If the opacity is set to 0%, the object displays transparent.

OpenGL

A software interface for graphics hardware that supports rendering and imaging operations.

Optical editor

An editor that lets you correct optical data, fix poor gap interpolation, switch swapped markers, and perform other optical data reconstruction.

See also noise on page 2009, occlusion on page 2011, and partial occlusion on page 2013.

optical mapping

The process of mapping optical motion data to an Actor.

Optical root

The main reference for imported optical data, represented in the Viewer window by a sphere.

origin

The point at the center of a 3D scene relative to which every location is defined. At the origin of a scene, the X, Y, and Z coordinates have a value of zero.

The center or reference point of a selected 3D object, relative to which the surface of the object is defined. At the origin of an object, all three 3D coordinate values have a value of zero, written as (0,0,0).

See also global coordinates on page 2001 and local coordinates on page 2005.

P

PAL

Stands for Phase Alternating Line —a standard for color television used in many European, African, and Asian countries.

PAL is defined by the frame size, a frame rate of 25 fps, as well as by the frame aspect ratio and pixel aspect ratio. Although there are various divisions within the PAL standard format which determine what frame size is used and what pixel and frame aspect ratios are used, the standard PAL video signal format sets the video to playback at 25 frames per second which contain 625 lines of pixels in each frame.

parameter

See property on page 2014.

parent

A model or element that has been made the parent of another. For example, in the hierarchical structure, Marker1 is the child and Marker2 is the parent.

See also hierarchy on page 2002 and child on page 1992.

parenting

The act of making one model or element the parent of another.

partial occlusion

A problem with optical motion data that often occurs if a sensor on a performer's body has been placed too close to another sensor, or the sensor becomes partially hidden from one of the cameras during the capture session. The resulting data may display peaks, shifts, or noise.

patch

A type of tesselation, something to do with a model's surface.

Phase Alternating Line (PAL)

See PAL on page 2012.

pitch

A rotation based on the movement up or down the Y-axis. For example an airplane banking up or down.

pivot

The point from which a selected object is transformed.

See also Auxiliary pivot on page 1986.

pole vector

A part of an IK rotate plane handle that begins at the start joint, and along with the handle vector defines the IK handle's reference plane.

The pole vector changes the orientation of the reference plane, so you can change the orientation of the joint chain directly. This is because the joint chain's degree of orientation, or twist, is defined as the difference in orientation between the reference plane and the joint chain plane.

Also known as "up-vector" in other software packages.

pose

A snapshot in time of a selected character or object's position.

property

Also referred to as an attribute or parameter, a value that quantifies a specific characteristic of an object, and can be animated. For example, the fog intensity of a light is a property.

Q

Qt

A cross-platform application development framework, widely used for the development of GUI programs (in which case it is known as a widget toolkit), and also used for developing non-GUI programs such as console tools and servers.

Qt uses C++ with several non-standard extensions implemented by an additional pre-processor that generates standard C++ code before compilation. Qt runs on all major platforms, and has extensive internationalization support. Non-GUI features include SQL database access, XML parsing, thread management, network support and a unified cross-platform API for file handling.

Qt is most notably used in KDE, Opera, Google Earth, Skype, Qtopia, Photoshop Elements, VirtualBox and OPIE. Qt can also be used in several other programming languages; bindings exist for Ada (QtAda),[3] C# (Qyoto/Kimono),[4] Java (Qt Jambi),[5] Pascal, Perl, PHP (PHP-Qt), Ruby (RubyQt), and Python (PyQt).

quadruped

A four-legged skeleton that makes contact with the floor using all four limbs.

quaternion

A complex number made up of four geometric components.

A quaternion adds a fourth element to the [x, y, z] values that define a three-component-vector. A quaternion represents an axis in 3D space and a rotation around that axis.

R

reference node

A null or joint that acts as the root of an entire model and is the parent of the models' Hips.

Relations

See relational constraint on page 2015.

relational constraint

Also referred to as Relations, constraints that perform custom operations on the data of a source object to determine the behavior of the constrained object.

See also constraint on page 1994.

remote port

An additional port provided by a serial device where you can physically connect input and output devices.

render

To generate an image file, a sequence of image files, or movie file(s) using the mathematical descriptions of the objects that compose the scene.

rest pose

The default position at which a Character Face asset is at rest.

retargeting

The process of taking the animation data mapped to one character, applying that animation to another character to drive its animation without having the need to plot (or bake) the animation.

Rigid body

Two or more markers grouped to correct occlusion.

roll

A rotation around the X-axis. For example, the rolling of a log.

rotation

The process of changing all the points on an object to reflect the degree of rotation around each of the three axes.

S

sample

The position of a sensor recorded by each camera at each frame. All samples from each camera generate a three-dimensional representation of each sensor's position in time when processed.

See also keyframe on page 2004.

saturation

A property that helps determine the chrominance and contrast of the color of an object.

scaling

The process of enlarging an object by moving all the points outward from the object's center, or shrinking it by drawing them all in toward that center.

scene

A representation of a three-dimensional world in which objects are placed and animated using a coordinate system.

See also 3D coordinate space on page 1984.

scrubbing

The process of moving through an audio track either forward or backward, while the audio is playing. This process is used to find and hear the audio at a specific frame.

segment

The data captured from an optical motion capture session.

See also current segment on page 1995, and motion capture on page 2008.

sensor

A reflector or light source attached to a performer's body. Sensors are tracked by optical cameras during the capture process. Captured data is combined to create segments.

See also motion capture on page 2008 and segment on page 2017.

serial port

Also referred to as a COM port, a port that uses a special communication protocol to control the flow of data between devices, allowing the transfer to be made at a higher speed.

shader

In 3D modeling, the term “shader” is used to describe an algorithm that specifies how a surface responds to light. In MotionBuilder, “shaders” are assets that you apply to models to create different types of effects. Various types of shaders can define how a surface responds to light, or create special effects like cartoon outlines and bump mapping. You can also use shaders to generate shadow maps and light maps for scenes with a static light source. MotionBuilder also supports custom shaders created using the Open Reality® SDK.

Shadow map

A *.tiff* image of the shadow created by the Shadow Map shader, projected onto planes and objects in a scene.

shape

In the Character Face settings, a Character Face modified to portray a particular expression, such as “angry”.

See also Character Face on page 1991.

shape operators

Also referred to as morph targets, special operators for use with models that have shape animations.

shuttling

The action of fast-forwarding or rewinding through an audio track while the audio is playing.

simple constraint

Constraints that use a pre-defined list of constrained objects and source objects.

skeleton

A set of points representing the joints, and of connecting lines representing the bones.

skin

The mesh of vertices that envelopes a 3D character, creating its shape.

SMPTE

Refers to the Society of Motion Picture and Television Engineers (SMPTE) founded in 1916 to advance theory and development in the motion imaging field.

solving

The process of calculating the position of both the forward kinematics and inverse kinematics rigs, then applying these results to the linked model while observing the settings in the Character Settings pane.

The results of calculating each rig. For example, IK solving refers to the result of calculating the IK rig.

In MotionBuilder, the result of all calculations, rigs, and settings when using the character engine.

source object

An object on which a constraint is based.

See also constraint on page 1994.

Sphere map

A reflection type that causes a 3D object to reflect the contents of its scene from only one point of view.

Spherical map

A reflection type that causes a 3D object to reflect the contents of its scene.

spline

A curve that is defined using control points.

stabilizing object

A sensor, a node from a skeleton, or a model from a hierarchy of models that stabilizes the entire blending object and corrects problems such as foot sliding.

See also blending object on page 1989.

stack

A data structure for storing items which are to be accessed in last-in first-out order.

stance pose

The starting or rest pose of a model.

SteeringWheels

Tool set that provides access to 2D and 3D navigation tools.

subcarrier

Also referred to as the SC, in NTSC or PAL video, a continuous sine wave of extremely accurate frequency which constitutes a portion of the video signal. The subcarrier carries picture hue and color saturation information.

swapping

A problem with optical motion capture wherein two markers either cross or pass close to each other, causing the capture system to misinterpret the markers and label the segments incorrectly.

See also motion capture on page 2008.

T

take

A snapshot in time of an animation instance.

NOTE Time can be measured in hours, minutes, seconds, and frames, or in frames per second.

tangent handle

The visual representation of the tangent of a keyframe on a function curve. Tangent handles let you change the slope of the curve on either side of the keyframe.

TCB

Tension, Continuity, Bias.

tesselation

A step in the rendering process in which the shapes of an object's surface mesh are rearranged into triangles.

texture

Various texture assets let you apply image or video files to materials, layered textures, and models. Textures are most commonly used to add detail to a

model's surface without adding to the model's geometry. Use textures with materials and shaders.

timecode

The value that indicates the current position in time of the current take.

Timewarp

A curve that alters the shape of a function curve and changes the timing of an animation.

See also function curve on page 2000.

track

A course along which something moves, or a sequence of events through time.

In MotionBuilder, there are two types of tracks. In the Motion Blend window, tracks can contain motion data and let you blend takes into a single result track. In the Story window, tracks can contain motion data, keyframe animation, audio and video, and let you blend specific types of clips along the timeline.

transformation

The process of changing the points on an object by translation, rotation, and scaling.

translation

The process of moving an object on one or all axes. Translation moves an object without changing its orientation.

transparency

The level of visibility of a object, determined by the opacity setting. When the opacity is set to 0%, the object is transparent.

trigger

In the Animation Trigger window, a device, such as a joystick or keyboard, that allows you to execute motion clips to test the transitions you created between them.

triggering group

A collection of motion clips and the triggers that initiate their execution.

T-stance

The neutral pose of a biped character similar to a “T” pose in which the arms are at a 90-degree angle from the body, the legs are fully extended, the feet are flat on the floor, and the spine is straight.

U

UCS

See User Coordinate System (UCS) on page 2024.

See also World Coordinate System (WCS) on page 2027.

unlabelled segment

A segment of data that has not yet been labelled to associate it with a marker. This is done during optical cleaning. Unlabelled segments display as blue asterisks.

unweighted tangent

A tangent on a function curve that does not have weight applied to it.

See also function curve on page 2000 and weighted tangent on page 2026.

up-vector

See pole vector on page 2013.

user channels

Custom channels you can create in the Character Face settings.

See also channel on page 1990 and Character Face on page 1991.

User Coordinate System (UCS)

A user-defined coordinate system that defines the orientation of the X, Y, and Z axes in 3D space. The UCS determines the default placement of geometry in a drawing. See also world coordinate system (WCS).

See also World Coordinate System (WCS) on page 2027.

UV

U and V texture coordinates. U and V represent vectors in a 1 x 1 pixel image that connects to places on a 3D mesh. The U and V coordinates let you place the texture on the 3D mesh exactly. This placement attaches the texture to the object's surface, and it is mapped to create a seamless effect.

V

value

A number that defines anything from the position, rotation, or scaling of a model, to a material's emissive, ambient, or diffuse color values.

See also property on page 2014.

vector

A straight line segment.

ViewCube

User interface element that displays the current orientation of a model. You can use it to restore and create a UCS, interactively rotate the view, or restore a preset view.

visual keyframe

Arrowhead-shaped tabs that display on the Action timeline and on the timeline in the Dopesheet window to indicate the location of keyframes that are set.

See also keyframe on page 2004.

voice channels

In the Character Face settings, channels that are preset mouth expressions.

See also channel on page 1990.

VK ripple

Visual keyframes ripple.

See also visual keyframe on page 2025.

VTR

Video Tape Recorder.

W

waveform

A graphical depiction of the continuous fluctuation in the amplitude of a sound over time.

WCS

See World Coordinate System (WCS) on page 2027.

See also User Coordinate System (UCS) on page 2024.

weighted tangent

A tangent on a function curve that has weight applied, letting you stretch the tangent handle and create special curves that you cannot create with unweighted tangents.

See also function curve on page 2000 and unweighted tangent on page 2023.

wheel

A reference to one of the individual user interface elements that make up SteeringWheels.

See also SteeringWheels on page 2020.

wheel surface

Area of a wheel that is used to organize wedges and other buttons.

wheel wedge

A section on the surface of a wheel that is designated for a specific 2D or 3D navigation tool.

wheels

A reference to more than one of the individual user interface elements that make up SteeringWheels.

See also SteeringWheels on page 2020.

wireframe

A manner of displaying objects, such as ghosts.

World Coordinate System (WCS)

A coordinate system used as the basis for defining all objects and other coordinate systems.

See also User Coordinate System (UCS) on page 2024.

world coordinates

Coordinates expressed in relation to the World Coordinate System (WCS) on page 2027.

X

X-axis

The dimension on which coordinates define the horizontal space of the scene.

See also 3D coordinate space on page 1984.

X-coordinate

The value that defines the horizontal space in the scene relative to the origin.

Y

Y-axis

The dimension on which coordinates define the vertical space of the scene.

See also 3D coordinate space on page 1984.

Y-coordinate

The value that defines the vertical space in the scene relative to the origin.

yaw

A rotation based on spinning an object using its center as the axis. For example, a record on a turntable.

Z

Z-axis

The dimension on which coordinates define the depth of the scene.

See also 3D coordinate space on page 1984.

Z-coordinate

The value that defines depth in the scene, relative to the origin.

Zero keyframe

A keyframe in which the effect of a layer is set to zero at a given time.

A keyframe set to define the start or end of an animation.

See also layer on page 2005.

zero point

The stance of an Actor where both translation and rotation are set to zero.

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