Chapter 9 – Animation

9.1 Animation Introduction

This chapter documents the new animation tools found in the Workspace (it does not cover the animation tools such as the KFE and similar that are found in the Model side). The Workspace features a powerful range of tools for creating animation which will let you work with physics simulation, skeletons, keyframed animation, and imported motion capture via BVH. You can in fact flexibly combine all of these different types of animation, giving you many different ways to achieve exactly what you are looking for.

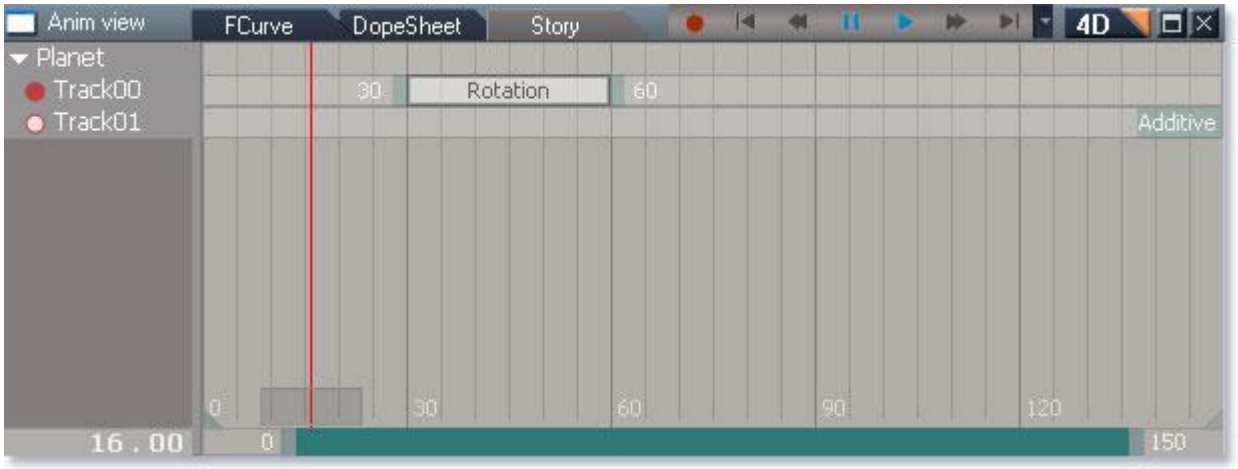
The chapter begins with a look through each of the tools associated with this process, and then moves on to some introductory tutorials that take you through some ways of creating animation in trueSpace.

9.2 The Animation Editor in detail

The Animation Editor is found at the bottom of the screen in the default view. The Animation Editor is actually a fourth aspect of a regular trueSpace7.5 window, named “4D” since it describes how things change over time (as a refresher and summary on the various aspects, 1D is scripting, 2D is the Link Editor, 3D is the rendered 3D view, and 4D is the Animation Editor).

The Animation Editor itself features three tabs that display three different views. These are

9.2.1 Story



The Story view

This view is the one you will find most useful when recording and arranging animations. This view displays all the objects in the scene which have any animation associated with them and lets you move, scale, cut, copy and paste Clips in this window, letting you re-arrange the animation in the scene.

Each object is listed in the tree view on the left – in the image above, there is only one object in the scene, named Planet. Each object can have its view expanded to show all the individual Tracks for that particular object.

Tracks are used to make it easy to record and mix separate actions, for example you might have Rotation on one track, with movement on another Track. Blending Clips is done using Tracks in Additive mode – if a Track is in Additive mode, this is noted on the right of the Story view (as can be seen in the image above for Track01).

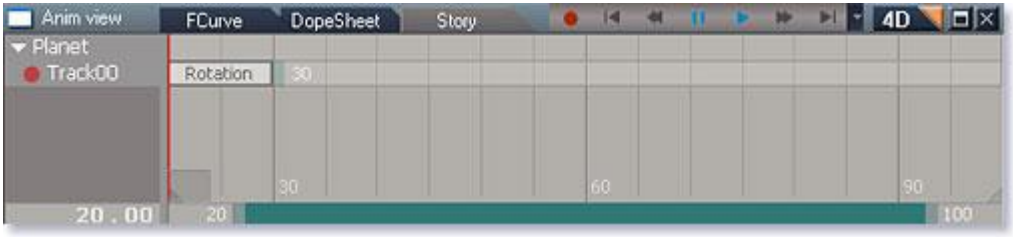
The main part of the view shows all the Clips on each Track. The example above has one Clip, which has been named Rotation. You name Clips yourself so you can give them meaningful names based on your scene and workflow. Each Clip has a number to the left and the right, which shows the start and end frames for that Clip.

Blue handles at the left and right ends of the Clip let you stretch and scale the Clip, while clicking in the central section makes the Clip selected, and also lets you click and drag to move the Clip on the timeline. Using CTRL click and drag, you can make a copy of the Clip. Note that you can move or copy Clips using drag and drop onto any desired Track.

To the bottom left of the Story view, is the current selected frame, displayed numerically (frame 16 in the example above). You can click on this and enter the frame numerically if you wish.

The current frame is displayed visually in the main window via the red line – the grey area at the bottom of this is a handle which you can click and drag to move the current frame and also to scrub through your animation to inspect it.

The main window displays grid lines for the frames. The two numeric values on the left and right define the playback range for the animation, setting the start frame on the left and the end frame on the right. The above image shows a scene with a playback range of 0 to 150, and the zoom is displaying this whole range.



You can adjust the playback range of the animation by typing new values into the start and end frame indicators at the bottom of the Animation Editor. The image above now shows the playback range of 20 to 100. Playing an animation will now start at frame 20 and end at frame 100. Note that clips and animation can exist outside of this range, as seen above, but will not be played back (or rendered) except within the range of the animation. The zoom

is still set to display the entire range of the animation. If you were to playback the animation using these settings, the "Rotation" Clip would start part way through its recorded animation.

You can zoom your view to give finer control using the blue control at the bottom of the window – the blue area shows how much of the current animation sequence is being viewed, and the handles at either side of the blue control let you zoom in and zoom out. Clicking and dragging on the blue area lets you move the zoom so that you can inspect other areas on the time line, rather like using a scroll bar. You can also use page left and page right (by clicking on the empty space in the bar) to move your view one whole step to the left or right.

In this image above, playback range has been set back to 0 to 150. However, the zoom range has been altered to display only the range 20 to 100. You will notice that only frames 20 to 100 are displayed in the main window. Also notice that the blue area shows the section of the animation you are currently viewing. If you were to playback the animation with these settings, all frames from 0 to 150 will be played and not just the range 20 to 100, so the "Rotation" Clip would play the entire Clip from the beginning. The zoom only affects your current display in the Animation Editor and not the start and end of the animation itself.

You can right click on various parts of the Story view to open menus. These are detailed below:

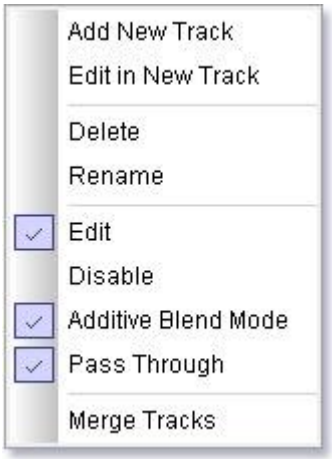
9.2.1.1 Right click on an object in the in the tree view on the left:

- **Add New Track** - Create a new Track for this object.
- **Edit in New Track** – Create a new editable Track for this object and set it to additive blend mode in one step.
- **Delete** - Delete the object you right clicked on (note, not just the Tracks, Clips or animation, but the actual object itself).
- **Rename** - Change the name of the object you right clicked on.
- **Merge Tracks** - This combines all the actions in the currently enabled Tracks and Clips into one Clip. This always creates a new Track to store the result on, and it is also non-destructive – all existing Tracks and Clips are left intact and unchanged. The new Clip is always the same length as the longest enabled Clip. Any Tracks or Clips that are Disabled at the time of Merging are not included in the end result.

This makes Merge Tracks very useful for creating one easy to use Clip from several others, for example if you have been mixing actions using Additive mode Tracks, you can produce one Track with all the actions merged together (note that this new Merged Track does not require a Static Base Clip, nor Additive mode – see later in the Advanced tutorial for more details).

One thing to note is that Merge Tracks creates one keyframe for every frame in the animation. This means the final merged Track will not be easy to edit – be sure to save your scene with the original Tracks and Clips before erasing them and leaving only the merged Track, in case you want to make any future edits to the animation.

9.2.1.2 Right click on a Track for an object in the tree view on the left:



- **Add New Track** - Create a new Track for this object.
- **Delete** - Delete the Track you right clicked on.
- **Rename** - Change the name of the Track you right clicked on.
- **Edit** - If checked, this is the currently active Track. Pressing Record will generate keyframes on this Track. The Dope Sheet and F Curve views will show the keyframes on this Track. If unchecked, then another Track is the current Active Track.
- **Disable** - If checked, then this Track is ignored during the playback of the animation. Use this to turn off some actions to make it easier when setting up new actions, for example to turn off the character walking so you can focus on making the character's arms wave. If unchecked, then this Track will playback normally during the animation. This is a non-destructive change which does not alter anything recorded on the Track.
- **Additive Blend Mode** - If checked, then the action in this Track will be blended with actions from other Tracks. This is the mode you will use most often. If unchecked, then the action in this Track will not blend with other Tracks, but will override the actions recorded in any Tracks placed above it in the Animation Editor.
- **Pass Through** - When checked, at any point in the timeline where there is no clip on this track, then the animated object will return to a state or pose set in the base track. When unchecked, the animated object retains the state or pose from the last keyframe in its clip.

  The Pass Through parameter affects the process of evaluating the value outside the clip interval (clip extrapolation). However, it does not affect interpolation inside the clip (between the start and end of the

clip). If the parameter is checked then the evaluation process passes through the track without change and the track is ignored if the current time is outside of the clip interval. If it is not checked, then the extrapolated value from the clip is added to evaluation process even outside of the range of the clip.

This is particularly useful when posing skeletons. For example, if are working with an Additive Mode track and you move the arm into a particular pose at keyframe 30, and you want to advance the time to your next keyframe and then adjust the pose.

With Pass Through checked, as soon as you move the current frame forward beyond frame 30, the skeleton no longer displays the pose you set at frame 30, and instead resets to the pose stored in the base track.

By un-checking the Pass Through parameter, when you advance the current time beyond frame 30, the skeleton remains in the same pose that you set in frame 30, making it easier to adjust the skeleton into the next pose you need for the animation.

Note that this parameter affects the playback of the animation as well as the process of capturing the animation – if your track has clips with some empty space between them, then un-checking the Pass Through parameter will leave the object in the last keyframed position between those clips, otherwise the object will revert to the base track default position between those clips.

- **Merge Tracks** – See the Merge Tracks information under the object menu, as the functionality is the same.

9.2.1.3 Right click on a Clip in the main area of the screen:

Note that all these operations affect the currently selected Clip only, and not the Clip you right click on. This is important to keep in mind. The options in this menu are :

- **Add New Procedural Clip** – Creates a new Procedural Clip on the Track you right clicked on (this is independent of the currently active Track). Procedural Clips are used to store animation generated by the Physics Simulation in trueSpace, turning it into keyframed animation that you can then edit and manipulate, and render using the offline render engines. See later tutorial for more details on how to use Procedural Clips.
- **Disable** - If checked, then this Clip is ignored during the playback of the animation. You can use this in a similar way to disabling Tracks, but it lets you temporarily turn off specific actions. This is a non-destructive change which does not alter anything recorded on the Clip.
- **Procedural** -: If checked, then this is a Procedural Clip. If unchecked, it is a regular Clip containing keyframes.
- **Rename** - Change the name of the Clip you right clicked on
- **Delete, Cut, Copy** – Editing commands you can use on the Clip.
- **Paste** – This pastes any Clip that you have copied or cut. The Clip will be pasted at the current frame, and always on to the same Track it was copied from (if the Track has been deleted since you Cut or Copied the Clip, it will not paste onto the timeline). If you want to place a Clip onto a different Track, simply click and drag the Clip onto the desired Track, or use CTRL click and drag to copy the Clip onto a new Track.
- **Razor** – The Razor option will split the currently selected Clip into two, divided at the current frame. If the current frame is outside the currently selected Clip, then Razor has no effect. Do note that it is the current selected Clip that is affected (highlighted in white) and not the Clip you right click on.

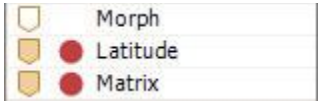
  Reverse - This reverses all the animation in the clip, in effect making it play backwards.
- **Generate Key Frames** – This activates and runs the Physics Simulation, and stores the resulting action into the currently active Procedural Clip. If there is no currently active Clip, then it generates keyframes for all Procedural Clips.

9.2.1.4 Right click on the Record button to open the Keying Panel:

The Keying Panel lets you define what attributed get recorded when a keyframe is set using the Record button in the Animation Editor. This is an important tool, and you'll need to use it to ensure that you can record the attributes you need for making your animation, particularly when those are attributes not set by default. For example you would need to access this panel to if you need to keyframe material settings, or morphs.

Note that the keying panel sets what can be recorded for the whole scene, rather than on a per object basis. An attribute shown in the keying panel can be in several different states, which are described below.

Attributes on a grey background are not enabled for recording, and will not be recorded in the keyframes.



An attribute on a white background is enabled for recording in the scene. This only affects recording via the Record button. Playback is not affected – previously recorded values will be kept and play back even if not enabled from recording.

An attribute that is set to be recorded has two possible states:

A red circle icon next to the attribute name shows that the currently selected object possesses that attribute, and the values of this attribute will be recorded.

With no red circle icon next to the attribute name, this means that the currently select object does not possesses that attribute – so while the attribute is enabled for recording, it will not be recorded for the selected object.

The final icon on the far left shows whether a keyframe is currently set for this attribute at the current frame.

An outlined (unfilled) orange icon shows that the object has no value recorded for this attribute at the current frame.

Clicking on this icon will create a keyframe for that attribute at the current frame – note that it will create that keyframe whether or not the attribute is enabled for recording. This acts as a way to "override" the scene settings and create keyframes for specific attributes. It also lets you protect particular attributes.

A solid orange icon shows that the object does have a value recorded for this attribute at the current frame.

If you click the filled icon, it will erase the keyframe for this attribute at the current frame – note that the value keyframed for this attribute is fully erased, not just deactivated. Clicking the icon again to restore it to the filled condition will not restore the originally keyframed values.

Of course the attributes listed in this panel will change depending on the object you have loaded. The panel shown here is for a primitive created in the Workspace. The parameters shown in this example are:

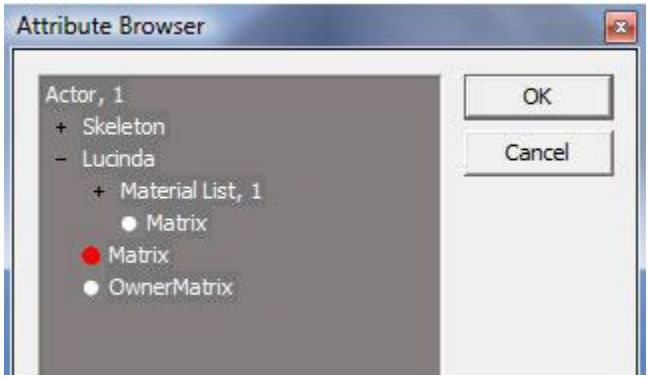
- **Morph** – Allows Morphs to be recorded. In this case, the selected object has no Morphs associated with it, even though Morphs are enabled for recording.
- **Matrix** – Stores the position, rotation and scaling of the object. If you want to record changes to any of these, then this parameter should be enabled.
- **Owner Matrix** – This is the parent matrix used in grouped objects (encapsulated objects). If you want to capture movement from the group that this object belongs to, then this will need to be enabled.
- **Depth, Height and Width Parameters** – These are the parameters that control the creation of a cube in the Workspace. Different objects have different parameters, and these will be shown here. If you want to record keyframes for any of the parameters that control an object's creation, then you need to enable those here in the Keying Panel.

Right clicking on any attribute opens the Keying Panel options seen on the right.

- **Set Keyframe** – This records a keyframe for this attribute at the current frame. This is the same as clicking on an empty orange icon to set a keyframe.
- **Add To Keying Template** – This enables recording for this attribute, and is the same as clicking on the attribute.
- **Remove From Keying Template** – This is the same as clicking on the red circle icon, and disables recording for this attribute.
- **Reset Keying Template** – This restores the attributes to a default state as to which are enabled for recording and which are not.

- **Browse Attributes** – This opens a navigation window that lets you browse through all the attributes and sub objects that belong to the currently selected object.

  The example shown on the right is for a character with skeleton. The Matrix and OwnerMatrix are shown for the top level (The Actor). The Skeleton and actual mesh (named Lucinda) are seen beneath that, and the information for the mesh has been expanded to show the Material List beneath that.



The Matrix for the mesh is also shown, and we could expand the Material List to view its individual components and attributes. Clicking on any attribute will add it to the Keying Panel template, enabling it for recording.

Do note that this enables only the attribute with that specific name, making the attribute object specific. In the example above, if we enabled the Matrix attribute for the Lucinda object (the mesh inside the Actor object) it would enable recording of an attribute named "Actor,1/Lucinda/Matrix". Other characters in the scene would not have their matrix enabled for recording, even though it would be at the equivalent place in the hierarchy, since they would have a different name.

As a note, you can also enter the Link Editor and exported an attribute from a sub-object out to the top level object in the scene. Doing this will make the attribute visible automatically in the Keying Panel. It would also enable recording for other objects that have an attribute of the same name at the top level.

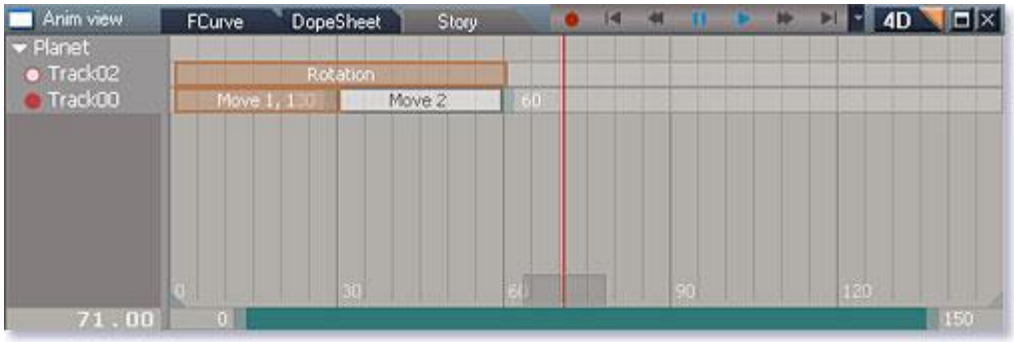
Modifying objects by working with them in the Link Editor lets you control certain parameters globally for the scene, but does involve editing the objects to allow those attributes to be recorded. Using the Browse Attributes option lets you avoid editing the object in the Link Editor, and is useful for where the internal parameter has the same name as one already higher up in the object (in this case, Matrix), but then is specific to the object name and not global for objects of a similar type.

9.2.2 Saving Clips

One important thing to note about Clips is that you can save them to a library for later use. This makes the animation system very flexible, as you can reuse animations instantly!

Before you save a Clip to the library, it is important to have the correct Clip selected. trueSpace will **only** save Clips from the current Active track, so be sure the required Track is active. trueSpace will then save the currently selected

Clip from the active Track – if no Clip is selected, then you cannot guarantee which Clip will be saved, so ensure your desired Clip is selected (highlighted in white).



The above image shows that the Move 2 Clip is ready to be saved – it is the selected Clip on the currently active Track, so this is the Clip that will be stored in the library when you save it. Note that in this example, if the Rotation Clip was selected, it would **not** be the Clip that is written to the library as it is not on the active Track. Instead one of the two Clips on the active Track would be saved (which one would be determined by trueSpace itself). So please double check before saving to the library that you have the correct Track active, and the correct Clip selected!

Once you are ready, you can save Clips to any library by right clicking on the library and choosing "Insert As". From the list of object types that you can save, select Rosetta Anim Clip (RsClip). The currently selected Clip on the active Track will then be saved, with a preview of the object it was attached to when you saved it.

It is often preferable to create a special library to store just Clips, and this is possible. Using the Library Browser, you can select Create Library and specify it is to be a library of Rosetta Anim Clips. This simplifies the saving process, as you can just click "Insert" rather than "Insert As" and choose the type of object you want to save, and also makes it easier to quickly find your animations when you need them!

9.2.3 Loading Clips

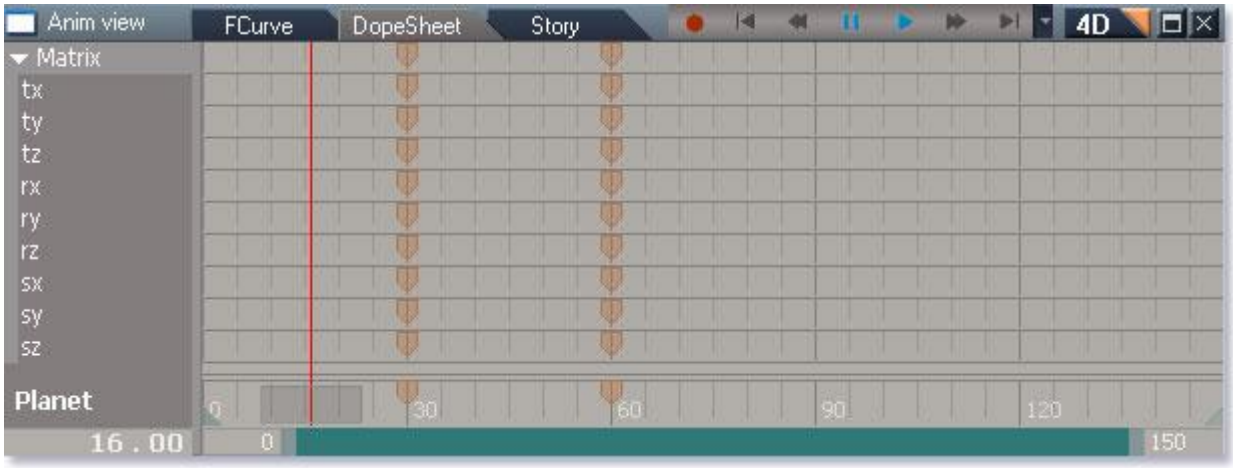
Once you have a Clip stored in a library, it is easy to load it onto an object. First, ensure you have the correct object selected, and then simply double click on the Clip in the library. The Clip will always load onto a new Track, and will always be positioned at the left edge of the current display, so if your Story view is set to start at frame 0, the Clip is loaded at frame 0; if your Story view starts at frame 50, the Clip is loaded at frame 50. You can use this fact to load the Clip into a particular location, although of course you can always easily move it later.

Do note that the result of loading an animation onto an object will depend on how the object is set up. If you try to load a Clip saved from a character with skeletal animation, it may or may not load onto another character depending on how the skeletons are set up; loading that same animation onto a regular polygon will of course be meaningless;

if you load a rotation around the z axis saved from a cube onto another object, quite how the object rotates will depend on the direction of its z axis, the position of it center of rotation, and so on.

So while the system for saving and loading Clips is easy, you do still need to give some thought about what you are loading and saving, and how your objects are set up.

9.2.4 Dope Sheet



The Dope Sheet view

This view is the one you will find most useful for adjusting the timing of keyframes when editing an animation.

This will display information for the selected clip on the active Track (as defined in the Story view) for the currently selected object. Some things to note are:

- If there is more than one Clip on the active Track, and none of those Clips are selected, then this view will select which Clip to display by itself.
- If you select a different object in the 3D view, then the Dope Sheet updates to display information for that object. Each object has its own active Track, and the Dope Sheet will display the information for that Track.

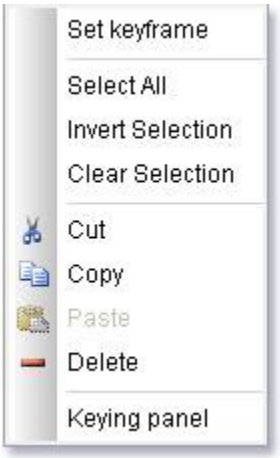
In the Dope Sheet, you can expand the display to show all the parameters that have recorded information. For example, with regular keyframe animation, you will see the Matrix information for an object, and expanding this will show:

- the translation (movement) keyframes in each axis as tx, ty and tz

- The rotation keyframes in each axis as rx, ry and rz
- The scaling keyframes in each axis as sx, sy and sz

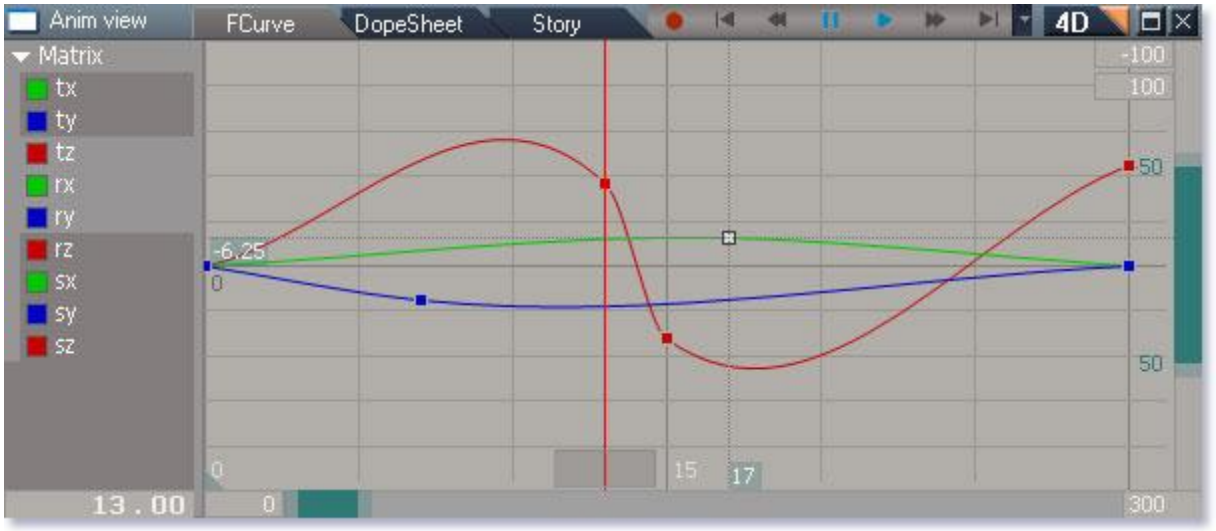
For skeletal animation, you can expand the display to show keyframes for the various parts of the model and the various parts of the skeleton.

9.2.4.1 Right click on a keyframe in the Dope Sheet view



- **Set Keyframe** – Record a new keyframe at the current time.
- **Select All** – Select all keyframes.
- **Invert Selection** – Invert which keyframes are selected and which are unselected.
- **Clear Selection** – Clear any selected keyframes.
- **Cut**– Cut all selected keyframes.
- **Copy**– Copy all selected keyframes.
- **Paste**– Paste keyframes from a previous Cut or Copy.
- **Delete**– Delete all selected keyframes.
- **Keying Panel** – Open the Keying Panel (same as right click on the Record button)

9.2.5 F Curve



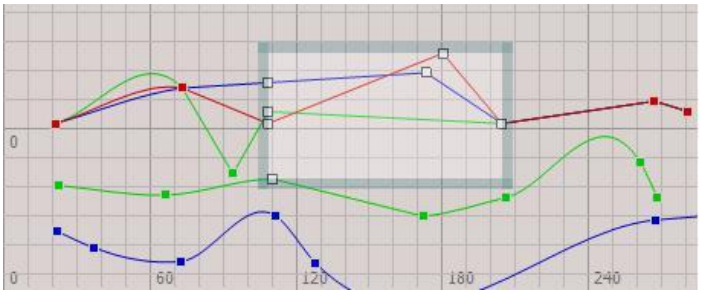
The F Curve (Function Curve) view

This view is the one you will find most useful for adjusting the values of keyframes when editing an animation.

The view displays the function curves for the selected clip on the active Track (as defined in the Story view) for the currently selected object. The same notes apply as for the Dope Sheet.

While the Dope Sheet is an easy way to adjust the timing of keyframes, it does not let you adjust the values. The F Curve view lets you adjust both though, and displays the value for the parameters as well as their position in time. As well as displaying the values recorded at the keyframes, the display also shows the way the value is calculated in between the keyframes – that is, you can see the line that displays how that parameter (movement, or rotation for instance) changes in between the recorded keyframes.

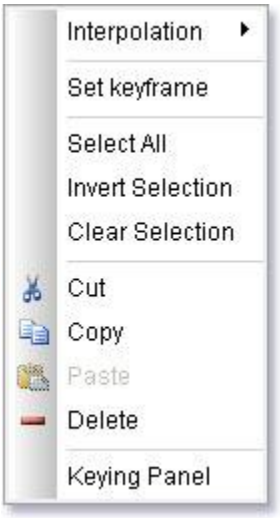
You can work with either individual keyframes, or with a selection of keyframes. Multiple keyframes can be selected by using CTRL and click to add or remove keyframes to the selection. You can also click and drag to select keyframes within a bounding box.



Once a selection of keyframes has been made, you can then manipulate all the selected keyframes at once using the handles around the selected region. You can scale or move all the keyframes in the selection at once using the handles, as seen in the image above.

You can also select keyframes from the context menu. Right click in the main F Curve pane and choose 'Select All' item to select all visible keyframes.

9.2.5.1 Right click on a keyframe in the F Curve view

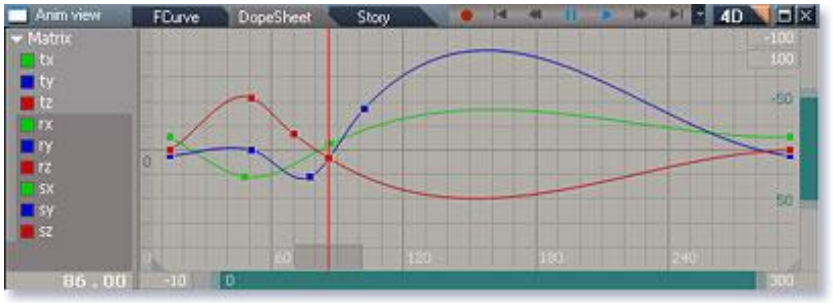


- **Interpolation**– Set the interpolation method to be used for the selected keyframes (see section below for details on each interpolation method).
- **Set Keyframe** – Record a new keyframe at the current time.
- **Select All** – Select all keyframes.
- **Invert Selection** – Invert which keyframes are selected and which are unselected.
- **Clear Selection** – Clear any selected keyframes.
- **Cut**– Cut all selected keyframes.
- **Copy**– Copy all selected keyframes.
- **Paste**– Paste keyframes from a previous Cut or Copy.
- **Delete**– Delete all selected keyframes.
- **Keying Panel** – Open the Keying Panel (same as right click on the Record button)

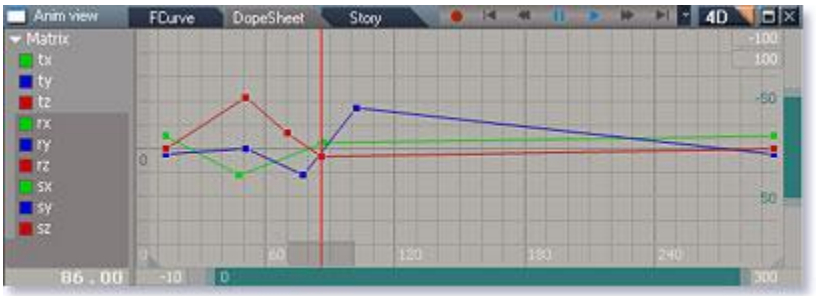
As noted above, you can change the interpolation type between keyframes, choosing from one of the following types of interpolation: Bezier (default) , Linear, Constant Start, Constant End and Custom Bezier.

By default, the animation system generates a Bezier interpolation curve, to create smooth motion between keyframes. To change the interpolation, right click in the F Curve editor window and choose the interpolation

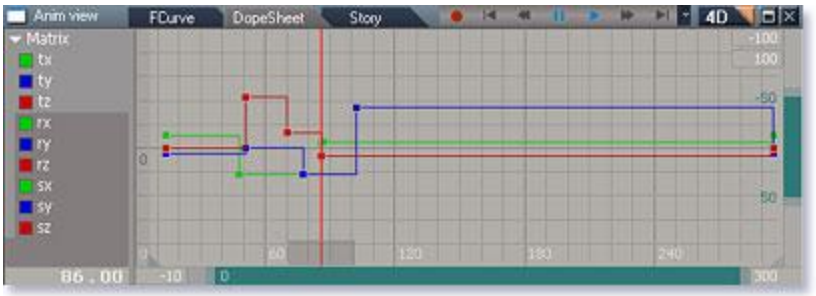
method for the selected keyframes from the context menu. Note that the interpolation method changes for segments between selected keyframes and for the next adjacent segment.



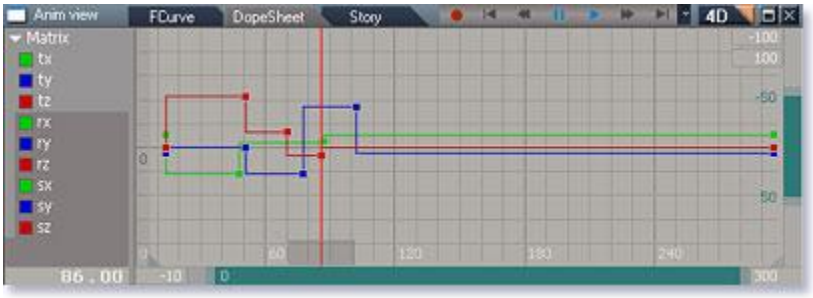
Bezier Interpolation



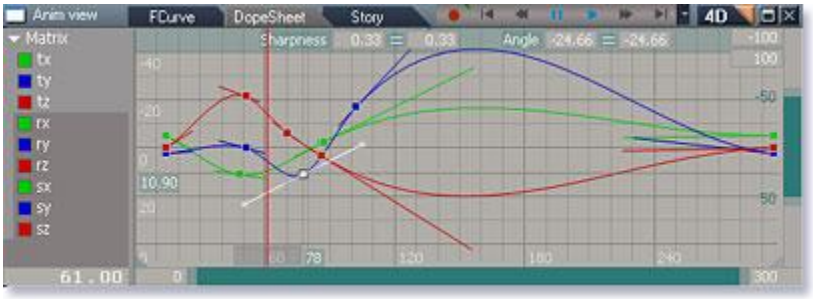
Linear Interpolation



Constant Start Interpolation



Constant End Interpolation



Custom Bezier

The five images above show the differences in the function curves depending on the interpolation method that is selected. More information is available in the Interpolation tutorial later in this chapter.

9.2.6 The Control Panel

This control panel appears in all the views in the Animation Editor and lets you control recording and playback of your animation. The controls are listed below:

Record Keyframe 

This button records a keyframe at the current frame. A right click on this opens the Keying Panel, which lets you define what information should be recorded for the keyframe (see the later section on the Keying Panel).

Move To The Beginning 

Moves the currently active frame to the beginning of the displayed frames (that is, to the far left of the Animation Editor display). This means if the Animation Editor is displaying frames starting from 0, then Move To The Beginning will move the active frame to 0; if it is displaying frames starting from 20, then it will move the active frame to 20, and so on (including for a starting frame with a negative value).

Move To The Previous Frame 

Steps back one frame from the current position.

Stop Playing 

This stops the playback of the animation.

Play Animation 

Plays the animation

Move To The Next Frame 

Steps one frame forward in the animation.

Move To The End 

Moves the currently active frame to the end of the displayed frames (that is, to the far right of the Animation Editor display). This means if the Animation Editor is displaying an ending frame of 300, then Move To The Beginning

will move the active frame to 300; if it is displaying an ending frame 600, then it will move the active frame to 600, and so on (including for an end frame with a negative value).

9.2.7 Animation Preferences Panel

This panel can be found in the Settings aspect of the Stack, and shows when the Animation Editor window has focus (simply click on the Animation Editor window and this panel will display in the Settings aspect of the Stack). The parameters are :

- **Show Objects** – This controls which objects are displayed in the Animation Editor. "All" displays all objects in the scene, whether or not they have animation created for them. "Selected Only" will display only the object (or objects) selected in the 3D view. "Animated" will display all objects that have any animation created for them, but no objects without animation.

- **Play Mode** – This controls which objects play back their animation during Play and scrub-through operations. "All Animated" will play the animation for all objects that have animation, while "Selected" will only play the animation for those objects that are selected.
- **Repeat** – If checked, the animation will repeat and play over once it reaches the end of the defined playback time. The two values at the bottom left and bottom right of the Animation Editor define the playback time (see earlier information on the Story view). If unchecked, the animation stops playing as soon as it reaches the end of the defined playback time.
- **Play Range Start and End** – This defines the start and end of the animation. Note that this is the same as setting the start and end points using the numeric fields at the bottom of the Animation Editor window. Updating those fields in the Animation Editor window will update the fields here on this panel. Note however that updating the fields on this panel will not redraw the Animation Editor window.
- **Frame Rate** – This is important when generating keyframes using physics simulation.
- **Speed Of Replay** – This adjusts the value for real-time playback only. You can use this to slow down the playback for closer inspection of the action during an animation. It does not affect either the real-time Render To File or the offline rendering of the animation. Setting it to a lower value (such as 1/5 times) will slow the playback down. Setting it to a higher value will speed up the playback.

The actual duration of real-time playback can be calculated from the Frame Rate and Speed Of Replay parameters. An animation that is 300 frames long will play for exactly 10 seconds at 30fps and 1x speed; or it will play for 2 seconds at 30fps and 5x speed. When the 'All Frames' option is set, then no frames are dropped during real-time playback – frames can be dropped in order to maintain the frame rate otherwise. Use the "All Frames" option when you have slow performance or complex objects.

- **Time Format** – This affects the display of the current frame, and the display of the gridlines in the Animation Editor. You can choose to view frames, minutes, seconds and milliseconds, or minutes seconds and frames. Note that the display of the frame numbers for the beginning and end of Clips, and for the animation playback range and zoom range are not altered (they remain as frames whatever value is set here in the preferences panel).

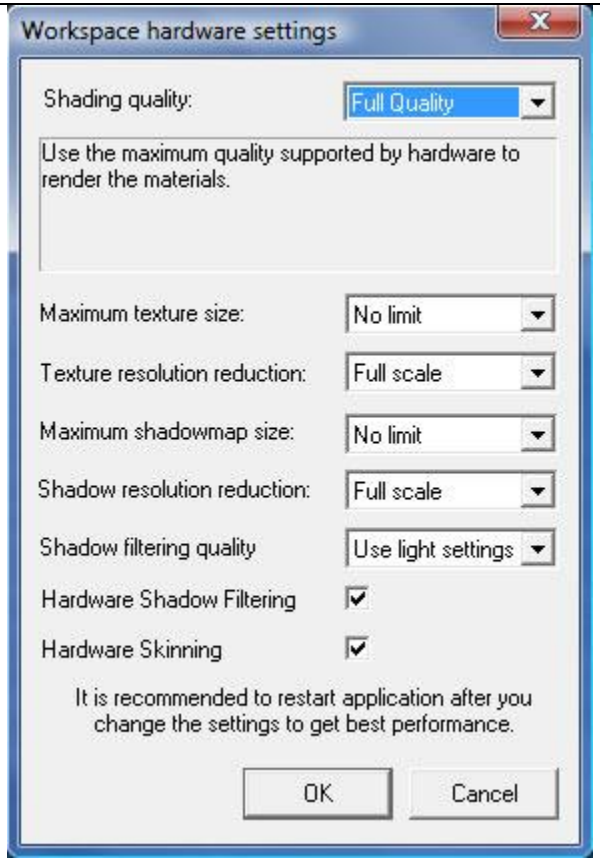
  Snapping – This parameter controls the movement of keyframes and Clips along the timeline and manipulation with the current frame scrubber. By default this is set to "Snap To Frames". With "Disable Snapping" set, you can move keyframes and Clips so that they are on fractional frames, eg to frame 1.5. Set to "Snap To Frames" you can only move a keyframe or Clip onto a whole frame value, so you could move it to frame 1 or frame 2, but not frame 1.5.

  The "Snap To Keyframes" option affects all three views, the Story view, the Dope Sheet view, and the F Curve view. In the Dope Sheet and F Curve view, it will make the current frame selector snap to keyframes as you move it, as well as make any keyframes you move snap to other keyframes set on the timeline. In the Story view, it will make the current frame snap to the beginning and end of Clips, as well as making Clips snap to the beginning and end of other Clips when you scale them.

A note about undo – Undo works for all operations in the Animation Editor, such as recording a keyframe, adjusting the F Curve, deleting a Keyframe, deleting a Clip, moving a Clip, deleting a Track, etc. Only changing the user interface or moving the current frame selector are not affected by Undo.

A note about rendering – There are several ways to render animations you have created in the Animation Editor. You can render from the real-time view using the "Render To File" option in the workspace. If you have the optional V-Ray render engine installed, you can also use the "V-Ray Render Animation" direct from the workspace. Finally, you can switch to the Model view and use "Render Scene To File" – the drop down list in the render to file dialog will let you choose to render the current frame only, the modeler animation only (created in the Model view KFE), or the workspace, which is the option to chose to render out your animation created in the Animation Editor.

9.2.8 Workspace Hardware Settings



This panel can be found File menu under the HW Settings option. Most settings are covered in Chapter 7 Lighting and Rendering, but the one setting of note here is the Hardware Skinning checkbox.

With this enabled, the processing of animated objects controlled by skeletons is passed to the GPU rather than the CPU, resulting in better performance on systems with good graphics cards.

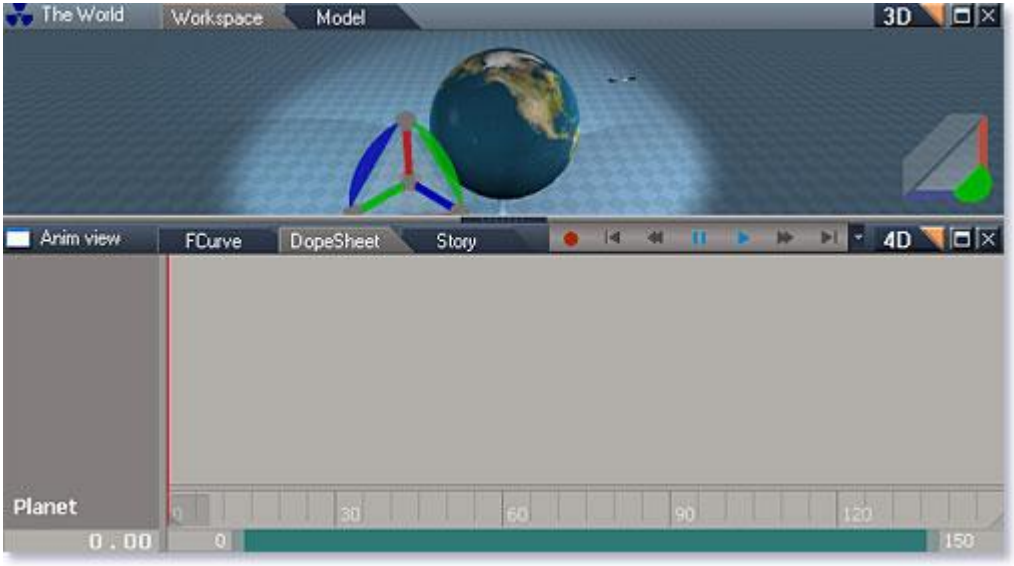
The effect is most noticeable with either complex objects, or where there are many objects animated by skeletons in the scene.

Note that any objects that are selected are always animated by the CPU. Be sure to deselect any objects animated by skeletons for the best playback. Also note this means that Hardware Skinning will have no effect when working with Dynapose, Weight Paint, etc.

9.3 The Tutorials

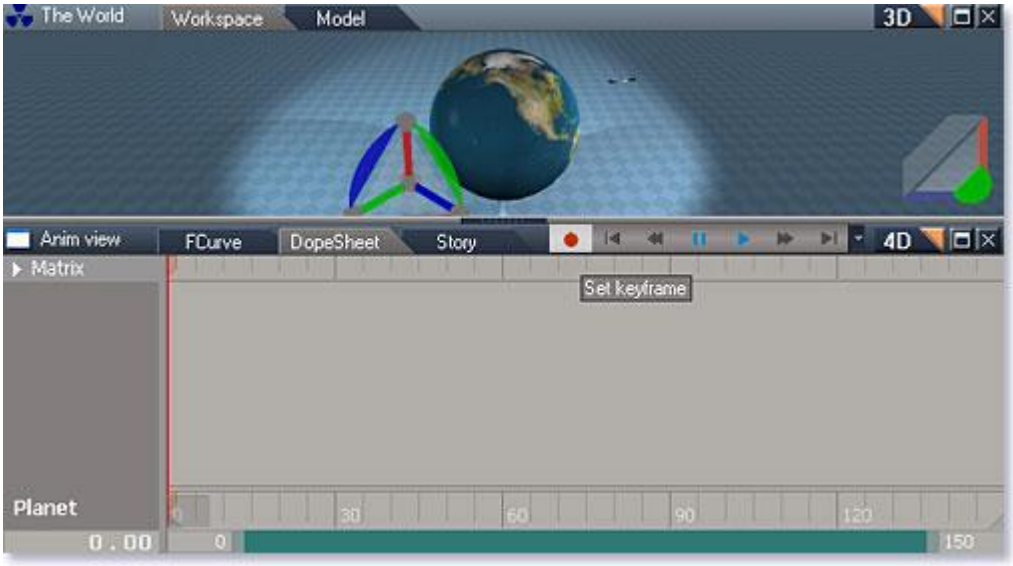
9.3.1 Basic Workflow – Simple One Track, One Clip Animation

Here is a basic workflow for making a simple animation with the Animation Editor. For this initial example, we will only be using one Track, and one Clip. It will show you how to create an animation of a planet spinning on its axis to give you grounding in using the Animation Editor and an introduction to keyframes. Later tutorials will explore more advanced and flexible animation workflows.



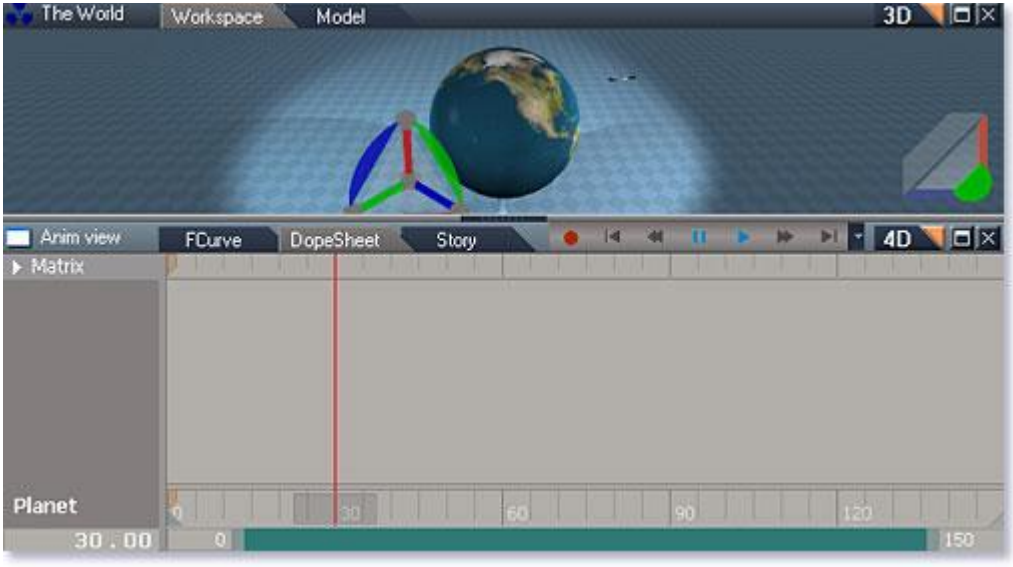
The scene ready to record the first keyframe

First, start with a new scene and load the planet object into it from the trueSpace Objects library. Position the planet where you want it to rotate, and ensure that it is the selected object. Next, ensure the current frame in the AE is set to zero, and that you are in the Dope Sheet view of the AE. Your scene will be set up something like the image above.



The orange marker appears on the Dope Sheet to show the first keyframe

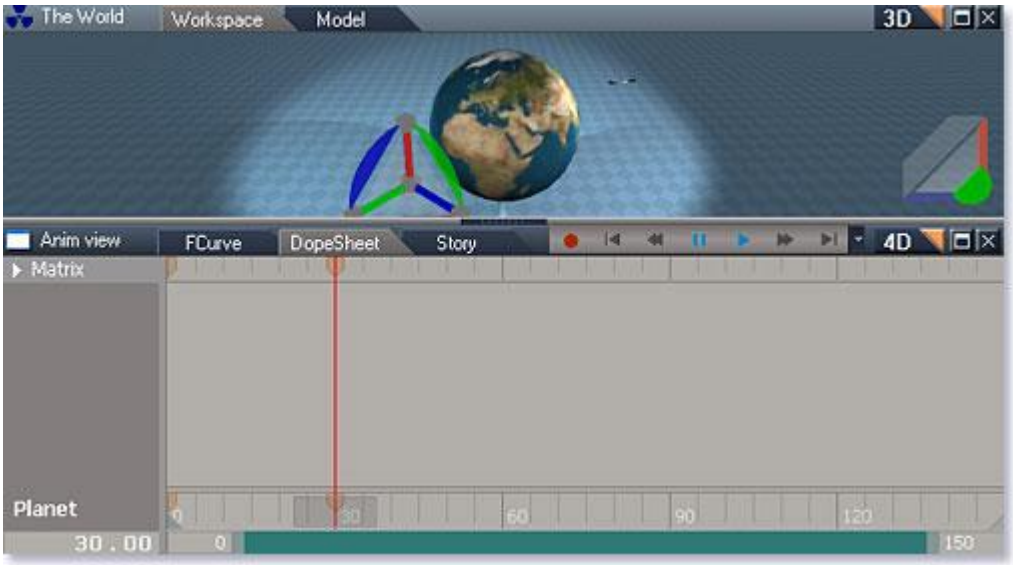
Now click the Record button – this captures a "snapshot" of the planet at this point in time, recording its position, its rotation and its scaling. You will see an orange marker appear in the Dope Sheet at position 0 on the time line, as seen in the above image, showing that there is a keyframe recorded at that point.



Current frame moved to 30, ready to record the second keyframe

Now move the current frame to the final frame of your animation, let us make that frame 30 as seen above.

At this point, it is worth a pause for a look at the concept of frames per second. How long an action takes in your animation will depend on the speed of playback you will be rendering too. This is measured in frames per second (fps). Common speeds are 24 fps (for movies), 25 fps (for PAL format), or 30 fps (for NTSC format). For this example, we will treat 30 frames as being equal to one second of animation, so by choosing frame 30 we are going to set what has happened over the first second of animation.



Record the second keyframe after the planet has been rotated

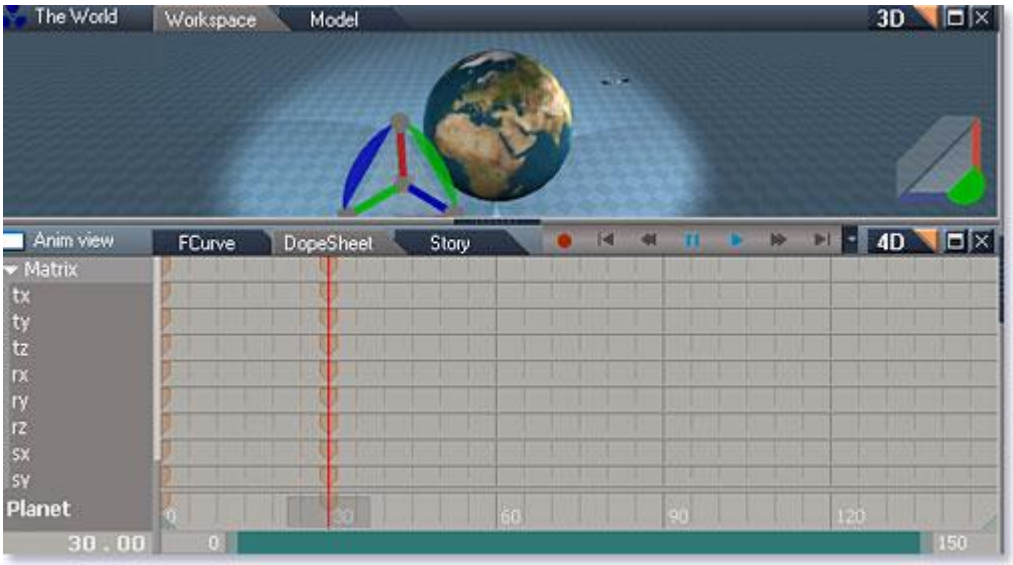
So now you have set the current frame to correct position to record the next keyframe, you should go ahead and rotate the planet into the new position you want it to end up at after these 30 frames (or 1 second) of animation. Once you have that rotation set, press record to take another "snapshot" of the planet in its new rotation. You will see a new marker appear in the Dope Sheet representing the second keyframe that you have recorded, similar to the picture seen above.

This is the standard way to approach creating animation via keyframes – you move the current frame to the frame you want to record, and then set up the objects in the position you want them in, and then press record. It is important to change the current frame first, before changing the objects, otherwise when you change the current frame, the objects will automatically move to their calculated position. So always remember – select current frame first, then update your objects with movement and rotation etc, and then press record.

You will notice that we did not record frames 1 to 29. Instead, we simply recorded a snapshot of the planet where we want it at the beginning of the animation, then another snapshot of where we wanted it at the end of the

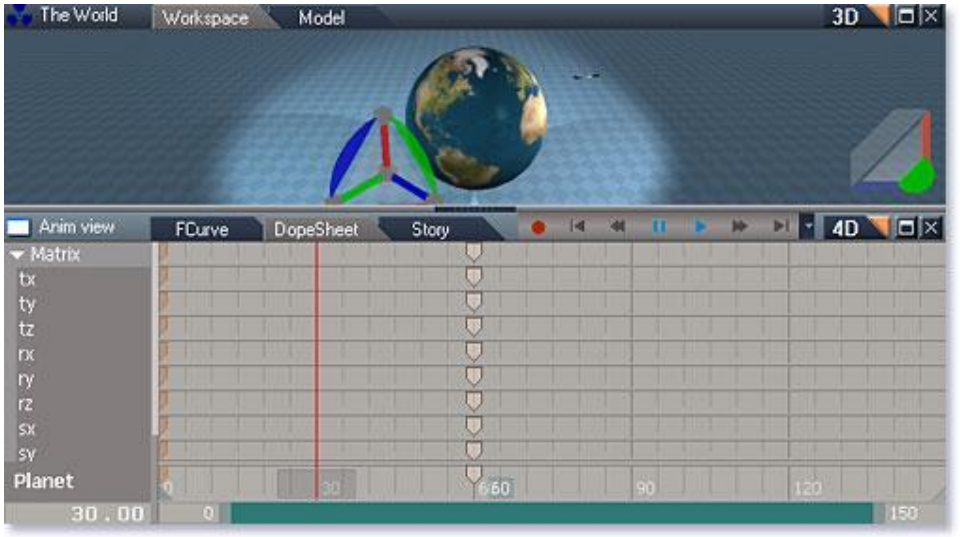
animation. trueSpace will calculate the rotation of the planet as it changes during the frames in between, in a process called “tweening”.

You can view the animation by clicking Play Animation. Alternatively, you can click and drag on the current frame indicator on the timeline, moving it back and forth, and you will see the planet rotate in the 3D window as you do so. Scrubbing through an animation this way is very useful for ensuring it all looks correct, as you can move through it as quickly or as slowly as you wish.



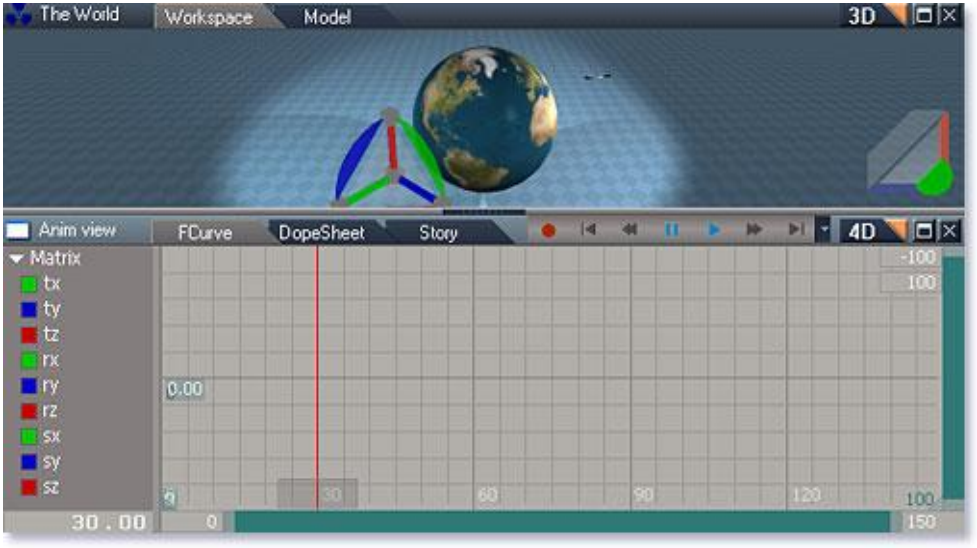
Expanding the tree view on the left shows keyframes for individual aspects of the animation

You will see on the Dope Sheet that you have two keyframes recorded. If you click to expand the Matrix setting, you will then see the individual keyframes for the various parameters for the planet, as seen above. Note that the Matrix is the name given to the collection of data that controls the position, rotation and size of an object.



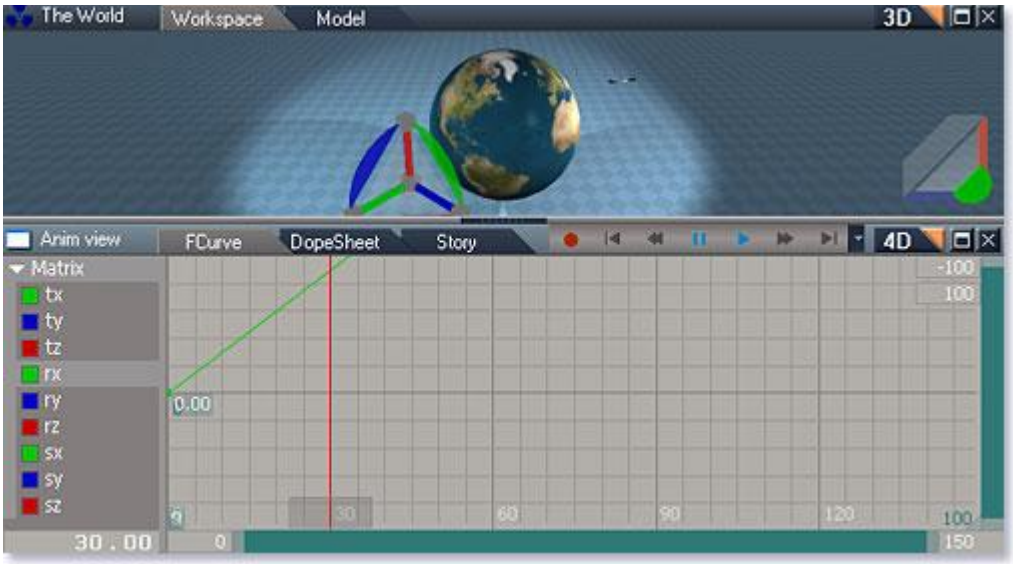
Moving the top Matrix marker moves the keyframes for the individual parameters

You can now make your planet spin more slowly by clicking and dragging the topmost keyframe indicator for the Matrix object, moving it from frame 30, where you recorded it, over to frame 60 like in the above picture. You will see all the other keyframes within the expanded Matrix object change along with it, moving to a new location in time. Now your planet takes 2 seconds (based on the output of 30 frames per second) to make the rotation rather than 1 second.



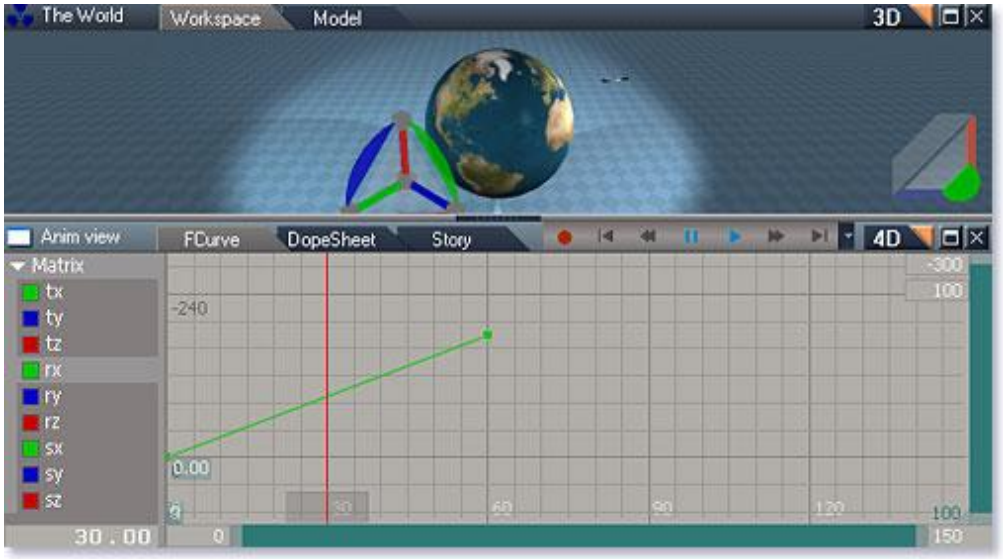
The F Curve window appears empty when first entering it

Now click on the F Curve tab, and expand the display for the Matrix, and you can click on the individual parameters to see how they are changing over time. Time is displayed along the length of the AE as in all the other views, and the vertical direction is used to show the values of each parameter at each point in time.



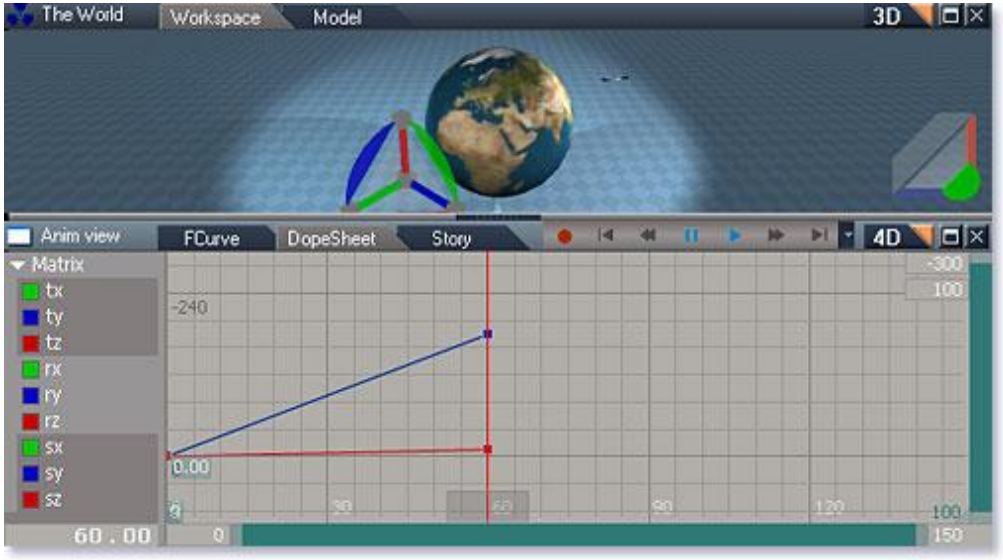
Select a parameter (rx is selected here). The window needs scaling for this range of values

Click on the rx value, and you will see the curve for that value displayed in the main window, similar to the image above. In this case, our window is not large enough to display the range of parameters. You can resize the window, or adjust the range of values it shows. In this case, since the manual images need to be limited in size, the display range will be adjusted.



Only the top range needed to be adjusted (see top left)

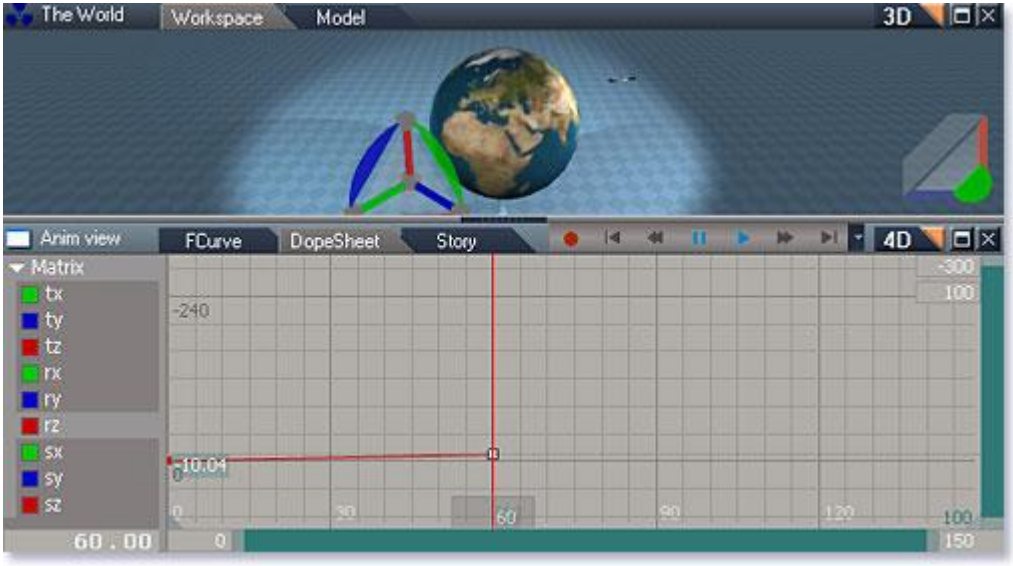
Since only the top value is not displayed, you will only need to adjust the top value displayed on the F Curve editor. The original values were -100 to 100, and a value of -300 should work should work well here, as shown in the image above (you may need to use a different value depending on the rotation of your planet). Now you can see the values at the two keyframes, marked by the squares on the curve. The line drawn between them shows how trueSpace calculates the in-between values for that parameter.



Use CTRL and click to select multiple parameters to display at once

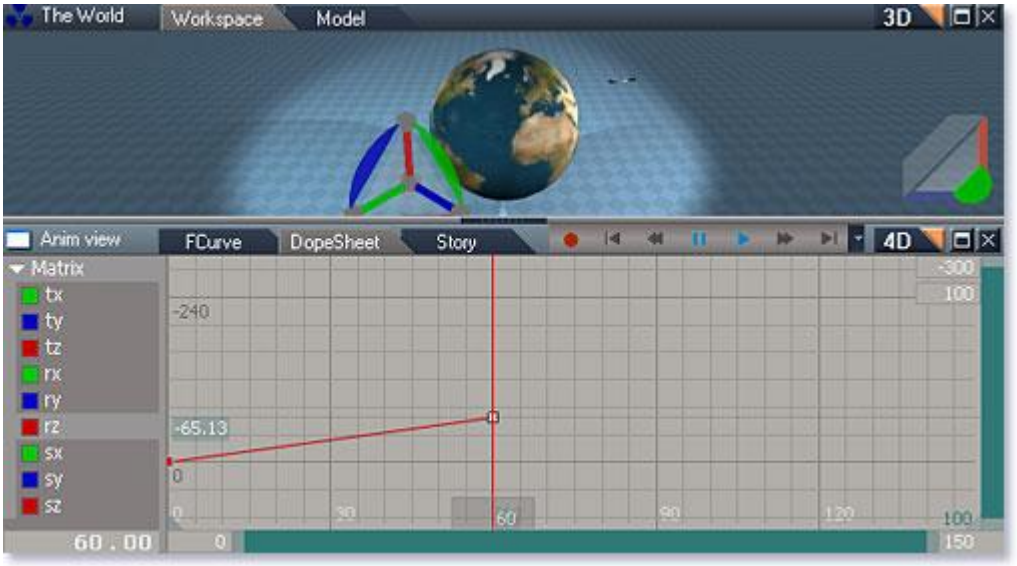
You can select more than one value to display at once by holding CTRL and left clicking. In the image above, rx, ry and rz have been selected and all three curves are shown at once in the F Curve editor (in this particular case, rx and ry have identical curves so they are overlaid in the image above).

While the Dope Sheet let you just change the position in time for each keyframe, in the F Curve view you can change the actual values themselves, to adjust how far an object moves, rotates, etc.



Display just the RZ parameter (the planet's rotation around its own axis)

Move the current frame to the last frame in the animation, which is now on frame 60 after the edits we made in the Dope Sheet. If you rotated the planet around its axis, then click on the rz parameter to display only that one curve. This shows the values for the rotation around the Z axis.



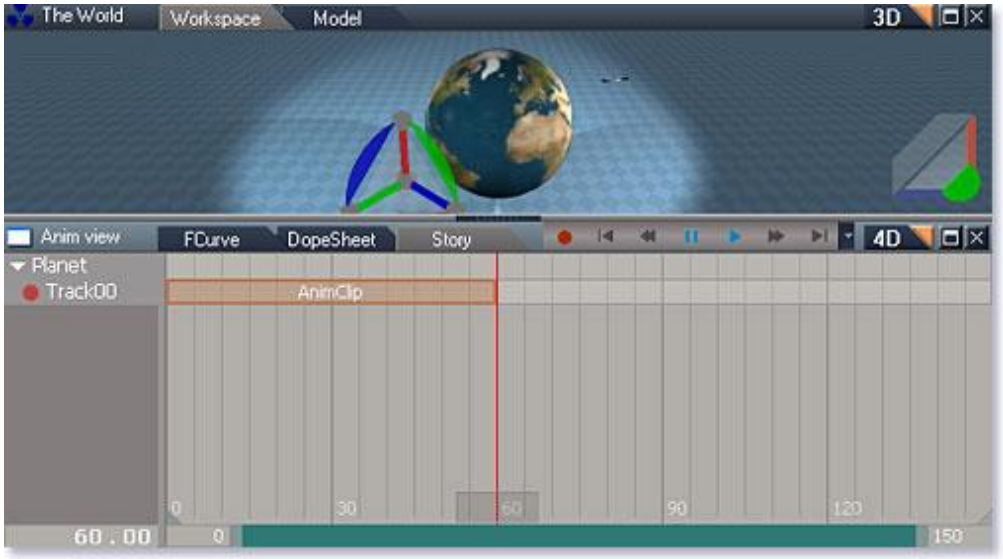
Moving the keyframed value upward makes the planet rotate further

Now click on the small square that shows where the keyframe is recorded, and move it upward. Note that at the bottom of the panel, you will see the keyframe number - if you move left or right, you will change the position of this keyframe in time and this number will update so you can see where you have positioned this keyframe. This can be useful, but for this example you should only alter the value stored at this keyframe, and not move the keyframe's position in time.

As you move the value, you will see the 3D view update. Note that if your current frame was not set to 60, you will see the value at the frame you have selected – this can be useful, to adjust a keyframe at one location to adjust the action at another particular frame, but most often you will want to be viewing the point in time where the keyframe is located.

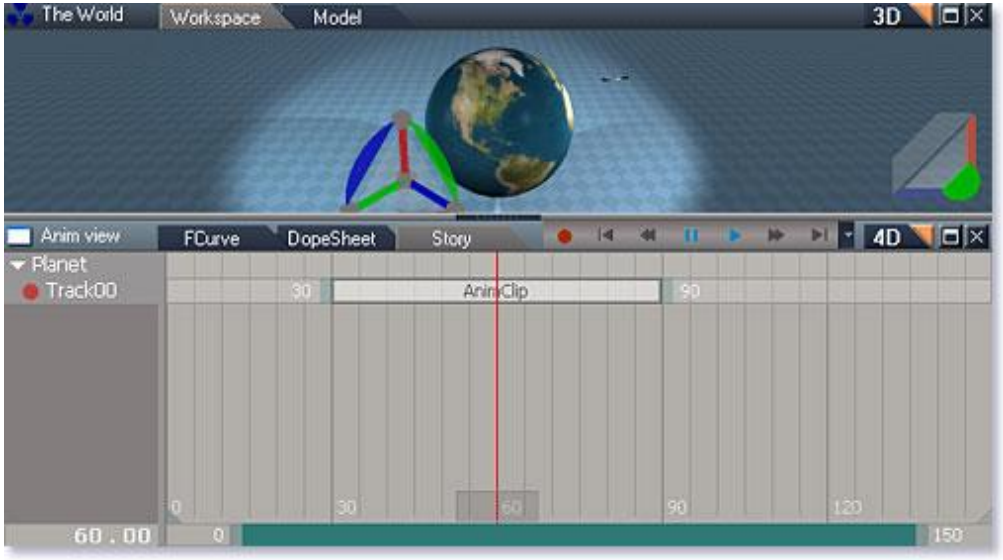
This is a good time to note that this means you two ways to adjust the speed of rotation for the planet. The first is to move the position of the keyframe in time, often easily done in the Dope Sheet, so that it rotates by the same amount but takes more or less time to complete that rotation. The other is to adjust the amount that it rotates without moving the position of the keyframe in time, so that you make it rotate by a larger or smaller amount but in the same amount of time.

You can adjust any of the parameters here, which would let you move or scale the planet as well as adjust the rotation.



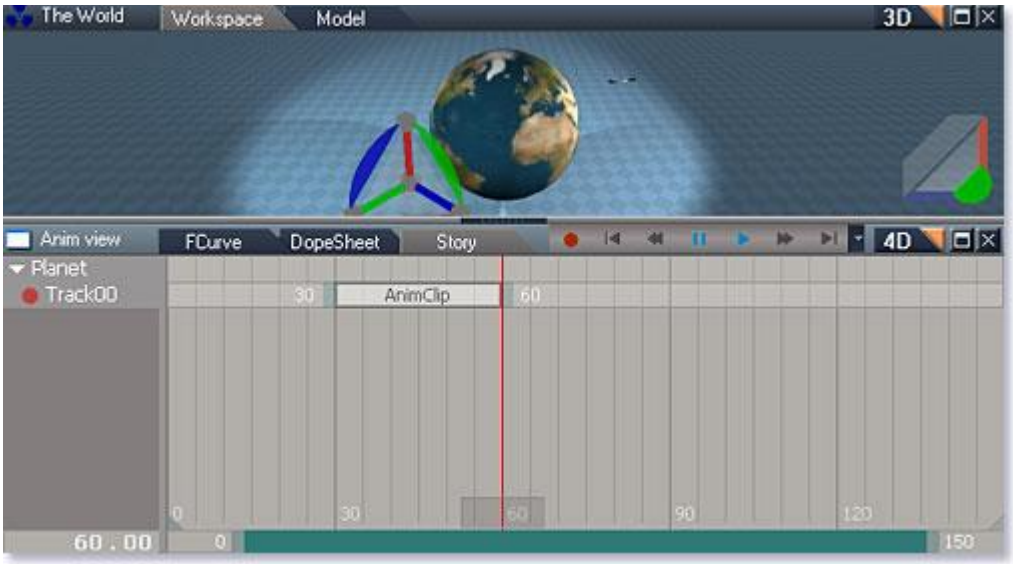
Display the Story view

Now click the Story view, and expand the display for your object. You will see you have one Clip, created on one Track. This Clip contains all the keyframes, but in this view you do not see the individual keyframes. Instead, the Story view is used to adjust and position the various actions that take place in your animation. For example, you can now move your animation on the timeline by moving the Clip.



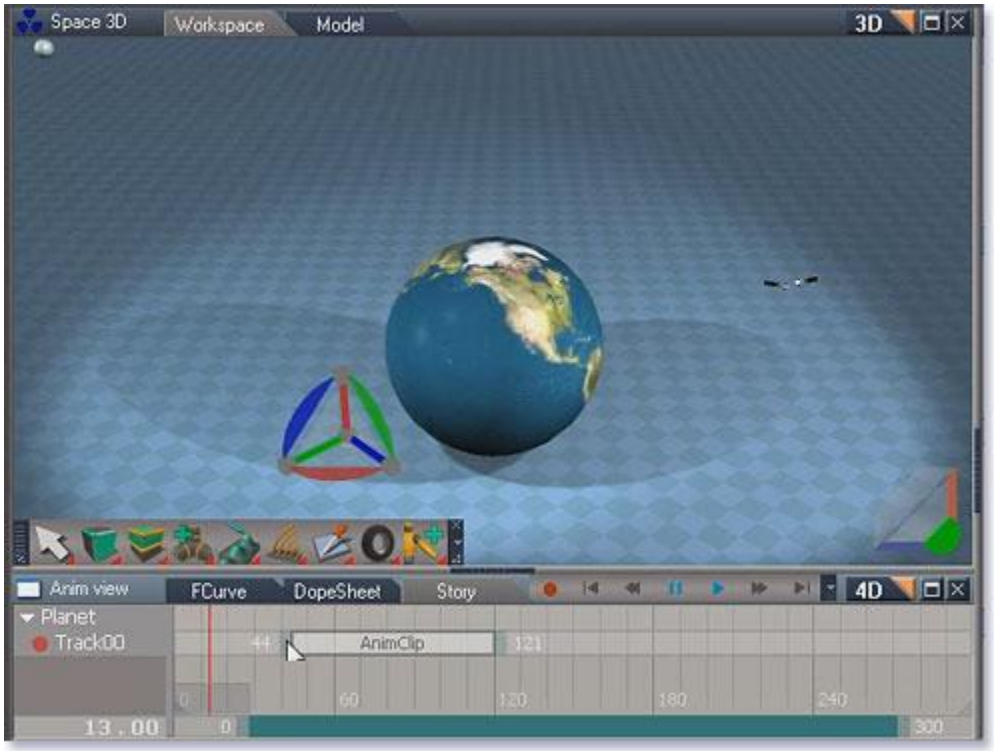
Move the Clip to start on frame 30

Now click on the middle area of the Clip and drag it to the right so that it starts on frame 30, and ends on frame 90, as seen above. Now when you play the animation, for the first 30 frames your planet does nothing, then over the next 60 frames it plays out the rotation you recorded.



Shrink the Clip by dragging its right edge

Next, try scaling the Clip– you do this by clicking either the left or right end of the Clip and then stretching or shrinking it. You will see the number at the end of the Clip update so that you know exactly which keyframe you are scaling the Clip to begin or end on. If you stretch the Clip by making it longer, then all the keyframes in it get stretched further apart, and the action recorded in the Clip takes longer to play out, so you are slowing down the action. If you shrink the Clip by making it shorter, then you squash the keyframes in it closer together, which makes the action take place in less time, and this makes the action in the Clip faster.



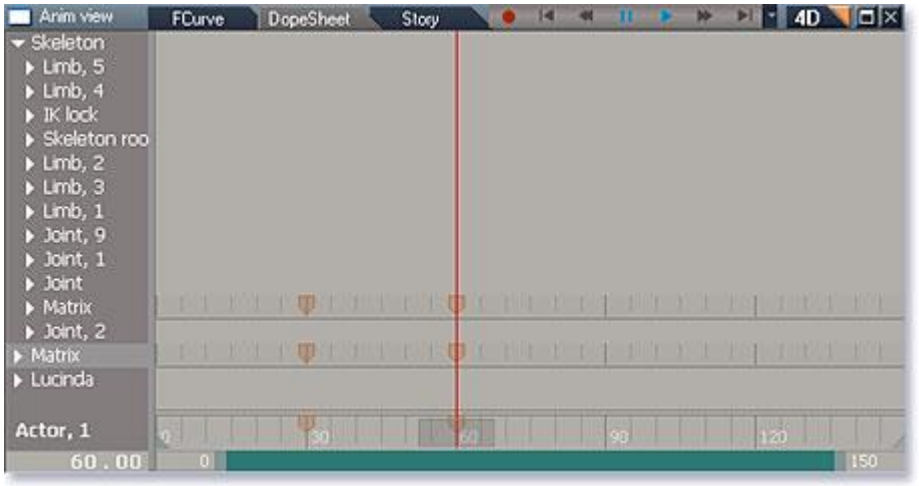
video link

9.3.2 Basic Character Animation - One Track, One Clip

Recording character animation follows the same approach as you tried in the basic workflow. Start with a new scene, and then from the trueSpace libraries, load up one of the characters which has a skeleton. Ensure your current frame is zero, and then click record to capture a snapshot of your character in this starting pose.

Two keyframes recorded to make the character raise their arm ready to wave

Now move to the frame where you want to take the next snapshot. Using the dynapose tool (or any character posing tool such as IK handles, or entering the values directly for a joint, etc), position your character into a new pose, and then press record. Now you can play back or scrub through the animation as before, and you will see your character move. The above example image has a Clip where the character raises their arm to wave from frame 30 to frame 60.



Expanding the information for a character shows the individual parts of the skeleton

If you check under the Dope Sheet, you will see that there is a lot more information recorded for a character with a skeleton than a regular object. You will find the Matrix information is recorded (so you can make your character move, rotate and scale) as you saw in the first tutorial, but there is now extra information recorded for all the joints – you can see this by expanding the Skeleton section in the Dope Sheet view, as seen in the image above.

If your skeleton has named joints and limbs, then you can easily identify particular movements of particular joints, and single those out for editing or fine tuning in either the Dope Sheet or the F Curve editor. Naming the joints of your skeleton is useful here (this is best done when building the skeleton, rather than during the animation process).

Once again you can use the Story view to move and stretch your Clip.

[video link]

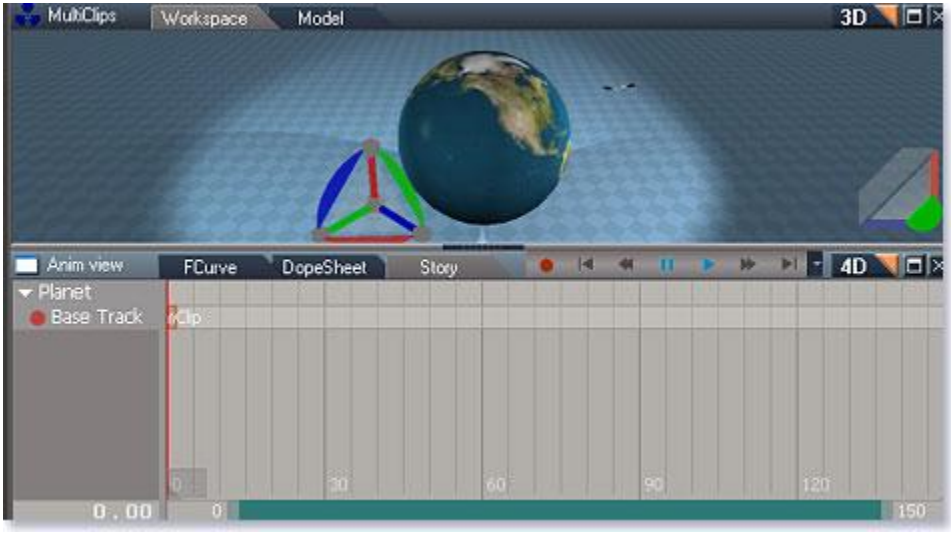
9.3.3 Advanced Workflow – Multiple Clips for Blending Actions

Clips give you a lot of control and options for your animation. Using them opens up a lot of new abilities and flexibility – for example, you can record a character waving their arm, and record them walking, and then combine the two, repeating the wave several times, adjusting when they start walking compared to when they wave; or you can make the up and down motion for a bouncing ball, repeat it making it bounce less high each repeat, and then mix that with some forward motion for the ball, letting you control both the bounce the movement forward independently.

It is usually best to reserve one Track for one kind of animation. While trueSpace does not require it, it can help you stay organized and make your animations easier to work with! For this example, you are going to make a planet object that rotates around its own axis, and which moves in the scene at the same time.

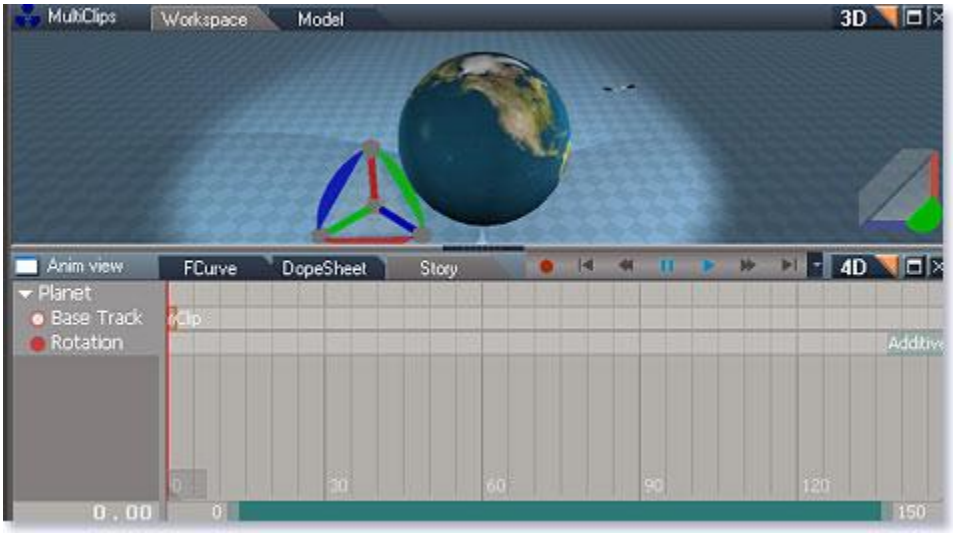
Ensure you are in the Story view, and then you are ready to begin.

The first step in working with multiple Clips is to record a starting position for the object. To mix Clips, we will use Additive mode on the Tracks, and for that to work we need a base Track which all other Tracks can be relative to. The base Track stores the initial condition of the object, such as its location, rotation, scaling, pose, and so on.



The planet with its Base Track created, ready for record animations we can blend or re-use

Making the base Track is simple – with your object selected and in the default state (at the start position, pose, size, etc), and current frame set to 0, press record. We only need to record the one keyframe for this Track as we are capturing only the initial conditions here – the actual changes in condition, that is the animation itself, will be recorded on the other Tracks.



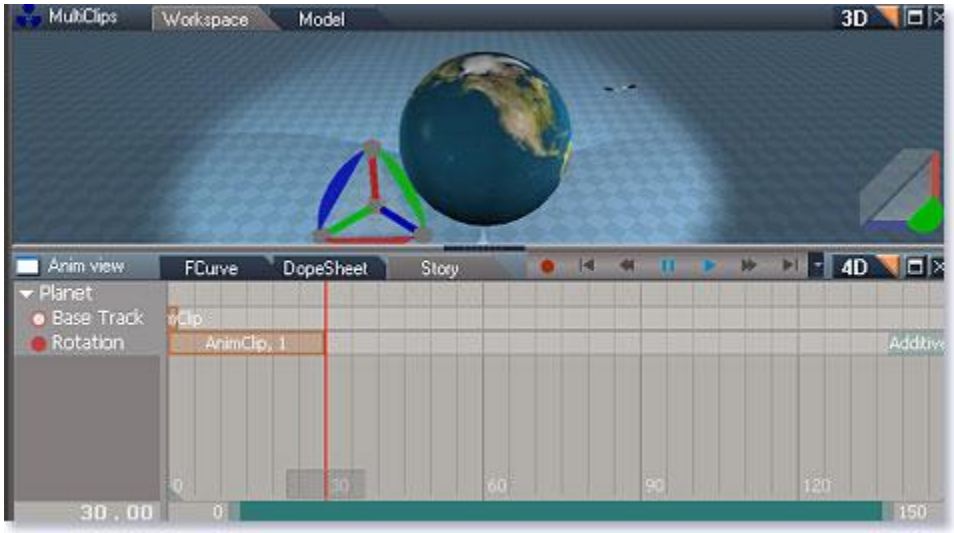
New Track created, named Rotation, and set to Additive mode before recording

Now use Add Track to create a new track for the object, and make that Track the active Track (click on the red circle to the left of the Track name). Right click on the Track and rename it to "Rotation" for ease of use. Then right click the Track and check the Additive option – it is very important to check this option **before** you record, as it changes how the information is captured as well as how it is played back!

You will need to use Additive mode for the Track if you plan on copying this animation onto another object later, or if you want to mix and blend various actions together for this object. Indeed, in most cases you will want to record your animation in Additive mode to keep your options open for how you can work with that animation.

The above process describes how to create an Additive Track manually – you can also simply click on "Edit In New Track" which will carry out all the above steps automatically, creating a new Track, making it the active Track, and setting it to Additive mode. We will be using the Edit In New Track option for the rest of these tutorials. If you want to create a Track that is not in Additive mode, simply use Add Track and manually set it to be active.

For tracks that will be blended in this way, it is usually best to disable the Pass Through parameter – right click on the track, and click on the Pass Through parameter to disable it. This will prevent the object from reverting back to the default location (set in the base track) whenever you move outside a Clip in your Additive track (see later tutorial on the Pass Through parameter for more information).

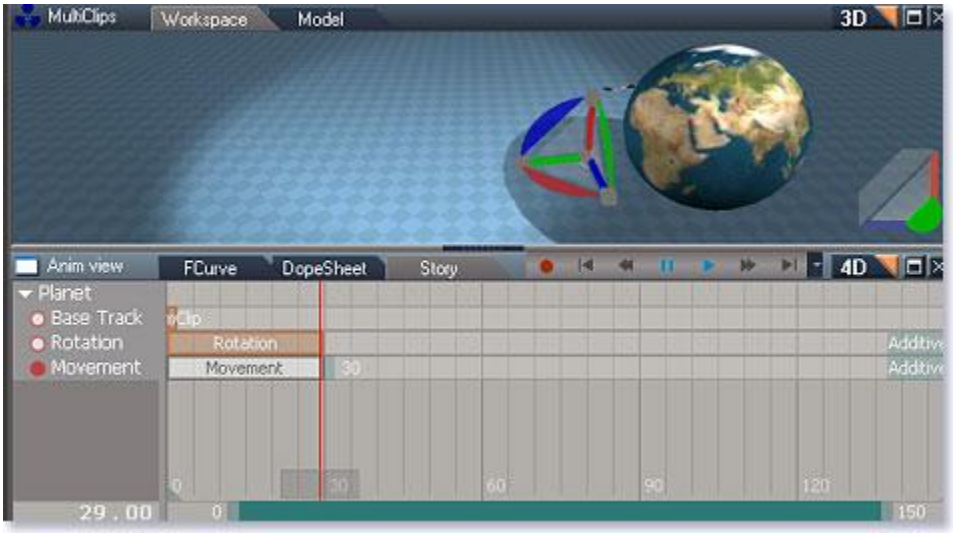


A Clip has been recorded with the rotation of the planet

Now you need to record the rotation for the planet. This is done using the same steps as in the first basic tutorial, and we'll go over them again here. First, record a keyframe for the start of this Clip. You must always record a start position, which will start the Clip and start the animation. In this case, we have recorded the first keyframe at frame 0, which defines the starting pose for the planet in this Track. Note that even though you recorded a clip at frame 0 in the Base Track, this new track needs to be self contained, recording start and end positions for its own action, independent of any keyframes recorded in any of the other Tracks, so you need to record a keyframe at frame 0.

This will be true for other Tracks too, and you can and should record keyframes on different Tracks that are on the same frame as keyframes in other Tracks. It is quite acceptable to have blended animations with keyframes that overlap in this way, and in fact is often necessary.

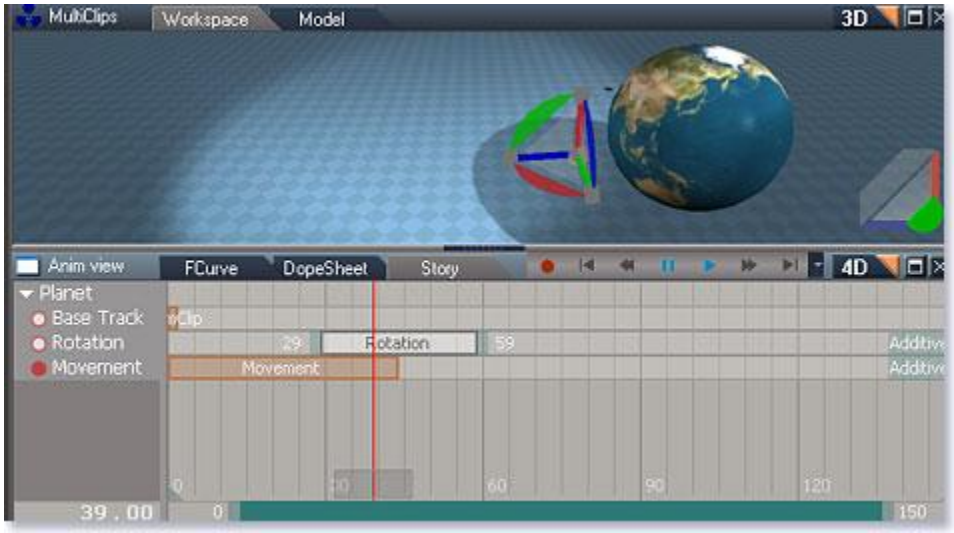
With our first keyframe recorded, in this case at frame 0, move forward to select the frame where we want to record the next step in the animation, then update the rotation of the planet, and click record again (in the example above, we have used frame 30). This now defines your rotation, capturing the start and end point for it and storing it as a Clip. Name the Clip "Rotation" as well as the Track, so that you will easily know what it contains if you save the Clip to a library for later use. Your scene will now look something like the image above.



Some movement has now been recorded on another Additive Track

Now create another new Track, using the Edit In New Track option. Name this new Track "Movement". As before, you will most likely want to disable the Pass Through parameter for this track by right clicking the track and clicking on the Pass Through parameter. Now repeat the keyframing process as before, but this time move the planet rather than make it rotate. Remember to record a keyframe where you want the movement to start (in this case, frame 0 has been used, the same as the Base track and the Rotation track) as well as a keyframe for the end of the movement. Name this Clip "Movement", again in case you want to reuse the Clip separate from its current Track, and your scene will look similar to the image above.

This Clip can be longer or shorter than your rotation Clip, and it can have the same or different start and end points, it is entirely up to you.



Additive Tracks give you freedom to blend the Clips any way you choose

Now when you scrub through or play back the animation, you will see your planet both rotates and moves. You can now move the Clips for rotation and movement in the time line, and stretch or shrink the clips too, to mix and match those actions in any way you choose - you can make the planet begin rotating, then begin moving; make it begin rotating and moving at the same time but stretch out the rotation so it keeps going after the movement has finished; make it move first then rotate. Any combination is open to you!

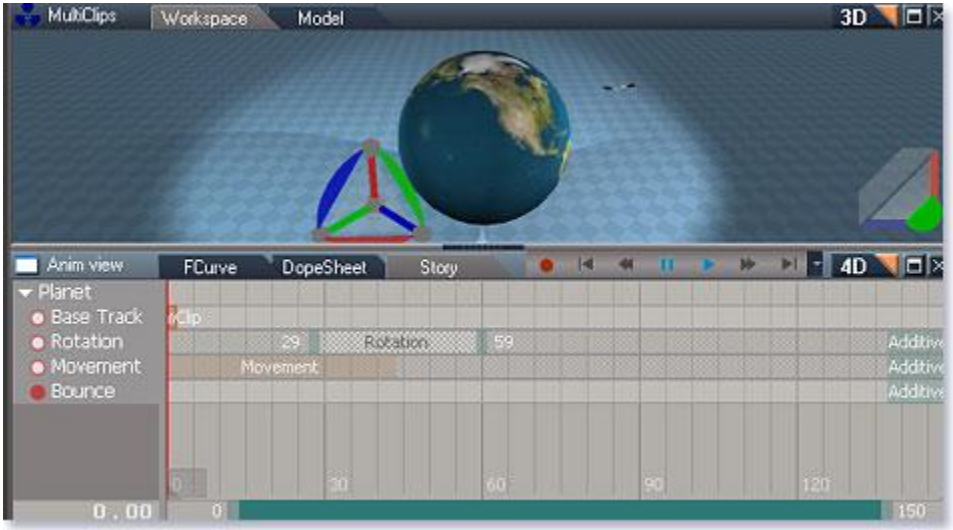
If you disabled the Pass Through parameter, then you will note that outside of the range of the Clips in your Additive mode tracks, the object reverts to its default state as captured in the Base track. With the Pass Through parameter checked (the default setting if you did not change it), then outside of the range of any of the Additive Clips, the object will return to its default state as defined in the base track – so before and after the movement Clip, the object will appear at its default start location, and before and after the rotation it will appear in its default rotation. Also note that it "snaps" back to this default state and does not move smoothly in and out of the Clips.

Try enabling and disabling the Pass Through parameter and see the difference it makes. Note that this parameter affects both recording and playback. See the later tutorial on Pass Through for more information.

If you want to add more keyframes to a particular Clip on any Track in Additive mode, simply ensure the desired Track is active (check the red dot to the left of the Track), then set the required current frame, set the way you want the planet to look at that point in time, then press record. For example you could move to the middle of the rotation Clip, tilt the planet on its side, and press record, to add more action to the rotation Clip.

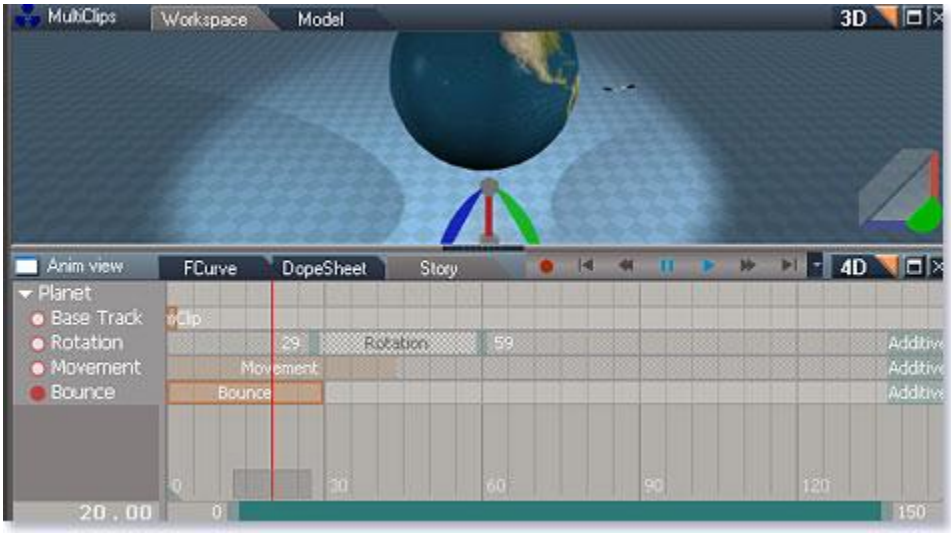
You can also extend Clips by recording new keyframes on that Track outside of its initial range, either before the Clip originally began, or after it originally ended (and here un-checking the Pass Through parameter can help).

While you could easily record motion into your rotation Clip, and vice versa – or indeed add scaling to either or both of those, and so on - for convenience and flexibility it is best not to do this. Of course where you do not need the flexibility to move and adjust the behaviors independently, for example if you know exactly what you want your animation to be, then it is fine to record that information into the same Clip. If you think you might at some point want to edit the movement separately from the rotation, and so on, then keeping the actions in different Clips on different Tracks adds a lot of flexibility.



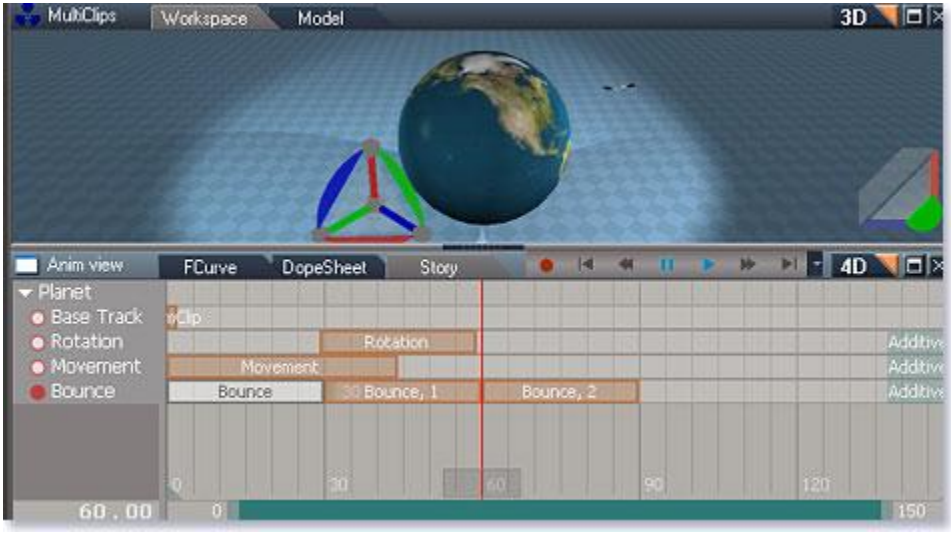
A new Additive Track for the bounce (Rotation and Movement temporarily disabled for ease of recording)

After having experimented with these two Clips, add another new Track using the Edit In New Track option, and name it “Bounce”. We are now going to record an up and down bounce for the planet. To make this easier to record, right click on the rotation and previous movement tracks and click on Disable. This temporarily turns them off during playback, so you can more clearly see the bouncing motion you are creating since you will be viewing it independently, as seen in the image above.



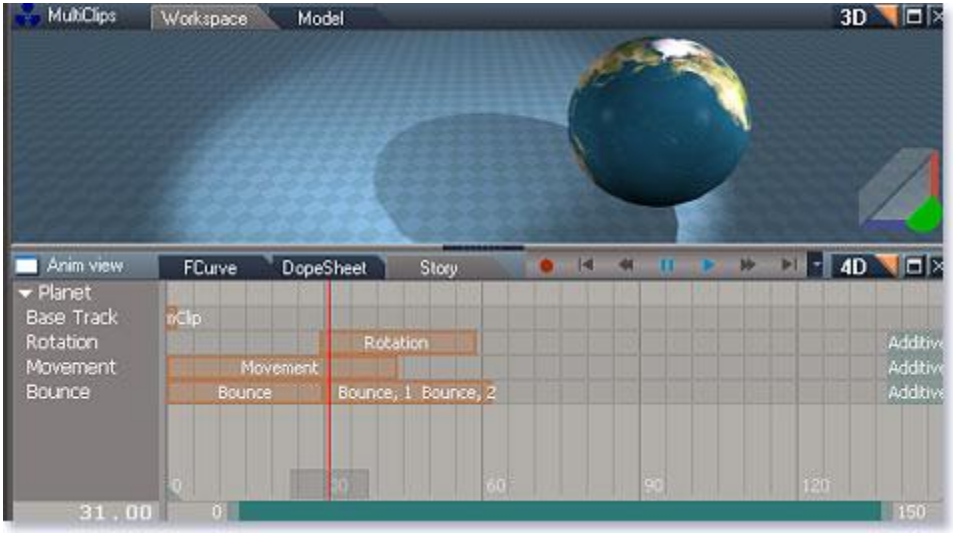
The bounce movement has been recorded into its own Clip

Record three keyframes for this Clip, the first with the planet in its original position, then one with it raised in height only, and the next with it back in its original position (if you enable Pass Through, it will be easy to record the last keyframe in the original position, as the planet will snap back to it once you move outside the Clip). Scrub through the animation and ensure your planet moves up and down in space. Name this Clip "Bounce" as seen above.



Copy and paste makes it easy to repeat the bounces

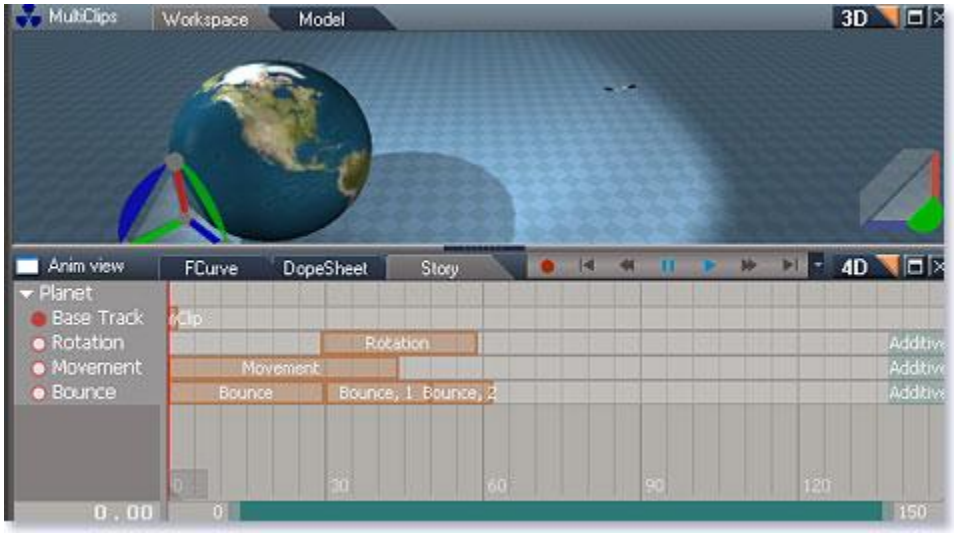
Now re-enable the other two tracks, and you will see that now your planet rotates around its axis from one Clip, while moving along through space from another, while moving up and down from yet another. Copy and paste the bounce clip so that you have several copies of it in its Track. As the planet moves along from the "Movement" Clip, it now bounces up and down several times from the repeated bounce Clips.



Each bounce can be edited separately, here made shorter each time

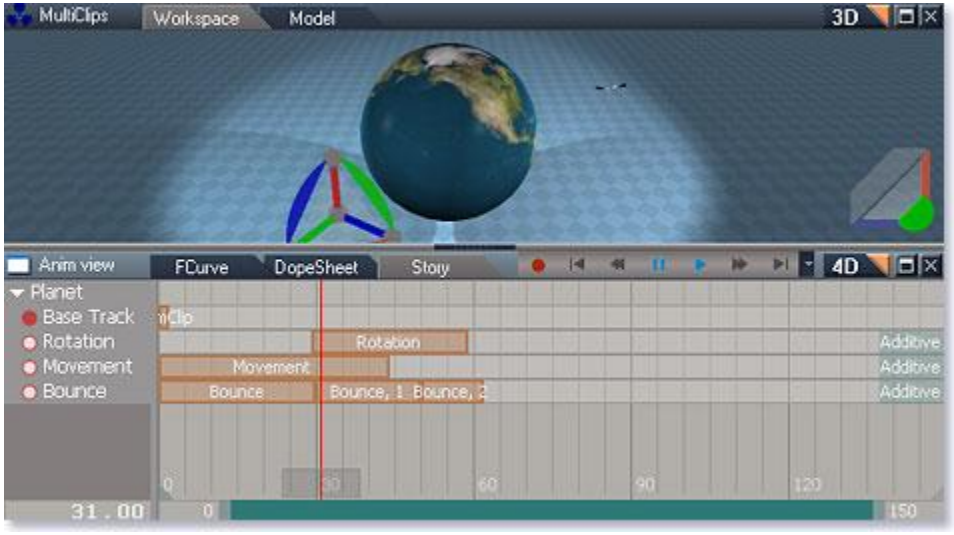
You can adjust those repeats, making each one a little shorter, so that it bounces faster and faster for example. As you edit those Clips, the resulting motion will still blend with the rotation and movement in your earlier Clips - and of course you can adjust those Clips too, changing their start and end points, their duration, copying and pasting those to make them repeat.

The base Track that we recorded lets us adjust the default state of the object, which lets us easily adjust our animation. Let's say we have good rotation and movement Clips recorded from above, but in our scene we now want the planet to start from a new location. Rather than re-record the movement Clip, starting from the new location, we can simply give the planet a new starting state.



Preparing to adjust the starting position of the planet by re-recording the Base Track keyframe

Ensure your first (non Additive) Track is selected. This is the base Track with just the one keyframe. Make sure the current frame is set to match that keyframe (it should be on frame 0 – note that while trueSpace does not require you to use frame 0 to set the default state, it is a convenient standard to follow for ease of use). Now simply move your planet to wherever you want it to start, and press record.

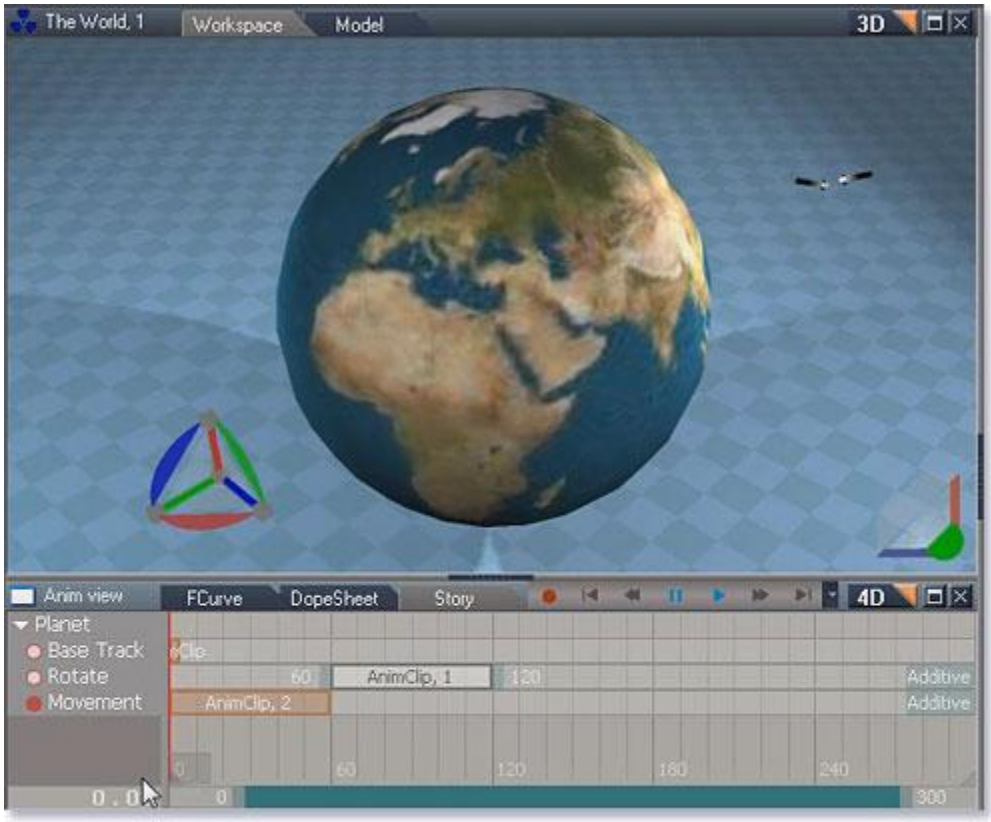


The planet now moves relative from its new starting location

Now when you play your animation, the planet will rotate and move as before, but will start from its new location. Since the movement Tracks were both in Additive mode, the planet does not move back to the old location (ie to the absolute location you previously keyframed on your movement Clips), but follows the same path as you recorded, making the same motions but relative to its new starting position.

The same is true for rotation and scaling – you can adjust and record those in the base Track, and your planet will begin from a new starting state, and will play through the same relative motions.

You can of course record animation on your base Track if you wish. Any animation recorded here will be absolute and not relative to anything. You must ensure this Track is not switched into Additive mode. Generally, it is easier and best to leave the base Track with just one keyframe for capturing the initial conditions, and to record any desired animation on other Tracks using the Additive mode, as this gives you the most flexibility in adjusting, re-recording, editing, repositioning, and re-using!



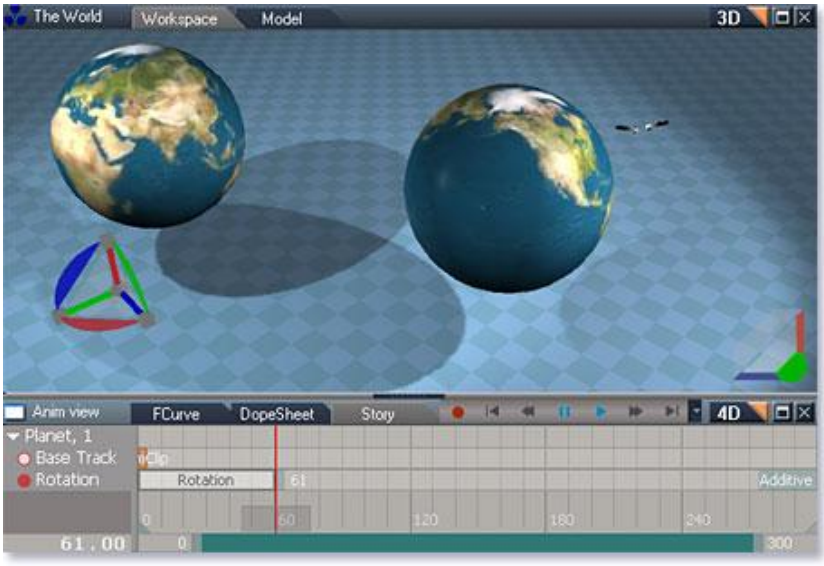
video link

View the basics of using multiple clips to blend animations in the video above.

9.3.4 Advanced Workflow – Reusing Clips for Other Objects

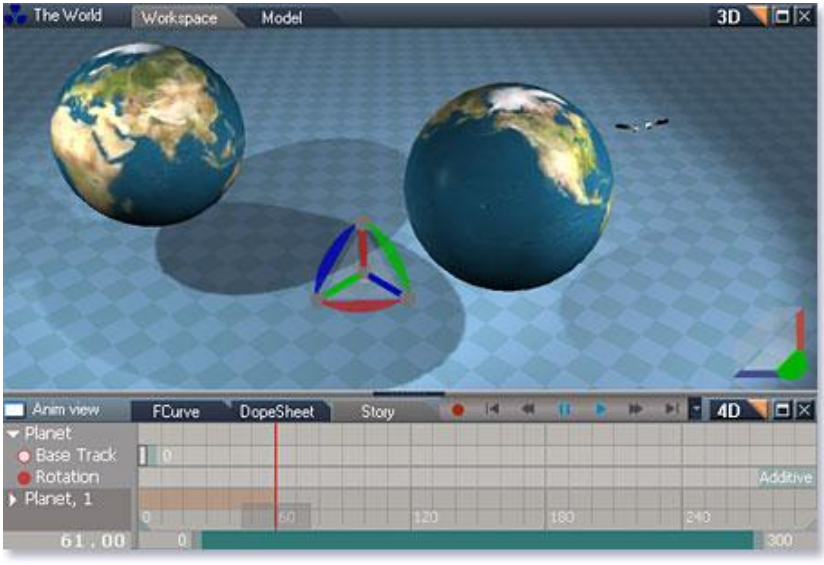
You have already seen how Clips give you powerful and flexible control over animation for one object. They have another use too, which is to move an animation from one object to another.

To demonstrate, we are going to make two planets rotating. Begin by loading two planets into your scene, and positioning them at different places.



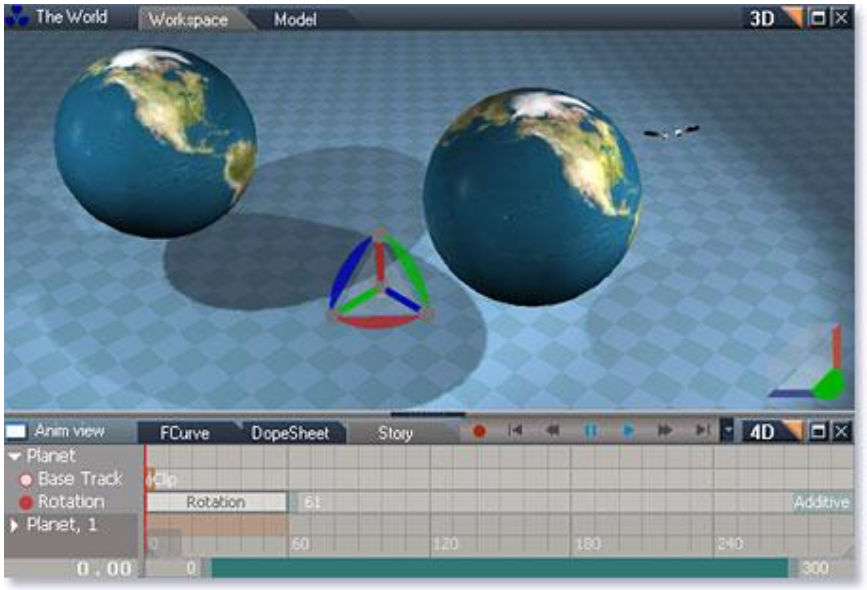
The first planet has its rotation set up

Record a Base Track for your first planet, and then create your rotation for the first planet just as you did in the previous tutorial (remember to use Edit In New Track, and then record your keyframes that define the rotation, naming the Clip "rotation"). You will see something like the image above.



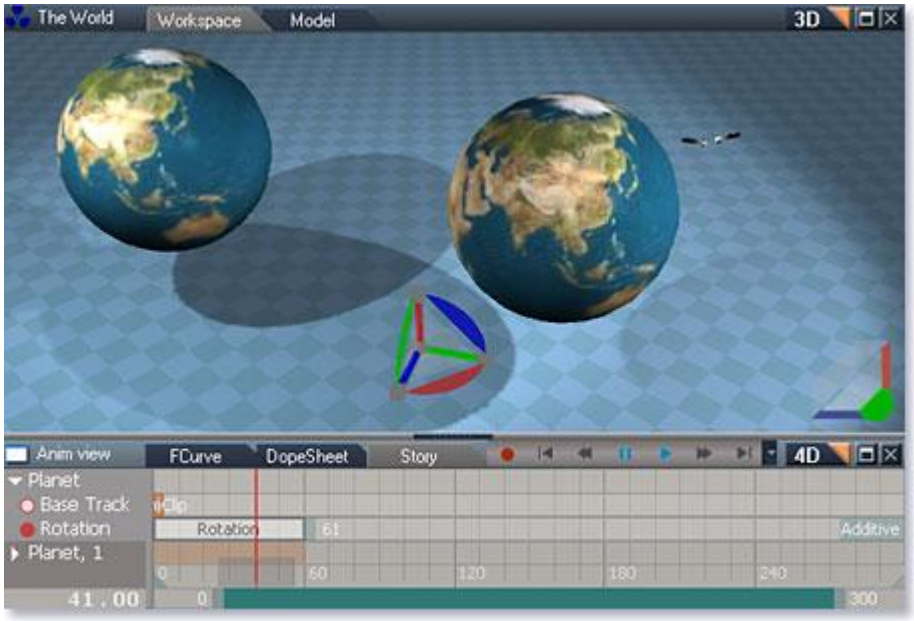
The second planet with its Base Track and empty rotation Track

Now right click on this Clip, and then choose Copy. Click on your other planet, and set it up with a Base Track too, then use Edit In New Track to set up a new Additive mode active Track.



Click paste to copy the rotation in place for the second planet

Now ensure your have the correct current frame, then right click on the timeline and choose Paste, and a copy of your rotation Clip from your other planet is dropped in place. Here the current frame was set to zero, and the copied Clip is pasted at the beginning of the active Track.



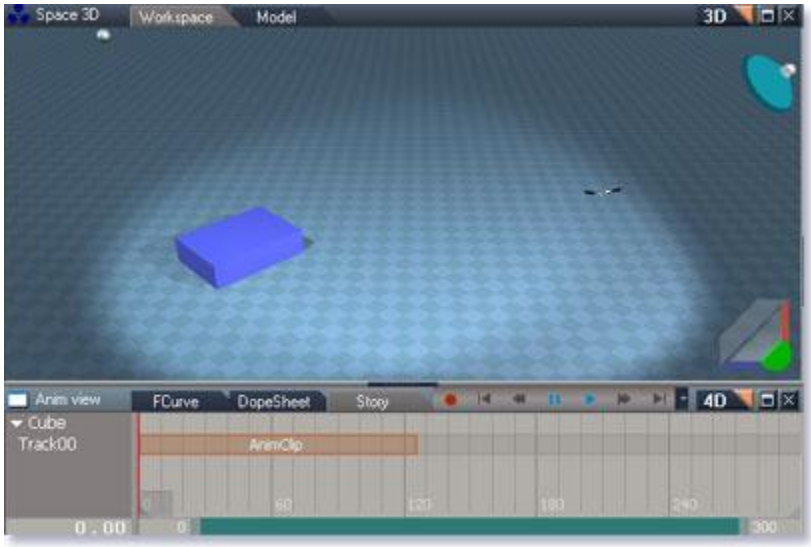
Now both planets rotate in unison, but each in their own location

Play through the animation, and notice that your second planet rotates around its own axis just as the other planet did, but stays in its own location with its own scale – it does not move to the position of the first planet for example. If you had not used an Additive mode Track to record this rotation, when you pasted the Clip onto the second planet, it would have received scale and position information too, and jumped to the location and size of the first planet.

You can also copy and paste motion or scaling too of course. For copying motion, each planet will again start from its own individual location and follow the same relative path. Try this for yourself, continuing on from this scene.

You can see that this is why recording in Additive mode is a good idea – you may not plan on reusing an animation when you start work on it, but you never know when you might decide later that you do want to store and reuse an animation. Recording in Additive mode will keep that option open for you, while recording an absolute action would make the animation harder to reuse.

There are times that you will want to copy an entire animation, including the absolute positions, onto another object – for example, you may have created an animation using a low poly object for speed, and now you want to replace it with the finished high poly version for rendering.


Space 3D
Workspace
Model
3D
Anim view
FCurve
DopeSheet
Story
4D
Cube
Track00
AnimClip
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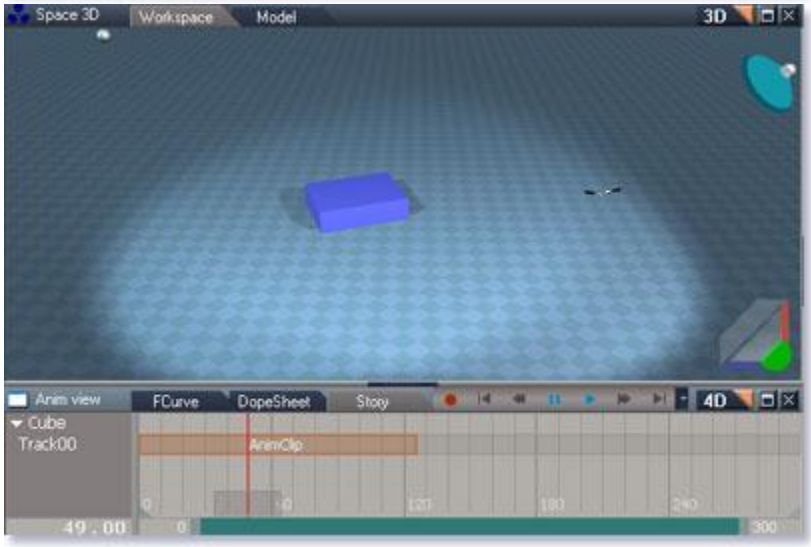
Space 3D
Workspace
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3D
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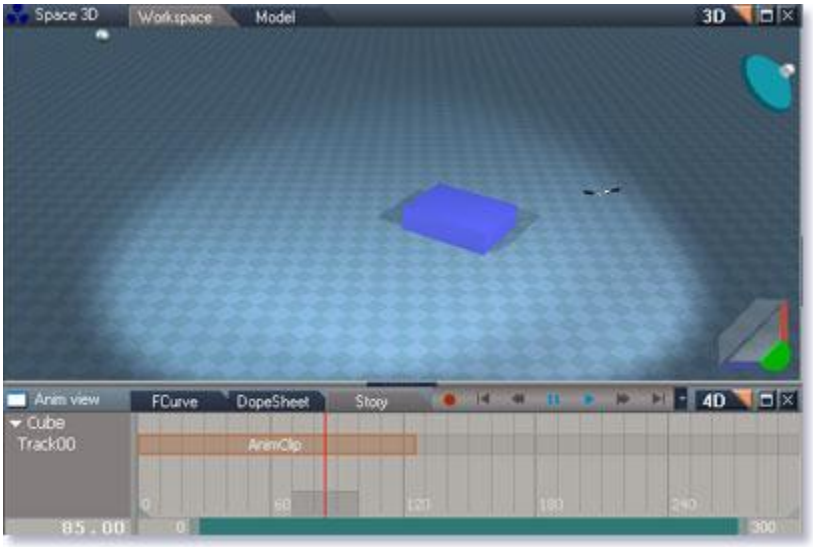
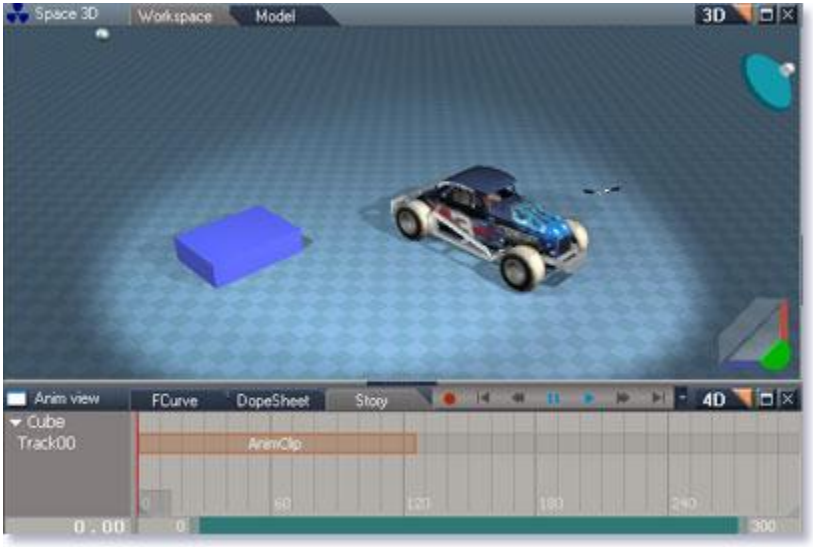
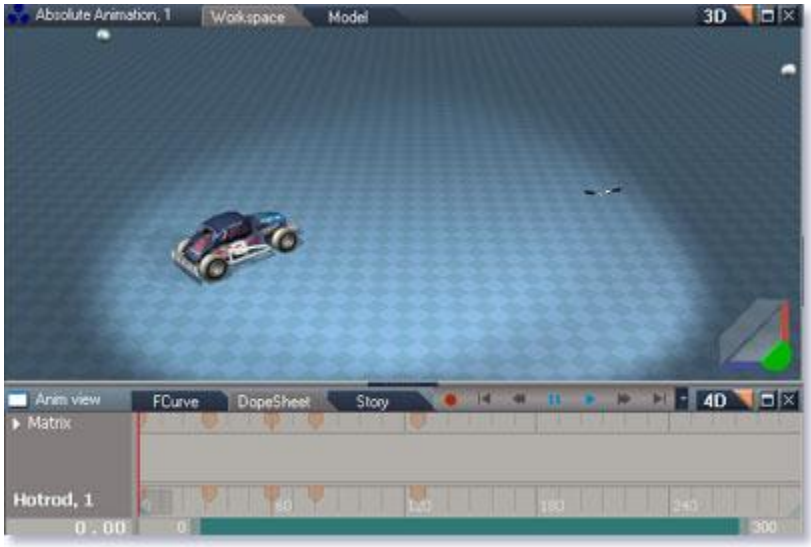


The image sequence above shows a sequence recorded using a low polygon cube, to keep you focused solely on the path the object is following. It can be faster and cleaner to create the animation with a simple object.



You can then bring in your high poly object. Notice its position, rotation and scaling are just as it appears when we drag and drop it into the scene, we don't need to set it up in any special way.


Absolute Animation, 1
Workspace
Model
3D
Anim view
FCurve
DopeSheet
Story
4D
Matrix
Hotrod, 1
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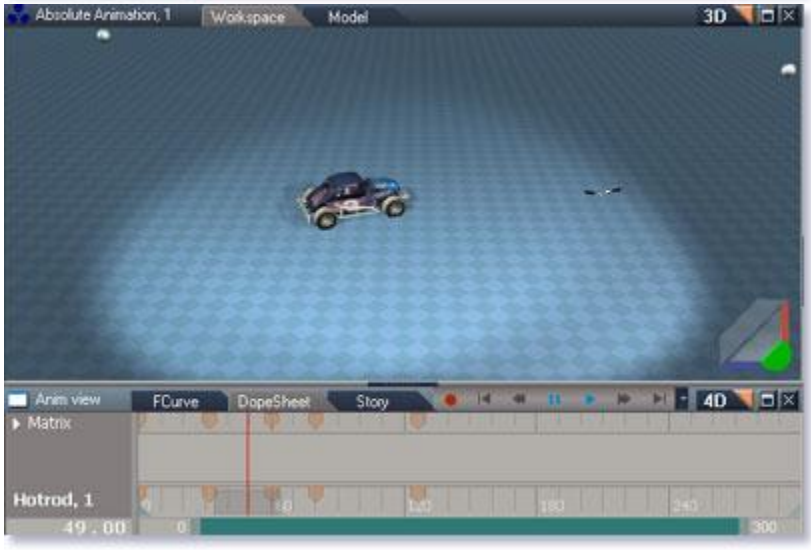
Absolute Animation, 1
Workspace
Model
3D
Anim view
FCurve
DopeSheet
Story
4D
Matrix
Hotrod, 1
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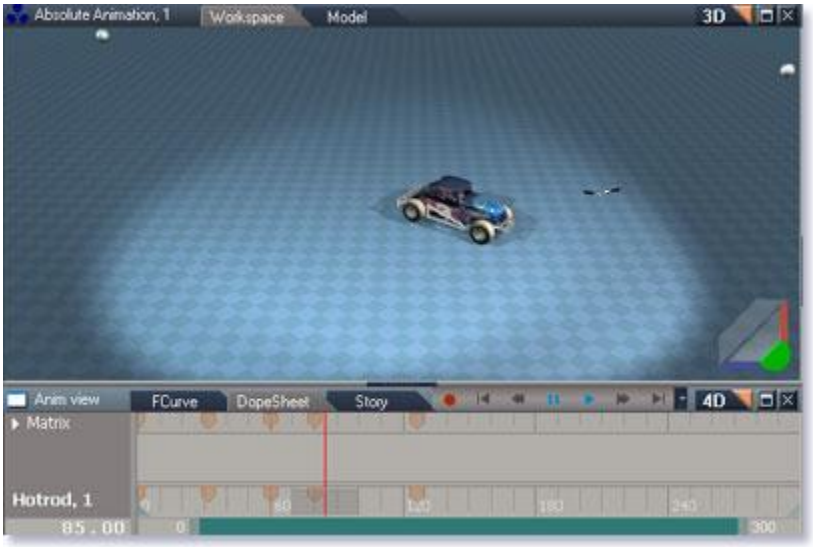


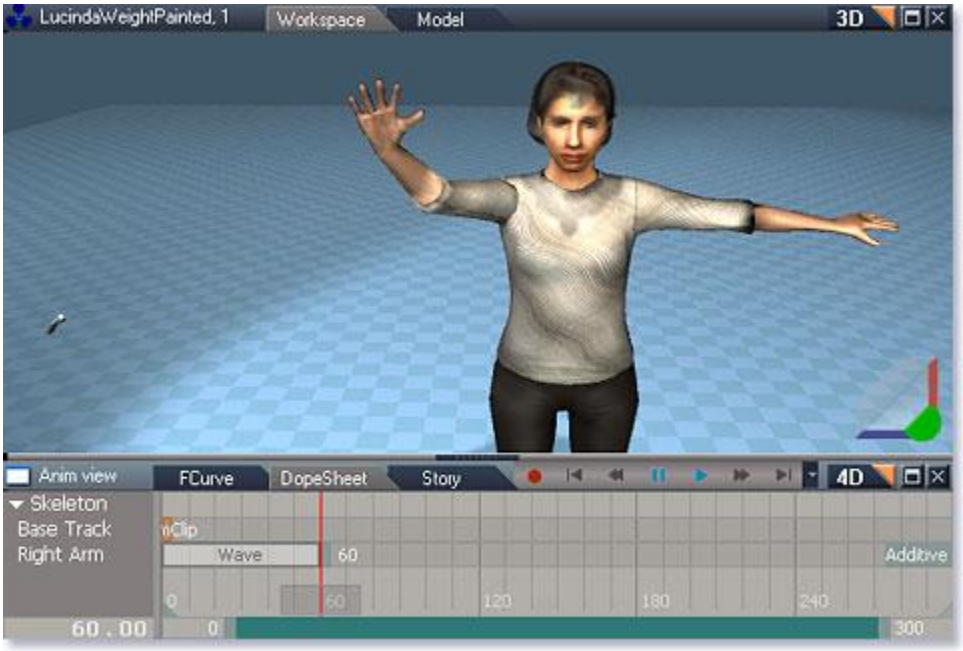
Now by pasting the absolute animation onto the car, it follows the same animation as the cube, with the same scaling, position and rotation. Do note it is important to have your high and low detail objects animated with their axes matched – check this first before creating the whole animation!

One handy way to copy an absolute animation from one object to another is to use the Merge function to create a new Track, which will have all the combined actions from the Tracks mixed down into one absolute action. You can then cut or copy this merged Clip onto your other object, instantly applying an identical absolute animation to the second object.

Most often though you will want to copy the "type" of animation, such as copying rotation from one planet to another, or from one wheel to another – while you want them to "rotate the same" you want to keep those other objects in their own location with their own scaling, maybe even combining with other rotations they already have too - and that is when Additive mode is invaluable!

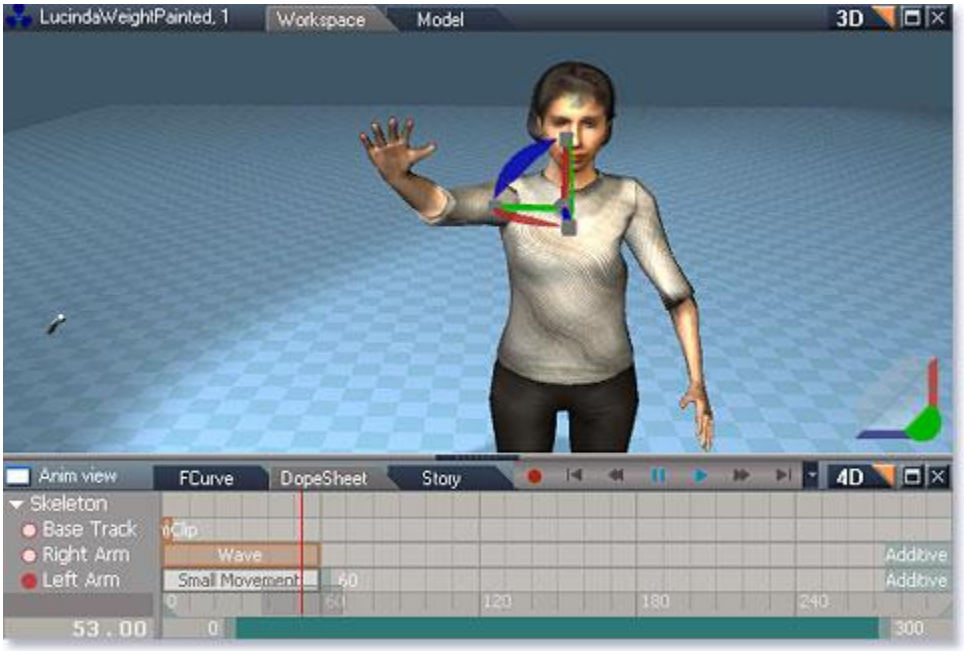
9.3.5 Advanced Workflow – Multiple Clips for Skeletons

You will not be surprised to learn that the same techniques that you used to mix different actions for your planet, like rotation and movement, can also mix different actions for a skeleton, such as walking and waving their arms.



A Base Clip is recorded, then movement for the right arm is recorded in Additive mode

The process is exactly the same – you create a base Track with a starting state for your character, and then you record using Additive mode for the other Tracks. When creating the multiple Tracks, remember to record a starting keyframe for each Track, even if a keyframe is already recorded at the same point in time on another Track, since each Track must be self contained. Also, disabling the Pass Through parameter for the Additive mode tracks will be useful in many cases for recording your Clips. The image above shows the first steps with some movement recorded for the right arm (Locks were used on the skeleton to move only that arm without the rest of the model moving).



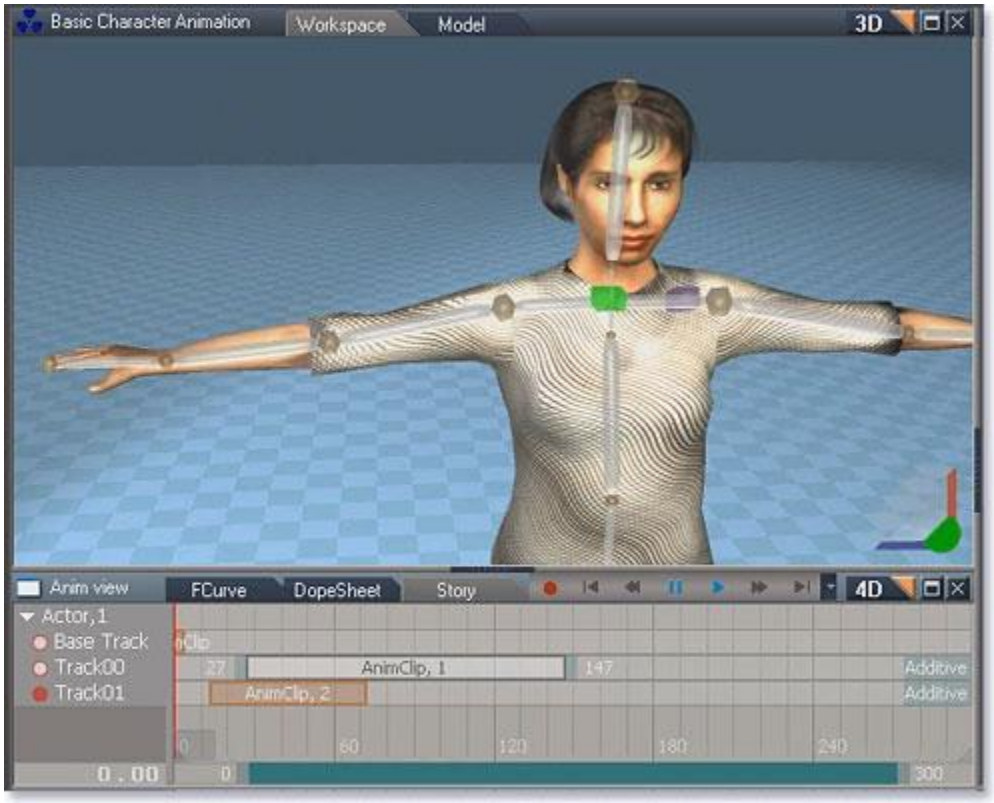
A second Additive Track handles movement for the left arm.

You can then record other motions for the character, in the image above a small movement has been created for the left arm. The process could then be continued to add a walking motion on another Additive Track, with a fourth Track added to handle the movement of the character forward through space.

It is very useful to take advantage of the ability to disable each Track while recording the others, so that you can clearly focus on just the one movement at a time (it could be distracting if your character was waving as you tried to adjust their legs into the walk cycle for example).

Once all the animations are recorded, you can then adjust their timing and duration independently until you have the final result you desire.

Using multiple Clips and Tracks is optional – you may simply want to make one Clip where the walking and waving are recorded all at once, and that is possible and a reasonable solution. However, in many cases it is easier to record different motions separately, as it allows easier adjustment of the end result. Putting everything into one Clip can mean a lot of rework if you decide to alter something later, as it might take re-recording the keyframes, or manually adjusting just some values in each keyframe using the F Curve editor, which is possible – but not as easy as simply using the Story mode to work with Clips!



video link

Check the video above to view the basic workflow for using multiple clips to create character animation.

As well as creating Clips for different parts of the body, you can create and blend Clips for the same part of the body. This lets you blend a forward movement for the right arm, with an upward movement for the right arm, and you will end up with a blended combination of both.

Once again, separating out these movements onto different Tracks is optional, but it does allow you to adjust and change each action independently, so can give you great control and make it easier to edit your animation.

video link

View the video above to see the workflow for blending together two movements for the right arm.

9.3.6 Advanced Workflow – Copying Clips from One Character to Another

Just as you can copy movement, rotation and scaling, you can also copy character animation from one character to another. To do this, both characters need to share an identical skeleton. All the bones, joints, etc must have the same names for this to work; otherwise the results of copying the animation will not be what you expect and want.

For characters that use IK handles, then these too must be present with the same name, or any IK interpolation will be lost.

9.3.7 Different Kinds of Animation

In this tutorial we will briefly consider the different categories of animation that trueSpace can handle. These are:

Keyframe Animation – the tutorials up to this point have all worked with keyframe animation that you create yourself. Whether you move an object in the scene, or pose a character using Dynapose, you are still setting up a particular situation then recording a snapshot of it. With this approach, you are the one who must decide how things look at a given point in time, then you must create that situation, and record the snapshot.

BVH Animation – this is in essence keyframe animation, however the keyframes have been created for you using motion capture. This removes the need for you to work out each pose yourself. Also, since the movement is captured from the real world, it often attains a level of realism that is hard to recreate when posing by hand. The keyframes can often be very "dense" however, which can make the motions difficult to edit.

Physics Animation – this differs from the previous two animation types. Instead of working out each keyframe yourself, or loading up some pre-defined keyframes, instead you set some initial conditions then ask trueSpace to work out what happens next. trueSpace will then simulate the real world and calculate how things move, fall, collide, bounce etc. It is possible to "capture" this information into keyframes, so that you can then edit and adjust it manually, and render it out.

Procedural Animation – here, trueSpace again works out the animation for you, this time by following instructions in scripts or blocks in the Link Editor rather than by following the rules of physical simulation.

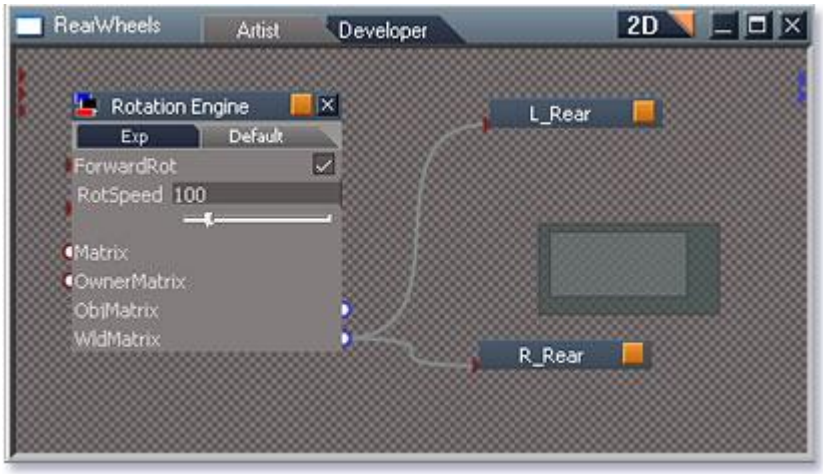
The real power of trueSpace lies in the fact that you can combine all these animation types together to achieve your desired end result. You are not limited to using just one kind of animation for one scene or even for one object, so you can find the workflow that best matches your current needs, whether that be for quick animation, realistic animation, carefully controlled animation, experimental "try it and see what happens" animation, etc.

The following tutorials and examples will look at different ways of using and combining these kinds of animation.

9.3.8 Procedural Animation plus Keyframes

In this tutorial we will look at how a Procedural Animation approach can be combined with keyframes.

First, in an empty scene load the Hotrod model. This model has scripting set up to generate procedural animation for the wheels.



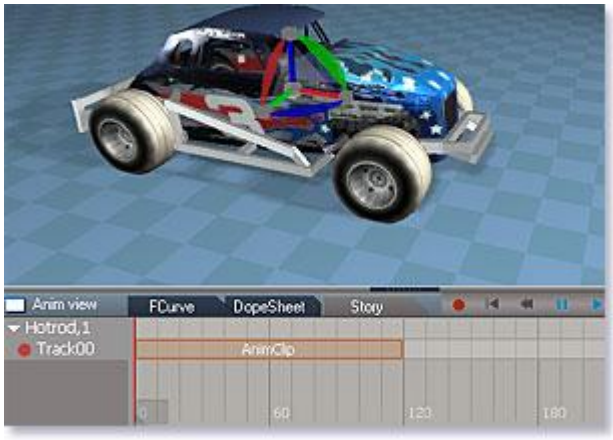
Inside the Rear Wheels object, where the Rotation Engine controls the spinning of the wheels

You can have a look at how the car has been set up in the Link Editor, as seen in the image above. However, the object can easily be used without any awareness of how it is set up and how it works, so you do not need to enter the Link Editor at all if you do not want to!

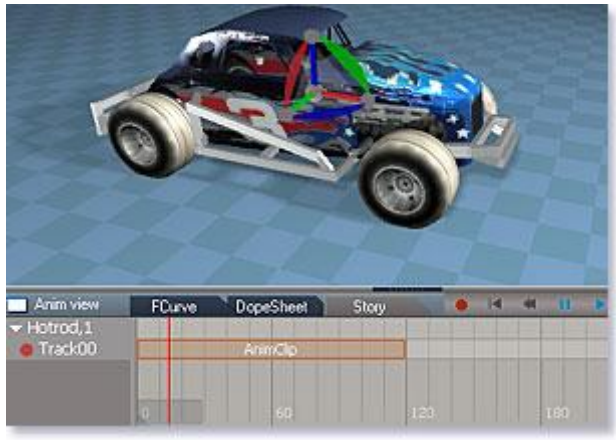
```
MotionVector = System.CreateDO('Math Package/Point Data');
MotionVector.x = nx - ox;          // Compute motion vector
MotionVector.y = ny - oy;
MotionVector.z = nz - oz;


////////////////////////////////////////////////////////////////////////
// Step 2: Depends on choosed rotation style choose the right one
//         and compute rotation.

if (ForwardRot)
{
  // Because we wants to rotate along Y axis it would be good
  // consider the motion vector and Y axis. So when they are
  // perpendicular, motion will be 0 and when they are
  // pararel the rotation will strongest
  // To compute right motion vector it is enough
  // calculate the dot product between object Y axis and MotionVector
  // (cosine of the angle between thea)

  len = MotionVector.GetLength();
  MotionVector.Normalize();


  WldAxis = NewWldMatrix.GetAxisY();
```

Inside the Rotation Engine itself

If you choose, you can even enter the Rotation Engine object to see and modify the code, as in the image above, so you can write your own procedural scripts and controls quite easily. Again though, this is optional, and it is easy to use these objects directly without the need to look inside them!



1



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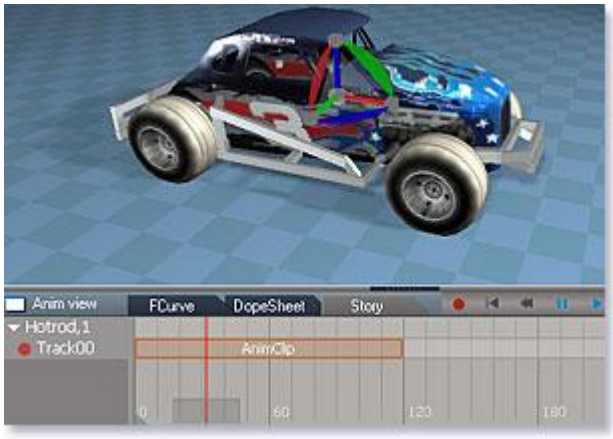

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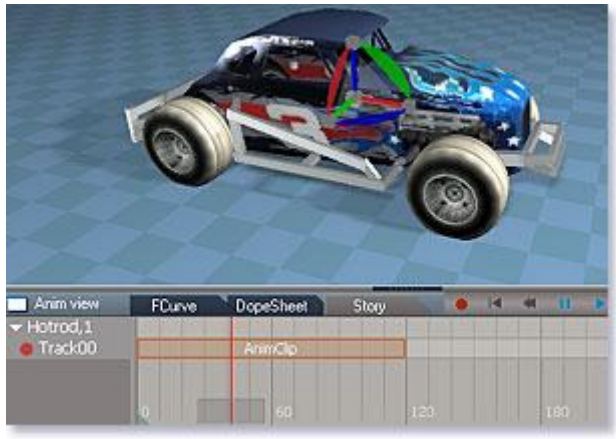


4

With this Hotrod object loaded, keyframe some movement across the screen. You will notice when you move the car that the wheels rotate, dependent on its position in space. Then when you play back or scrub through the animation, you see that the wheels still rotate, and you will see something like in the four images above.

The important thing about this example is that the rotation of the wheels has not been recorded in the keyframes. The keyframes only store the information for the movement of the car. The rotation of the wheels is actually calculated procedurally by the scripting and control blocks in the Link Editor.

Naturally, this makes it very easy to create some types of animation – without it, you would need to keyframe the rotation of the wheels yourself, or perhaps have some plug-in try to calculate it for you. With procedural animation in trueSpace, though, the object itself – in this case, the car – contains all it needs to animate itself, and it will respond to keyframed animation just as well as it will respond to real-time interaction.

With an “intelligent object” such as this Hotrod, you need not know any scripting or even open the Link Editor at all – the object is created in such a way to respond usefully all by itself.

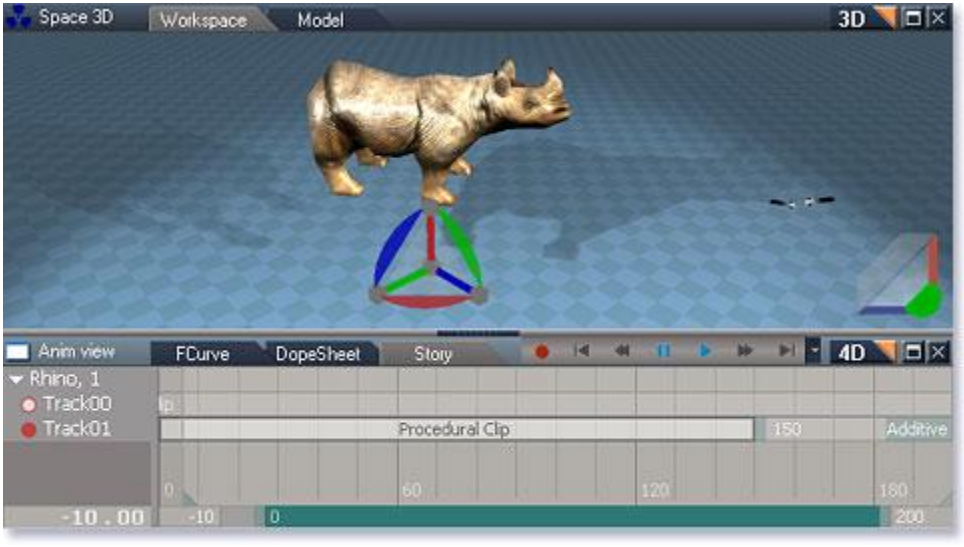
A note about rendering the Hotrod – the procedural animation contained in this particular model renders well with the real-time workspace “Render To File” option, and with the “V-Ray Render Animation” option; the procedural animation does not render so well on the Model side and may show unusual behavior in the front right wheel.

9.3.9 Using Physics to Generate Keyframes, Part 1

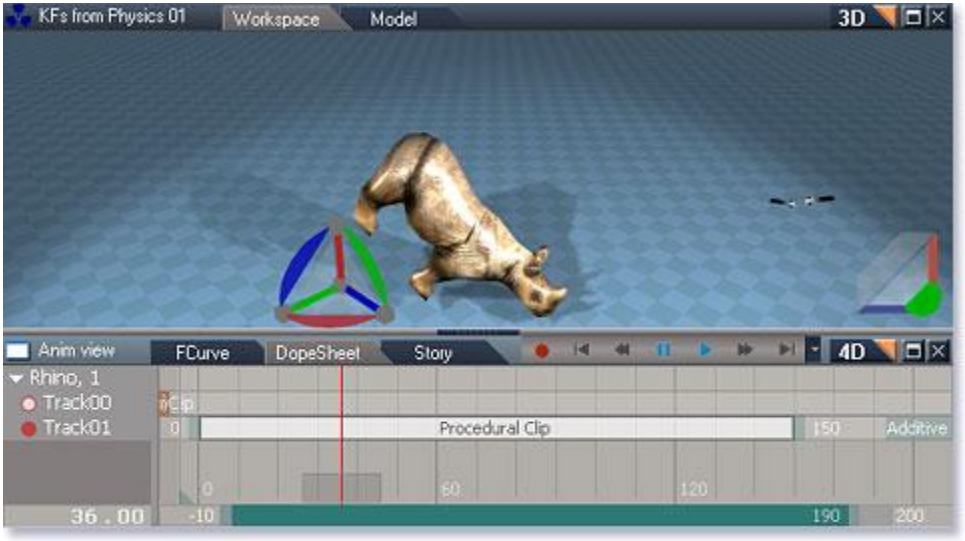
There are many ways to combine physical simulation with keyframes. One of the most general is to use physics to calculate what happens in the animation, and capture this to keyframes for fine tuning and rendering.

Start with an object in your scene raised up off the ground (in the example in the manual, the rhino model has been used). Give this object physical properties, and then run the physics simulation – your object will fall to the ground and bounce. If you were to use any of the render options though, you would find that no animation is rendered.

Physics simulation is always calculated “live” so cannot be rendered directly. It is easy to capture it to keyframes for rendering though. Record a base Track for your object as you have done in the earlier tutorials, and create a new Track using Edit In New Track.



Now right click in this empty Track and select “Create New Procedural Clip”. Name the Clip “Procedural Clip” just for clarity. A procedural Clip means one generated from the physical simulation, rather than one where you set the keyframes yourself. Your scene will look something like the image above.



Now right click again and select “Generate Keyframes”. This runs the physics simulation and captures the result into the Procedural Clip. For such a simple set up, this will run very fast! Now playback or scrub through your animation and you will see that the object has been recorded as it fell and bounced. You can see this in the above image, where the current frame has been scrubbed through the timeline and you can see the rhino now falls and bounces when the animation is played back.

It is not necessary to make this an Additive Track in order to capture the keyframes from the physics simulation, but again it is useful – for example, you can now move the starting position of the object and re-record this on your Base Track. Now your object will fall down from its new location. You can also save the Clip and apply it to another object. It is up to you when to use Additive Tracks for recording and when to use regular Tracks, but as a default it is usually more flexible to use Additive mode Tracks.

Once keyframes have been captured using Generate Keyframes, you can right click on the Clip and uncheck the Procedural parameter. This turns the Clip into a “regular” Clip, just like any other. This can prevent accidentally overwriting the Clip when using Generate Keyframes on another Procedural Clip, and also lets you use more than one Procedural Clip on the same Track.

9.3.9.1 Capturing Physics from a Particular Point in Time

It is possible to capture physics from only a particular point in time. For example, if you have an object raised in the air, and you want it to remain in place until frame 30, when you want it to start to fall under the effects of physics simulation, then simply create a Procedural Clip starting at frame 30. When you use Generate Keyframes, the object will only begin to fall under physics simulation at frame 30, so when you playback the animation, the object will remain in place in the air for the first 29 frames, and only begin to fall at frame 30.

You can also use this to avoid extra keyframes when nothing is happening. For example, if you have two objects that collide, one that is moving from the start of the scene, and one that is static but is hit by the other object at frame 45. In this instance, you only need to start recording the keyframes for the second object at frame 45, as it is not going to do anything up until the point of impact, and you can do that by starting the Procedural Clip for that object at frame 45.

9.3.9.2 Multiple Procedural Clips for the Same Object, Part 1

You should be aware of the effects of using more than one Procedural Clip for one object, to ensure you achieve the results that you want. To learn more, follow the examples below.

First, set up a cube raised in the air and assign Physical Attributes to it, so that it will fall under physics. Create two Procedural Clips on one Track for this cube. Shorten each Procedural Clip so that it is 5 frames long, and place the first Procedural Clip at frame 0 (so it ends on frame 5) and the next Procedural Clip at frame 10 (so it ends on frame 15).

Ensure neither Procedural Clip is selected (click anywhere on an empty space in the Story view). If you have a Procedural Clip selected, then keyframes are only generated for that one Procedural Clip. With no Procedural Clip selected, keyframes are created for all Procedural Clips in the scene at once.

Now use Generate Keyframes, then play back or scrub through your animation. You will find that the cube falls from frames 0 to 5, stays still from frames 6 to 9, then at frame 10 jumps ahead as if it had still been falling for frames 6 to 9.

This is expected and correct behavior, but it is important to be aware of it when using Generate Keyframes, so that you don’t expect the cube to begin falling at frame 10 from the position it stopped at in frame 5.

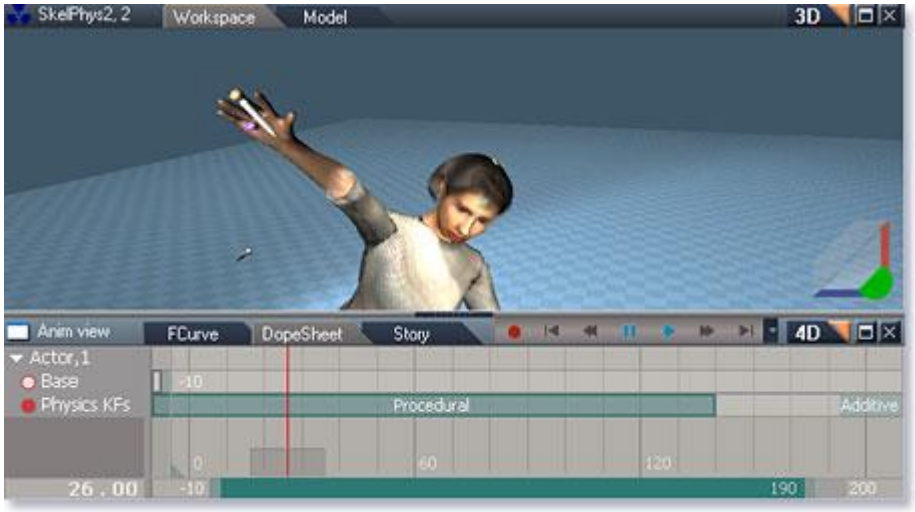
9.3.10 Using Physics with Characters

You can easily apply physical simulation to characters too – simply select the character, and apply physical properties as you would any other object. Now when you run the physics simulation, you will see your character fall to the ground.

Then just as you captured physics to keyframes for a regular object, you can do exactly the same for a character – create a Base Track, then an Additive Track, then add a Procedural Clip and Generate Keyframes to capture the results of the physical simulation into the Clip.

The scene prepared to generate keyframes from physics simulation

Once you are ready (your scene will look something like the one above) you can Generate Keyframes as before, which will be recorded into the Procedural Clip.



Scrubbing through the animation after generating keyframes

Note that you can set Locks to be active with physics simulation. Any Locks that are active and are enabled to work with physics simulation will constrain the movement of character generated by physics. For example, if you set a position Lock on the right hand, it would be as if the character was attached or holding on to something with their hand, and while the rest of their body would fall under gravity, their hand would remain locked in place. The above image shows the result of such a set up once the keyframes were generated from physics.

9.3.11 Using Physics to Generate Keyframes, Part 2

So far we have looked at capturing physics with objects on their own. However, part of the physics simulation is that objects can interact, so let's see how to use that to our advantage in making an animation.

In this instance example, you will take a character and have them hit by an object flying toward them, which will knock them backward. The only "work" you will have to do is to set up the initial conditions for the simulation, and after that trueSpace will do the rest!

Add a character to your scene and an object positioned off the ground and in the air which will hit them – a simple sphere for a concrete ball would do. Make the ball heavy, otherwise it will bounce off the character without moving them much (just as in the real world). Also add some initial speed to the ball, so that it is moving fairly rapidly toward your character. (See the chapter on physics for more information on controlling the physical properties for the ball such as initial speed and mass.)

Now assign physical properties to your character – the default will probably do. Run the physics simulation, and you will see the ball fly toward your character, who will then fly backward, their joints bending and moving with the impact.

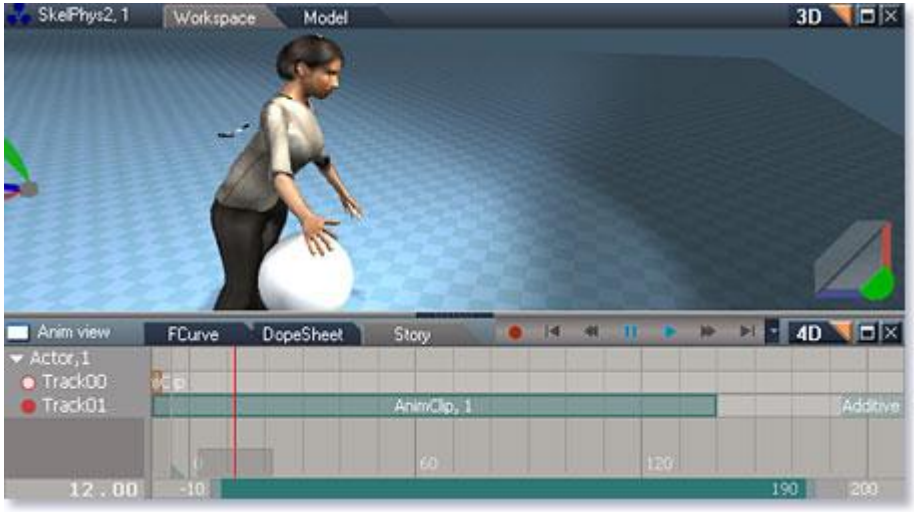
Setting up the physics simulation to get the desired result

Feel free to adjust the various aspects of the initial scene such as the speed of the ball, the position and angle it hits the character at, the mass of the ball, etc. Once you are happy with the results, we can capture this ready for rendering, or for further editing. You can see an example of how the scene might look in the image above.

To generate keyframes in this case, we will need to create Procedural Clips for both the ball and for the character. You can do this one at a time, or you can do both at once. For this example, you will record both at once. To do this, set up both the ball and the character so that they each have a Procedural Clip on an Additive Track.

Procedural Clips are in place for ball and character to capture the results of the physics simulation

To record both at once, you must ensure that there is no current active Clip. If there is an active Clip, then that will be the only one that records keyframes. With no active Clip, all Procedural Clips will capture keyframes from the physics simulation for their object. To ensure no Clip is active, just click on an empty space in the Animation Editor. Your scene will look something like the one in the image above. Now use Generate Keyframes.



Playing back the animation shows the impact has been recorded as keyframes into the Procedural Clips

You will note when you play back or scrub through the animation that both the ball and the character move, as we have captured the keyframes for both at once, as seen in the image above.

It would have been possible to record them separately. For example, if the Clip for the character had been selected and active, then the physics simulation would have run for both ball and character, but only the character would have had keyframes recorded. Playing back the animation would then show the character being hit by an invisible object, while the ball stayed in its original location! This can be useful – you can change the initial conditions to get the effect you want for each object independently. You might also want to reuse this "impact" animation and make it look as if something else other than the ball had been responsible for it – so there are times you will want to generate keyframes for all objects at once, and times you might want to generate them separately.

> **Important Note 1** – if you use Generate Keyframes with no selected active Clip, you will overwrite all Procedural Clips for all objects in the scene. You can avoid accidental erasure of captured keyframe data by unchecking Procedural for a Clip that you are happy with.
>
> **Important Note 2** – You can continue to run the physics simulation, without affecting the recorded keyframes. Running physics simulation has no effect on keyframe data – it is only when you use Generate Keyframes that the physics simulation is written to keyframes, so don't forget that running physics simulation may not be the same as playing your animation in the Animation Editor!

By using an Additive mode for the Track, you can now create other behaviors for the ball or the character – for example, you could create an animation of the character walking along, then arrange this with the physics simulation Clip you captured so that they walk for a while, then fall back when hit.

You would reposition the action of the ball to match where you position the impact for the character. As noted earlier, now that you have a Clip of the character falling backward as if hit, you could replace the ball and make it look as if something else hit the character, perhaps a different object, or perhaps even another character, making it look as your character is falling back from a punch or kick.

There are many ways to use physics simulation to speed the process of making an animation. To fire your imagination, here are some ideas! You could animate a cartoon character walking along and tripping, and then leave trueSpace to calculate their resulting tumble down a flight of steps. You could animate them swinging from a ledge using physics, with Locks keeping their hands in place, and then manually keyframe them climbing back up. Perhaps you could recalculate some physics part way through, adding a lock to one leg, but letting the other fall with physics as they lose their footing, before returning to manually created keyframes as they finish climbing back up.

9.3.12 Using Physics to Generate Keyframes, Part 3

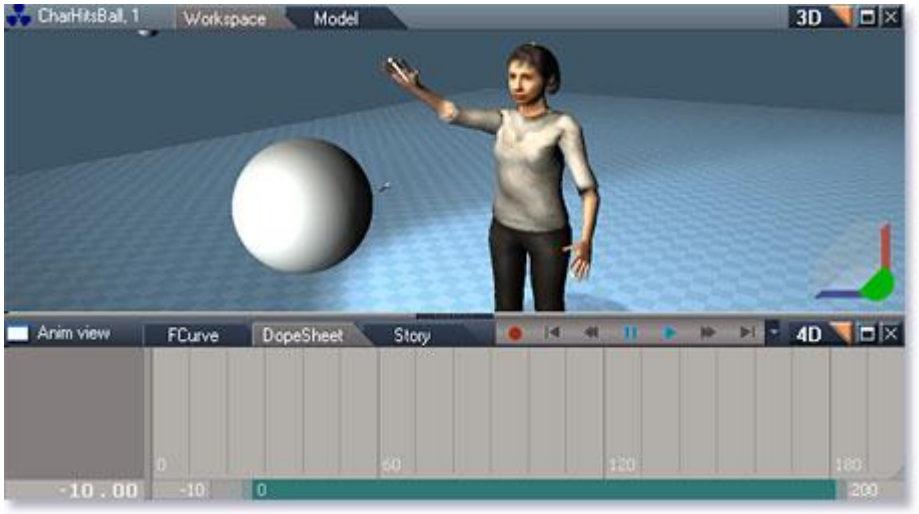
One interesting extension of using physics simulation is that you can apply individual physical forces to different bones. Just as you applied some initial speed to the ball in the previous tutorial, you can apply initial speed or even acceleration to a bone in the skeleton.

The above image shows some initial speed applied to the forearm. Applying initial conditions to bones in this way could help you generate keyframes for specific motions without having to work out each pose yourself. You could for instance put some forward motion onto the foot, to make one leg kick forward.

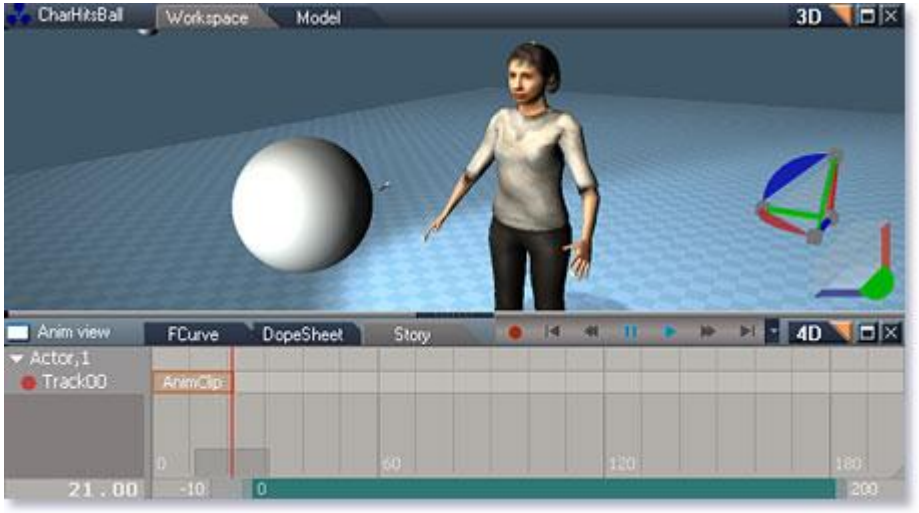
You could adjust the resulting effect by adding other initial speeds to the opposite arm for example, to control the motion that is generated. In combination with locks this can help you "generate" motions rather than just pose them yourself – and by using Additive mode you can copy and re-use those actions elsewhere, combining them with manually created poses (or even with BVH imported action) to achieve whatever end result you are looking for.

9.3.13 Using Keyframes to Generate Physics, Part 1

So far we have looked at ways of using physics simulation to generate animation. What about the other way around however? What if have animated a character using keyframes, and we want the environment to react to that character?



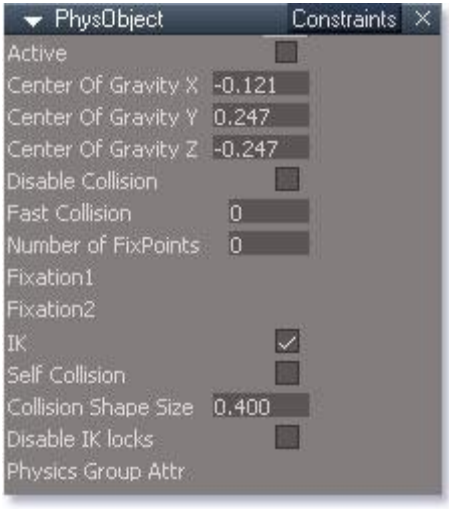
This is possible too in trueSpace. We will again start with our example of a character and a ball heading toward them. The ball will have some initial conditions set up as before, so that it has an initial speed and is heading toward the character. The initial conditions are much the same as for our previous scene, as in the picture above.



This time we will record some keyframes for the character, making their hand move as if to swat the ball away. You can make them sweep their hand up, down, or left or right, it is up to you. Record this action in the normal way. Then ensure you apply physical attributes to the character. In the picture above, you can see the end pose for the character.

Now, when you run physics in this default state, the character will not playback their keyframed animation, but will fall to the ground under gravity and will be hit by the ball, giving the same result as the last example. To change that and make the character playback their keyframed behaviors while the physics simulation is running, simply right click on any of the physics tools (such as Add Phys Attr, or Speed, etc).

This opens a panel in the Panels aspect of the Stack, which displays information about the object, like in the image above. This particular panel as several aspects, and you can see the chapter on physics for more information.



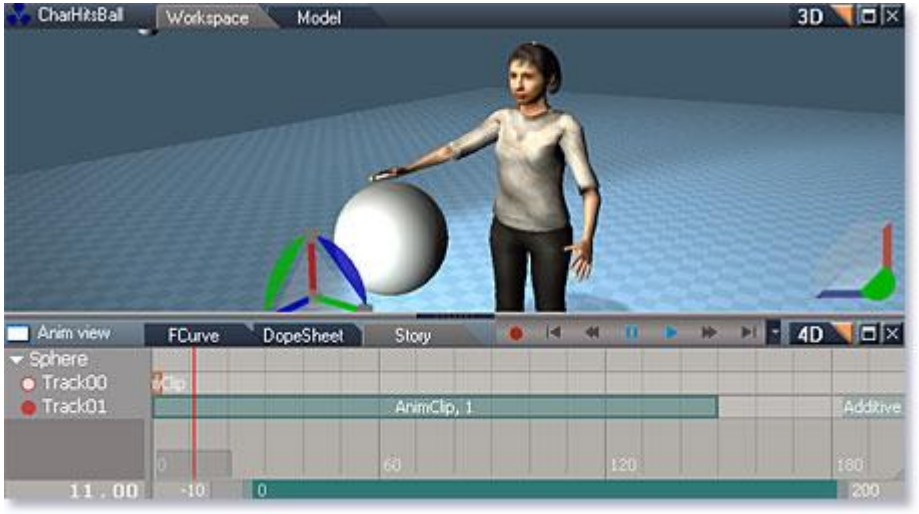
Right now the only parameter you need to look for is under the Constraints view of the PhysObject panel. Change to that aspect, and the panel will appear as seen above. At the top of this view is a parameter named Active, which is checked by default.

Un-checking this is all you need to do. Once unchecked, the character will no longer have physics simulation calculated for them, but instead will playback their own keyframed animation during physics.

Test your result by running the physics simulation. You may find that you need to adjust the timing of the hand movement so that it intercepts the ball, but that should be easy by scaling or moving the Clip containing the hand

movement. Once you have it right, the hand will hit the ball as it heads toward the character, and will deflect it away!

Naturally, the character will not respond to the impact of the ball, as the character is being driven by keyframes alone now. You could keyframe that reaction to the impact yourself of course, and check how it looks by running physics. There is another solution which we will look at later in this tutorial too.



For now, you should capture the motion of the ball with a Procedural Clip, using Generate Keyframes – the ball will then record flying forward and being deflected by the character and that action will be stored into a Clip. Your scene will now look something like the image above.

You can use this ability to have a keyframed character interact with objects via physics in many ways, and here are some ideas to get you thinking – a character could have a keyframed "shove" action (perhaps one you made yourself, or perhaps loaded from BVH), and could then push on a door, which will swing open (use Cogs and Pivot Points for your door object so that it is anchored correctly and swings open rather than falls down!). You could have a keyframed kick knock over a pile of boxes, or a keyframed flick of a figner start the toppling of a line of dominoes.

The process will also work with other characters; so that the shove or kick could impact a character insead of a regular solid object.

And it doesn't stop there. If we wanted our character to respond to the impact of the ball, we can freeze most of the character in place using Locks, but leave the arm that swatted at the ball free to move. Now you can re-check the Active setting in the Constraints aspect of the PhysObj panel, which makes the character affected by physics again.

Use “Edit In New Track” for the character, and create a Procedural Clip in the resulting Track. Ensure the Procedural Clip is positioned so that it starts at the time when the hand and the ball impact. In this case, we don’t want to record physics simulation for the character before the point of impact, as we want the keyframed animation that we made to control the arm’s movement up until the impact.

With the Procedural Clip properly positioned, use Generate Keyframes, letting the ball move regularly under physics. Now it will hit the arm, and the arm will be deflected by the impact.

Now the character has two Clips, one you created by hand which made the hand swat at the ball, the other created from the physics when the ball hit the hand. You can blend these two to give a combined result which mixes both the keyframed animation you made, which hits and deflects the ball, and the ball now also hits and deflects the arm.

This ability to blend Clips will give you a lot of options – you could keyframe a movement for a character (or use a BVH import), which could knock down some boxes, which in turn could knock down the character. By using keyframes to generate results in physics simulation, then using physics simulation to generate keyframes, you can simplify many animation tasks by letting trueSpace do the hard work of figuring out how things should look and what things should happen.

9.3.14 Fine Tuning a Character Pose Using FK

If you have a pose that is almost but not quite what you want, you can adjust it using Forward Kinematics (FK) rather than Inverse Kinematics. This lets you take precise control over each joint, adjusting the exact angle of just that joint, rather than using Dynapose or IK Handles to move whole portions of the skeleton, which might upset other elements of the pose you have set.

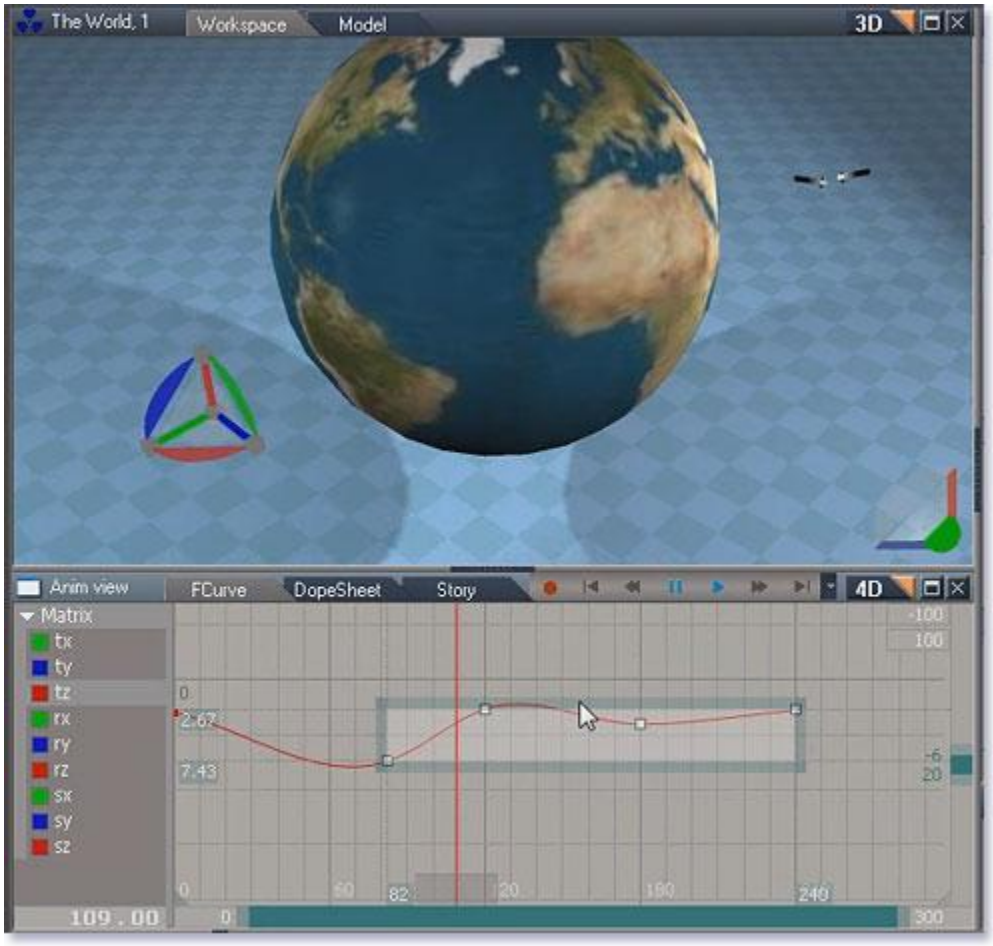
Simple enter Dynapose, and click on a joint that you want to adjust. You can then use the 3D widget to tweak the position of that joint, without it causing any other changes to the skeleton.

video link

The video above shows how you can alter the exact angle of the shoulder joint to fine tune a particular pose.

9.3.15 Using the F Curve Editor

Editing the F Curves can give you a lot of control over your animations, and with good visual feedback that can help you see what is going on better than just a view of the keyframes or clips.

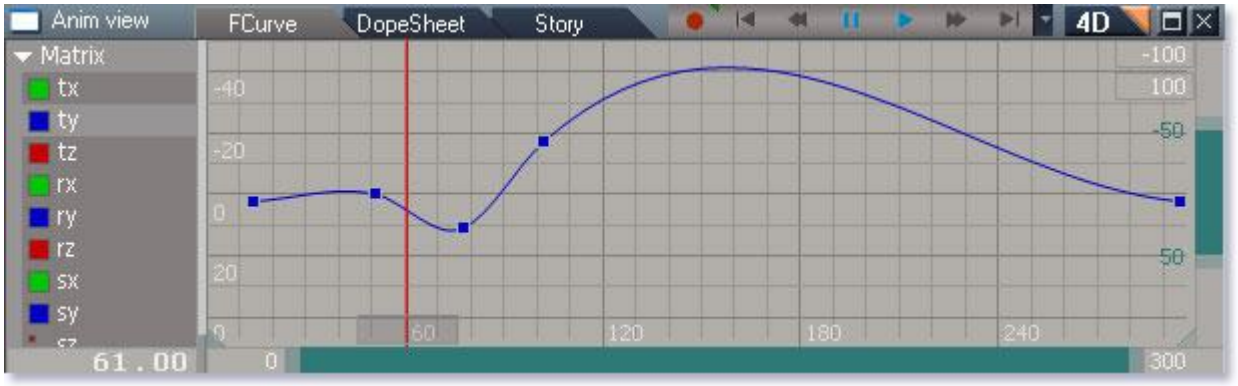


video link

Watch the video above to see how you can use the F Curve view to edit and adjust your animations

9.3.16 Interpolation

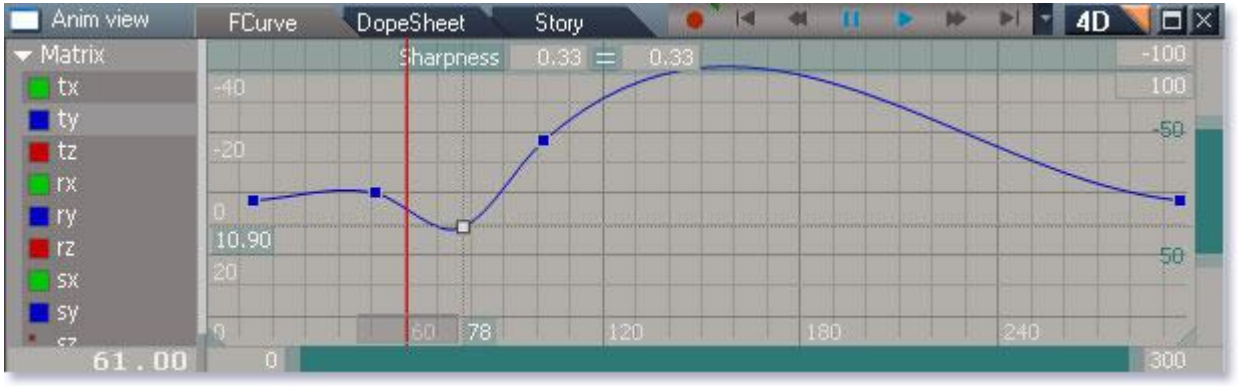
You may already be familiar with curves from 2D art packages, and you will find that curves in the F Curve editor work in much the same way. For this tutorial, we will be considering a deliberately simplified example of an object that moves left and right in the world. This creates information for the ty parameter which we can see under the Matrix for our object.



The F Curve view for our test object

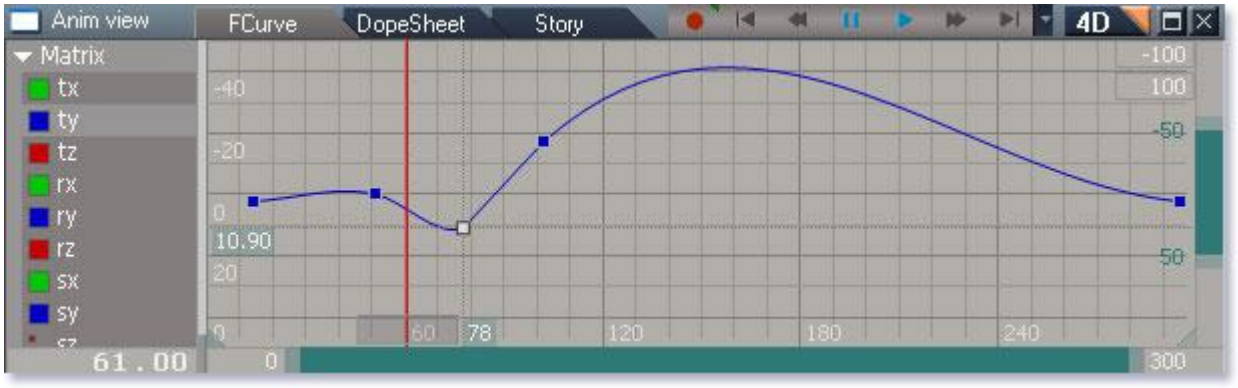
You can see in the image above that our object has some keyframes recorded for it. Each keyframe is represented by a small square in the F Curve window, and the actual value for the object's position in the y direction in the world is shown by the line drawn through all the keyframes.

You can set the Interpolation for each keyframe. Interpolation simply means the way that the line is drawn through that keyframe, and this affects how the object moves in your animation.



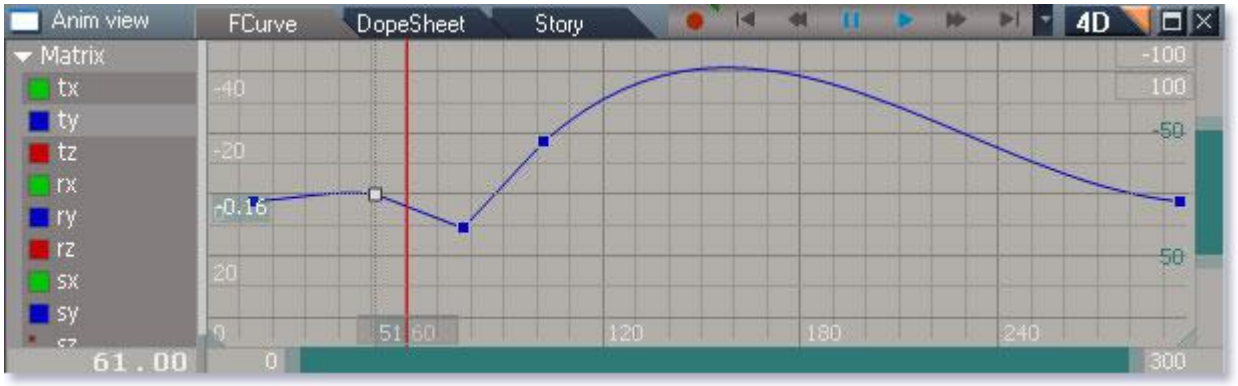
Selecting a particular keyframe shows the Sharpness values for that keyframe

When you select one keyframe, as in the image above, you'll see some values shown for it. This tutorial will look at those later – for now, we will look at some of the different kinds of Interpolation and the effect they have.



Setting Linear Interpolation for the selected keyframe – not how the line no longer curves coming out of this keyframe

Let us choose a Linear Interpolation for one keyframe. You will notice that while there is still a curve leading up to our selected keyframe, there is now a straight line between this keyframe and the next, as seen in the image above. You will note that the values for the keyframe disappear, as there is no adjustable parameter for Linear Interpolation. Now select the keyframe before this one, and change it to Linear Interpolation too.

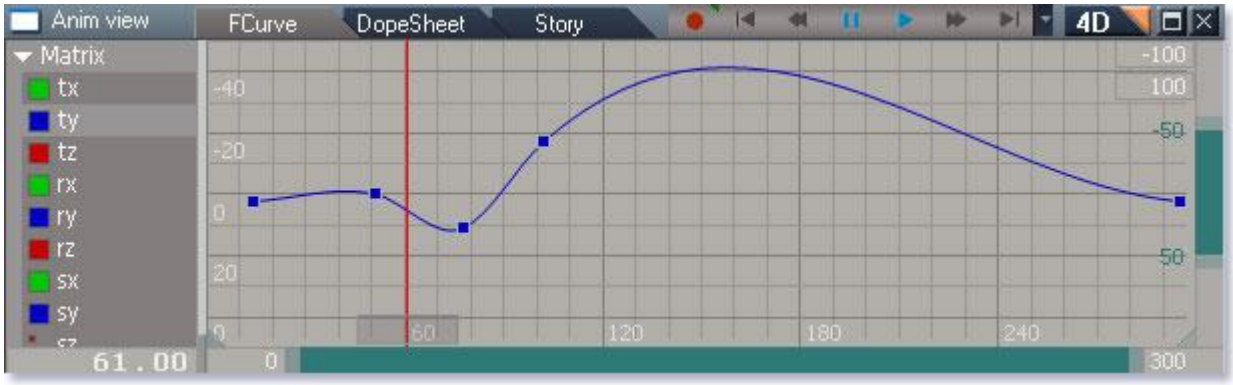


Setting Linear Interpolation for the previous keyframe gives us a "sharp point" in our curve

Now there is a "sharp point" in the line, as Linear Interpolation is being used before and after this keyframe. This will result in an equally "sharp change" in the animation – your object will be moving in one direction, and then in the space of one keyframe (about 30th of a second) it will change direction. Note that it does not slow down as it is about to change direction, or speed up after changing direction – the change is instant at that point in time.

This is often not the effect you are looking for, as most actions in the real world take time to happen, and most objects take time to change their state. For example, a car does not go instantly from 0 to 60, and neither does it stop instantly from 60 to 0 when it brakes; similarly if a person raises their hand, there is an acceleration over time for their hand to reach it's top speed, and there is also a slow down as it reaches the fully raised position.

There are exceptions to this, and that is where Linear Interpolation is useful – for example, when an anvil hits the ground it does not start to slow down before it hits, but changes state suddenly at the moment of impact. So Linear Interpolation has its uses! Do remember when using Linear Interpolation that depending on the result you want to achieve you may need to set two keyframes to Linear Interpolation, as it affects the way the value changes after the keyframe but not before.



Returning to the default Bezier Interpolation

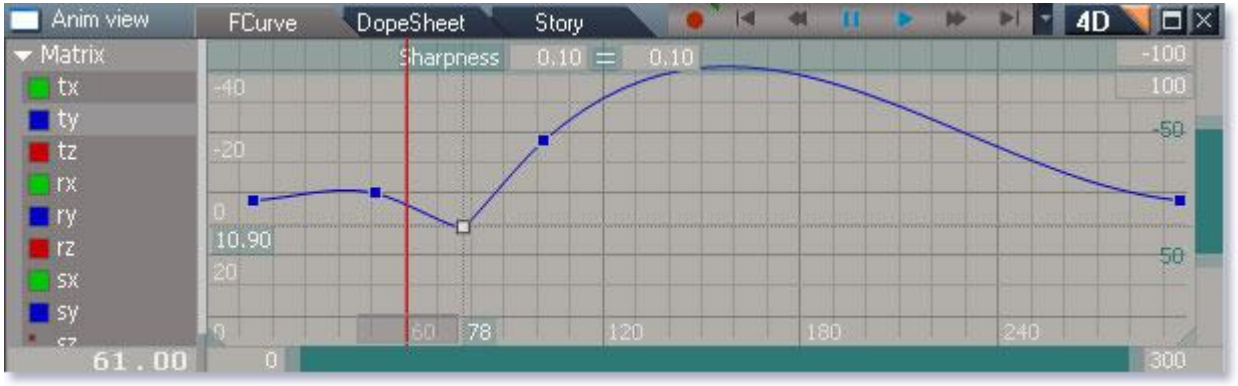
Most times though you will want to have the "lead in" and "lead out", where something does not change state suddenly at one instant in time, but the change happens over a small but noticeable period of time. The default Interpolation is Bezier, and gives just this effect, as seen in the image above (the same as our first image, since this is the default setting).

You will notice that this type of motion looks like a smooth curve in the F Curve editor. In many cases this gives you exactly the effect you need, with a realistic and believable look to the movements and changes in the animation.

With the default Bezier Interpolation, you can choose just how smoothed out you want the transition to be, by adjusting the Sharpness value for the keyframe. A low value will give a much sharper change (similar to having Linear Interpolation both leading in and leading out of the keyframe), while a larger value will give a more smoothed out change, extending the time it takes for the change (in direction in our example) to happen.

A high Sharpness value extends the effect of the keyframe outward to a wide area

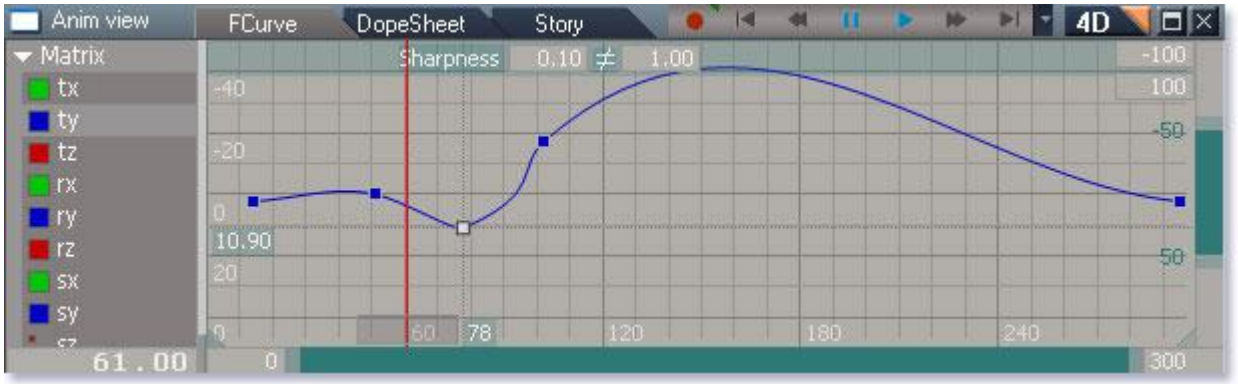
As the Sharpness value gets smaller, the area affected by the lead in and lead out for this keyframe gets less



At low Sharpness values, the effect is a sharp change in the curve

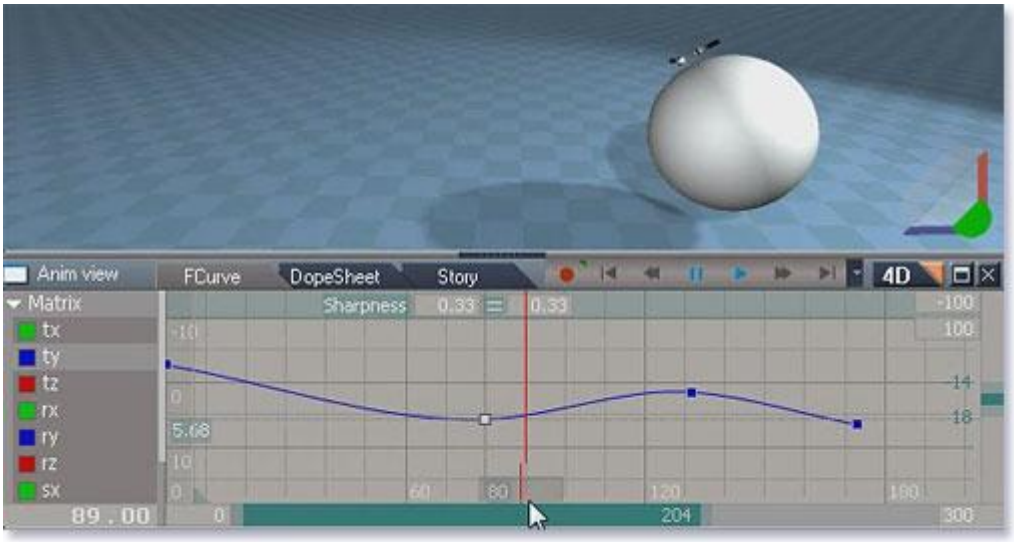
Above you can see the results of different Sharpness values for our Bezier Interpolation. Notice how the low value of 0.1 in the Sharpness resembles the effect of setting Linear Interpolation on this keyframe and the one before it;

also notice how the large value of 1 in the Sharpness extends the time it takes to make the change, and that this affects the shape of the curve coming out of the keyframe before this one, and going in to the next keyframe.



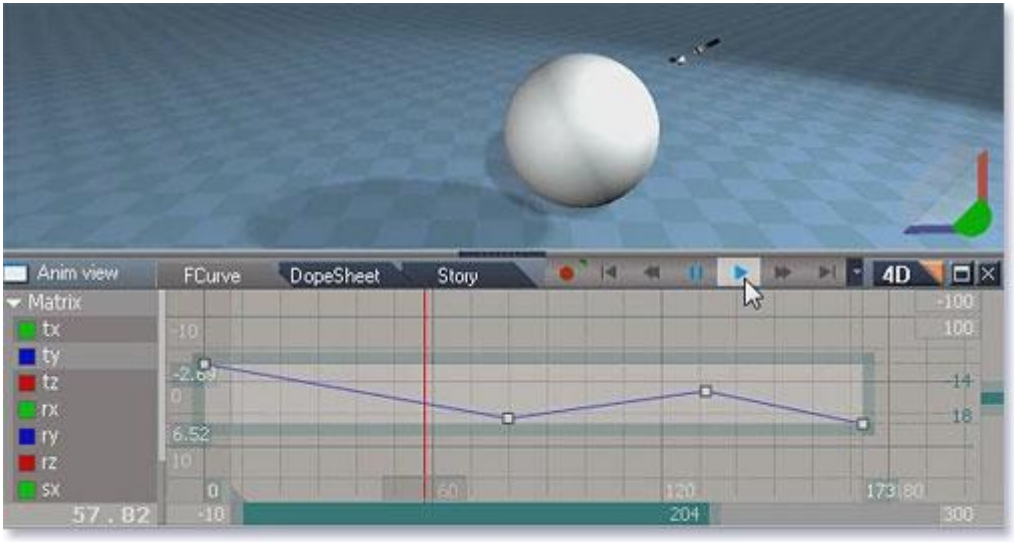
Clicking on the equals sign allows you to set independent Sharpness values for the lead in and lead out

If you want more control, you can adjust the sharpness leading in to the keyframe separately from the sharpness leading out of the keyframe. Simply click the = (equals sign) in between the two sharpness values. The symbol will change, and the two sharpness values can then be adjusted independently, as seen in the example image above.



Video - adjusting the Sharpness with Bezier Interpolation

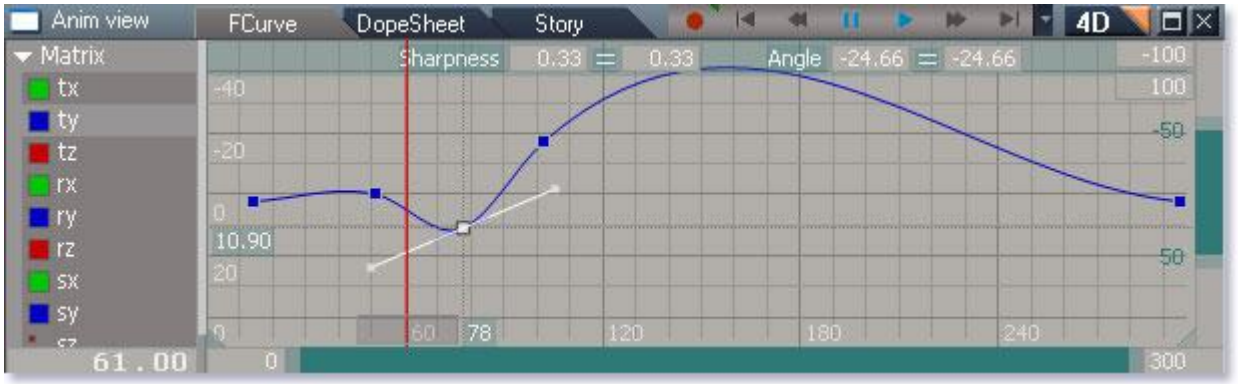
video link



Video – using Linear Interpolation

video link

If you need even more control over the way the curve is drawn through the keyframe than either the Bezier or Linear option, then you can choose Custom Bezier Interpolation.



Changing to Customer Bezier Interpolation gives a control handle for the keyframe, shown in white

As well as controlling the sharpness of the change at the keyframe, you can also change the angle of the curve at the keyframe. When you select Custom Bezier, then control handles are shown while the keyframe is selected to let you adjust the curve (see above image)

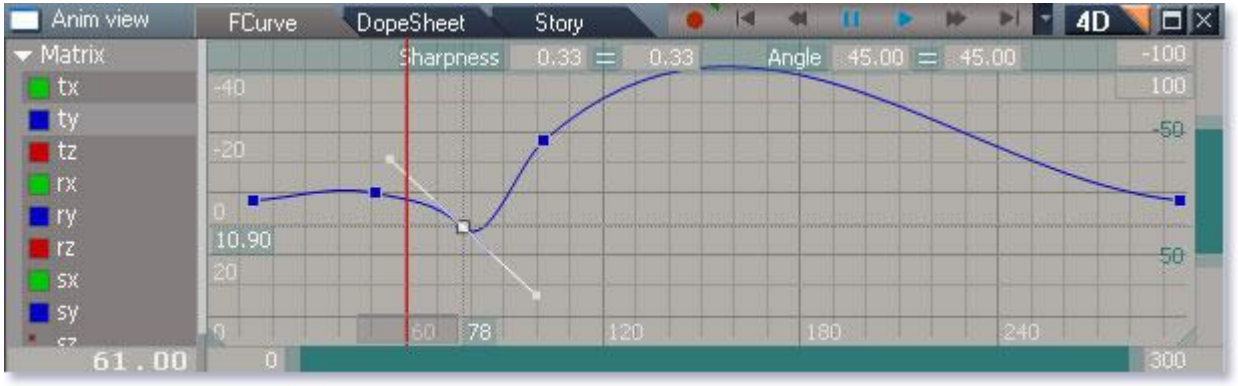
When a Custom Bezier keyframe is not selected, the tangent line for it is still shown

Even when the keyframe is not selected, as shown above, you can still see the tangent line for any keyframes that have Custom Bezier set as their Interpolation type.

You can adjust the values for Sharpness just as you did for the default Bezier Interpolation, and again the equals sign lets you choose whether or not the Sharpness leading in and leading out of the keyframe should be the same. For Custom Bezier, you can also adjust the angle of the curve at this keyframe.

A negative Angle gives a tangent which slopes upward from low on the left to high on the right

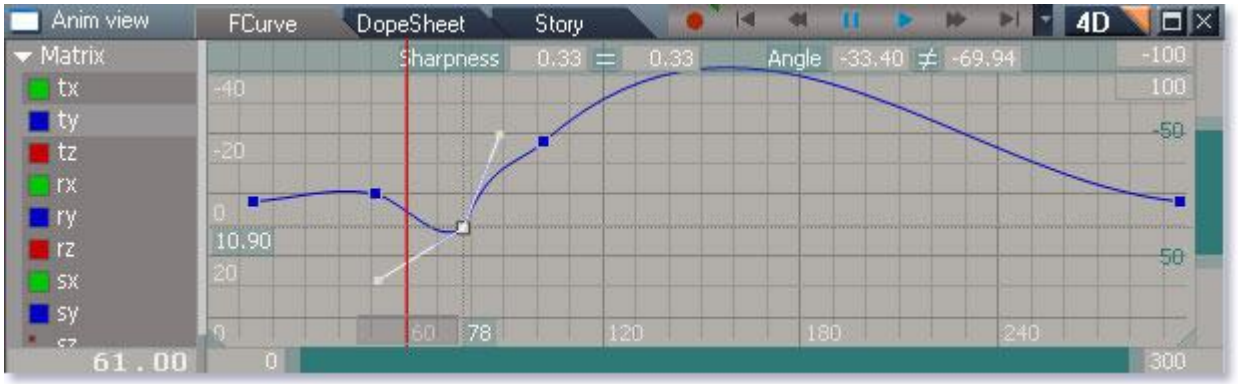
An Angle of 0 gives a flat tangent for the curve at the keyframe



A positive Angle gives a tangent that slopes downward from high on the left to low on the right

As you can see in the images above, a negative Angle gives a tangent at that keyframe which slopes from low on the left to high on the right; an Angle of 0 gives a tangent which is completely flat at the keyframe; while a positive Angle gives a tangent which slopes from high on the left to low on the right.

Note that you can adjust the Angle either by entering values into the text boxes, or by using the handles on the control.



Clicking on the equals sign for the Angle lets you set independent Angle values leading in and leading out of the keyframe

Just as you can adjust the Sharpness leading in and out of the keyframe independently, by un-checking the = symbol for the Angle, you can independently adjust the Angle leading into the keyframe and leading out of it, as seen above. Alternatively, even if the = symbol is still checked, you can press and hold CTRL while moving the control handles, to move each control handle independently, which lets you set the Angle in and out of the keyframe independently.

Using Custom Bezier, you can achieve any effect you want and adjust exactly how the animation changes as it leads into and leads out of the keyframe. For example, you could make an object slow to a stop quite suddenly, then slowly begin to move again, by creating a sharp and sudden change leading into the keyframe, but a longer, smoother and slower change coming out of the keyframe.

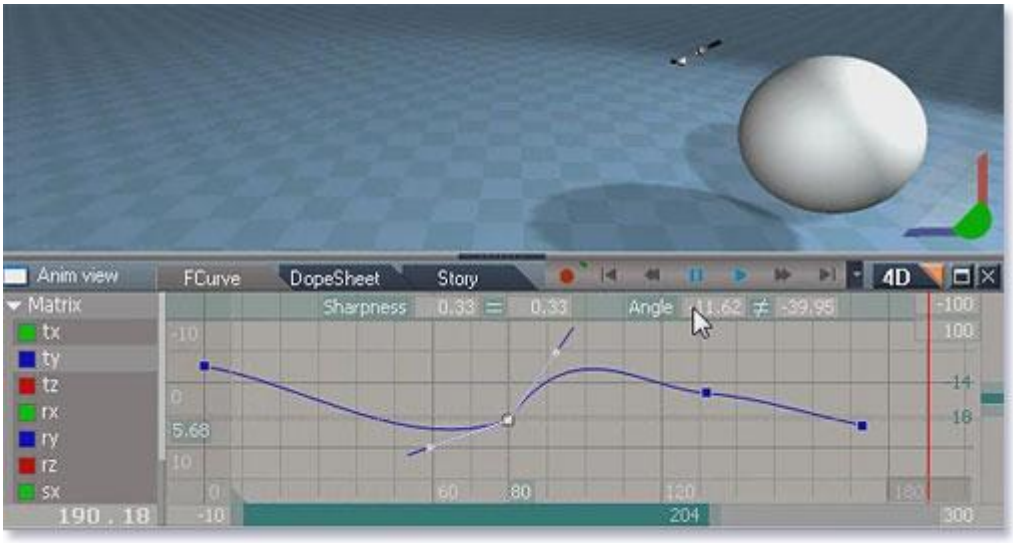
Using Custom Bezier and adjusting some keyframes to achieve a desired effect

You can see the sudden stop and slower moving off in the image above, where the Custom Bezier has been set for

two keyframes, and the second of these keyframes has been moved on the timeline. This gives a result where the object changes position in space evenly until the selected keyframe, at which point it stops suddenly.

Following that selected keyframe, the position in space changes slowly, meaning the object moves off slowly, picking up speed as it approaches the next keyframe. It then slows and changes direction in an even, gradual way.

One thing you should note is that with the curve settings shown in this image, the object only reverses direction at a point in time that is well after the second Custom Bezier keyframe, and not at that keyframe itself. It is important to keep that in mind about Custom Bezier Interpolation and to remember that adjusting the curves can make a change (such as a change in direction, scaling, rotation, etc) happen outside of the actual keyframe itself, depending on the values you set.



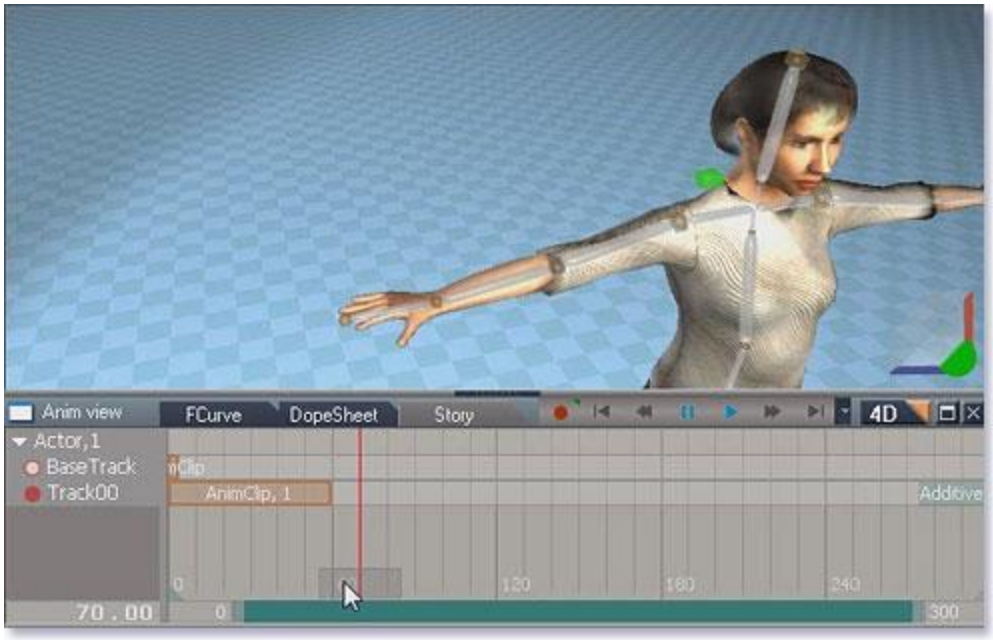
Video – using Custom Bezier Interpolation

video link

With these different types of Interpolation and with the controls you have over each type of Interpolation, you can obtain any effect you require in your animation, with complete control over how each keyframe is handled.

9.3.17 The Pass Through Parameter

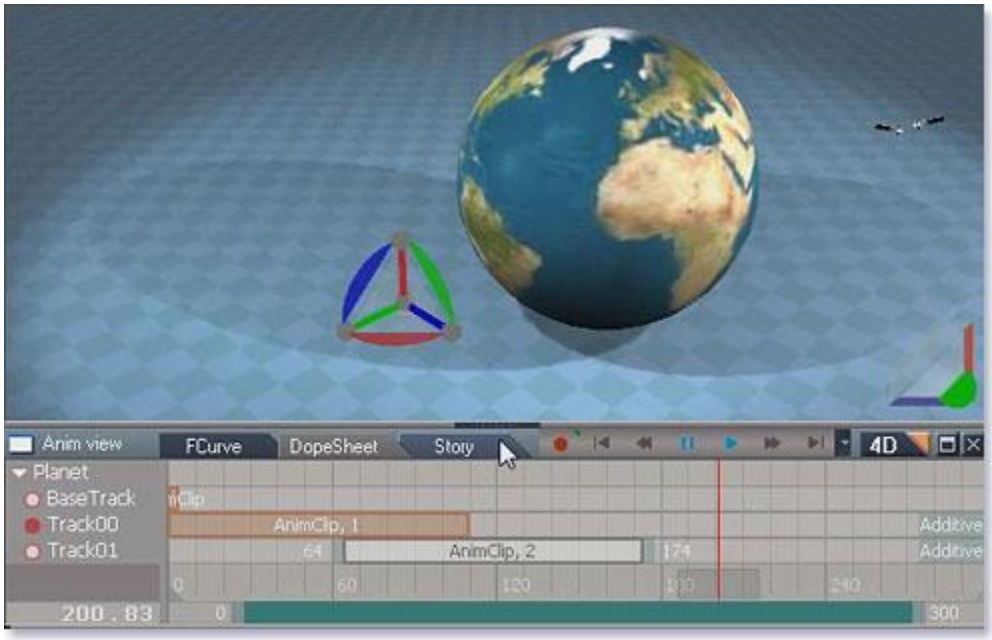
In this tutorial you will explore the Pass Through parameter in a little more detail. Begin by working with a character, as correctly setting Pass Through is important for working smoothly when animating your characters.



Video - using the Pass Through parameter with an animated character

video link

The above video shows the difference that Pass Through makes when recording a Clip on an Additive mode Track. With Pass Through enabled, the character will revert to their default pose (defined in the Base Track) whenever you move outside the recorded Clip on the Additive Track. With Pass Through disabled, you can move outside the recorded Clip and the character remains in their last pose, defined by the last keyframe recorded in the Clip. This makes it easier to continue moving your character into their next pose for the next keyframe you wish to record.



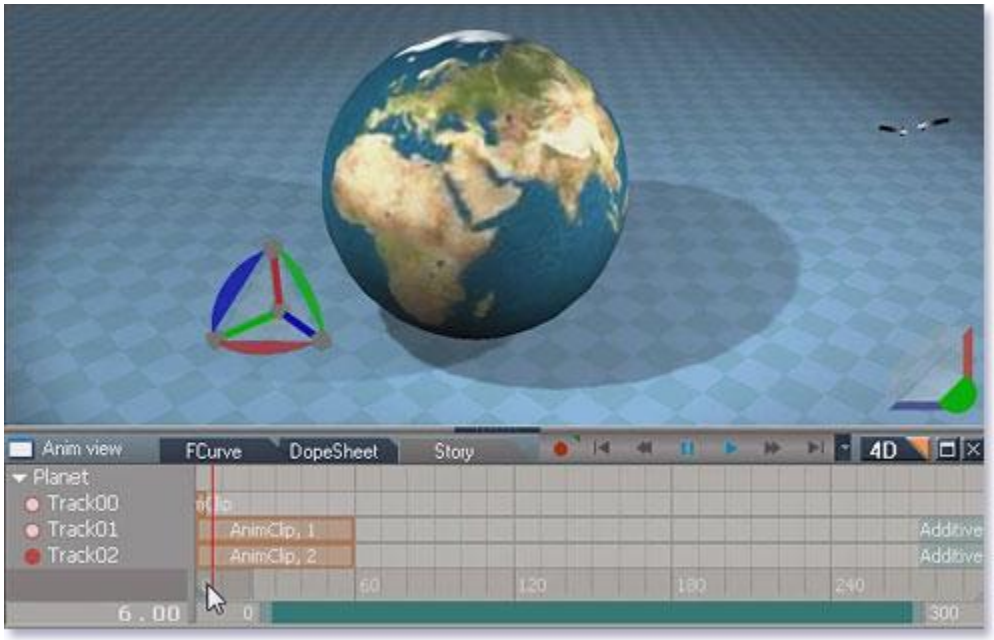
Video - using the Pass Through parameter with regular objects

video link

The Pass Through parameter works in a similar way for objects. When enabled, then outside of a Clip, the object will return to its default state as defined in the Base Track. This might be a default rotation, position, scaling, etc. With Pass Through disabled, the object will remain in the last keyframed state even when outside of the range of a Clip.

Note that Pass Through affects both recording and playback.

9.3.18 A Little More About Additive Mode



Video - exploring how Additive Mode works

video link

The above video shows you a little more about Additive mode Tracks. It is important to realize that Additive mode Tracks need to be self contained, and are independent of other Tracks. In the video, you can see how one Additive mode Track is recorded to capture some movement for the planet.

A second Additive mode Track is created, and keyframes are recorded for it but with nothing in the scene being edited. Since the planet is at two different locations when the record button is pressed for the start and end keyframes in this new Clip, you might expect it to contain the movement for the planet – however, it does not, as Additive mode only captures changes, and not the absolute position of the object.

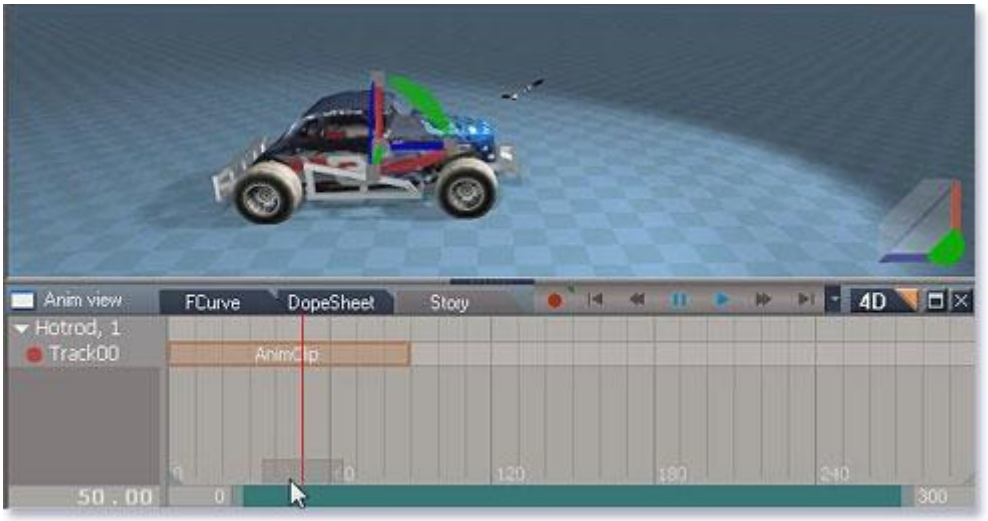
This is what allows you to record different motions independently from each other, and blend them together on playback. It is also why all start and end states for an object must be captured in a Clip on an Additive mode Track, even if there are keyframes on other Tracks at that point in time already.

9.3.19 Ensuring Nothing Happens Between Two Keyframes

Sometimes in an animation, you will want a period of time where "nothing happens" in the middle of some action, where an object stays still and doesn't move, before it starts taking some action again.

Begin by creating an object in your scene, and then recording a keyframe at frame 0. Now move the current frame to frame 30, and move the object and record a keyframe at this new position. Now move the current frame to frame 60, but this time do not move the object – leave it where it is, and simply record another new keyframe. This gives you a keyframe that is an identical snapshot to the first. Now to complete the scene, move the current frame to frame 90, move the object, and record a new keyframe.

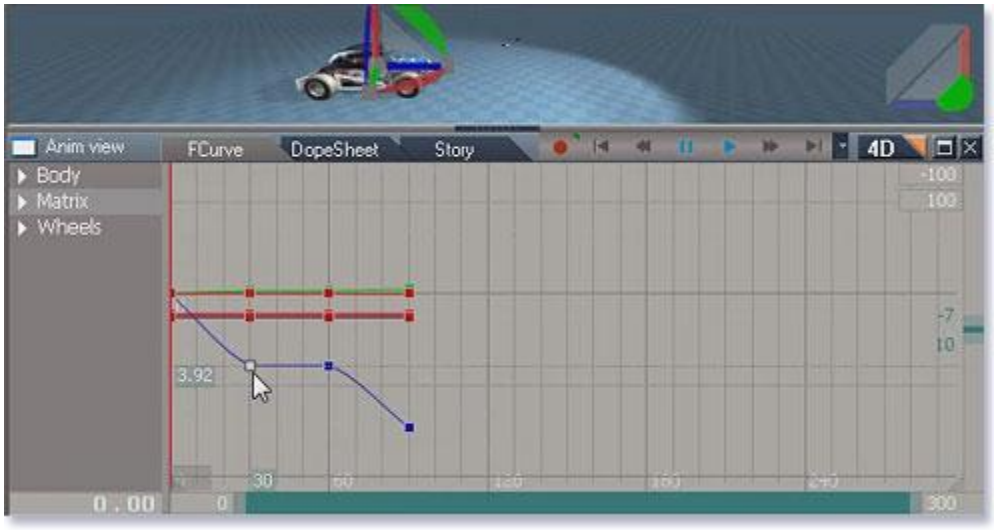
In this example, the effect we want to achieve is to have the object move from frames 0 to 30, then stay still from frames 30 to 60, and then move again from fames 60 to 90.



Video – using Interpolation to make an object remain static in the middle of an animated sequence

Scrub through your animation, and you will find that there is in fact some movement between frames 30 and 60 – the object moves backward even. The reason for this can be found in the F Curve editor – switch to it now, and display the curves for the object.

Remember that Bezier interpolation (and Custom Bezier interpolation) smoothes action at a keyframe, blending it so the action specified by the keyframe does not happen "instantly" but blends across time. This smoothing results in some movement for our object between frames 30 and 60, as the interpolation smoothes between the moving state in frames 0 to 30, and the static state in frames 30 to 60.

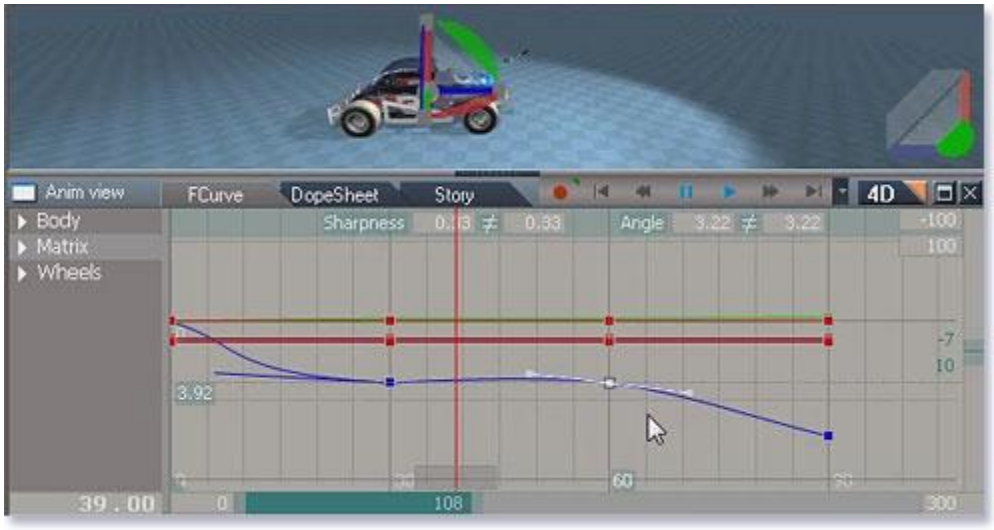


Video – using Interpolation to make an object remain static in the middle of an animated sequence

This is easily fixed however. In the F Curve editor, select the keyframed values you need to adjust (in this example, it is just the movement keyframes) at Frame 30 and then choose Linear interpolation. Remember that Linear Interpolation affects the animation after the keyframe, so you still get a curve leading up to frame 30 (allowing the object to slow down before coming to a stop). With Linear Interpolation, however, the values after the keyframe follow a straight line, giving the desired effect – the object stays completely stationary between keyframes 30 and 60.

If you want to use Custom Bezier to control the way the animation leads in to the keyframe at Frame 30, then you will need to set the Angle and Sharpness leaving that keyframe to 0 (actually setting either to 0 should work, but for clarity it is best to set both to 0) – note that for this to work, you will also need to set the keyframe on frame 60 to Custom Bezier, and set the incoming angle and sharpness for that keyframe to 0 as well.

Note that these principles apply whether this is animation recording in a Base track, or recorded in an Additive Mode track.



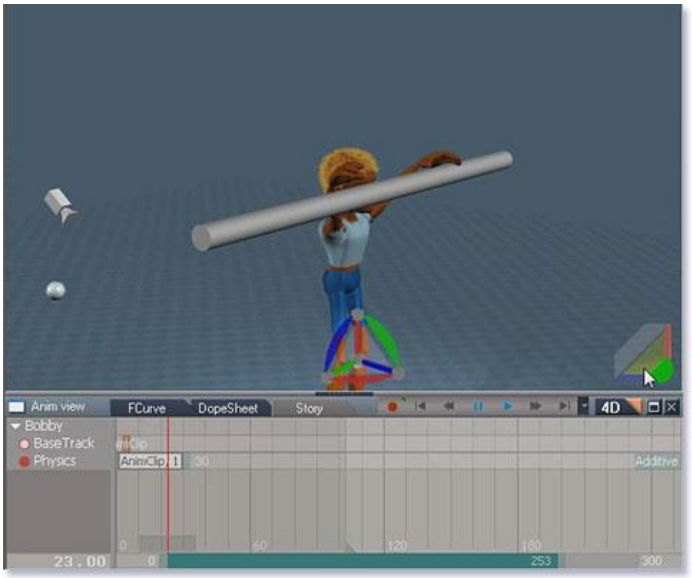
Video – using Interpolation to make an object remain static in the middle of an animated sequence

video link

You can view a video showing the process describe in this tutorial above.

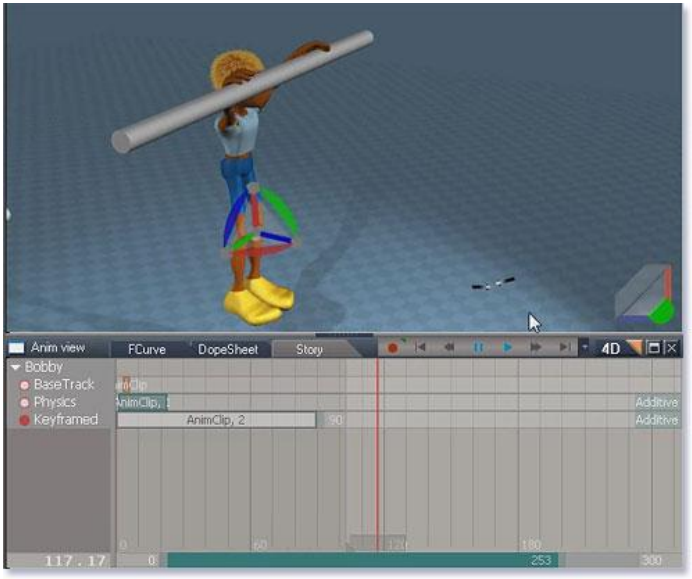
9.3.20 Putting it all Together

In this tutorial, you'll see how to bring together the ideas and techniques shown in the earlier tutorials to make a simple animation using a real-world workflow. The tutorial goes from start to finish, with a particular aim in mind – the character will start falling, then grab hold of a bar. The bar will give way a little, causing some alarm for our character, before giving way altogether, leaving him falling once more.



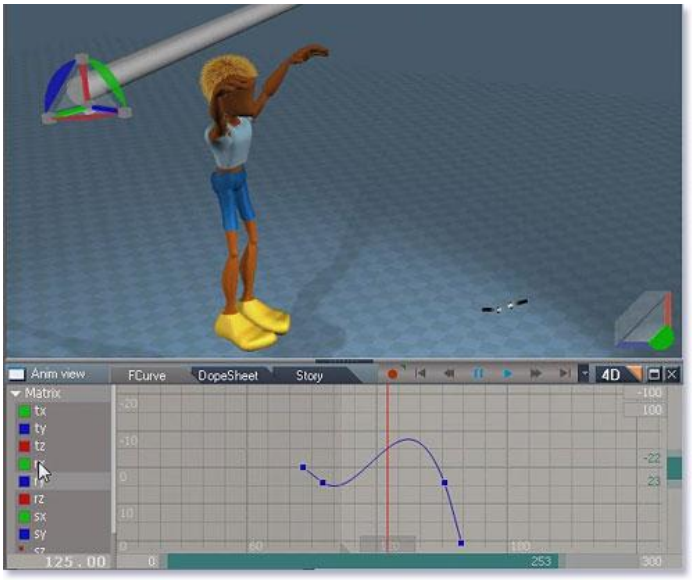
Video – setting out to make our animation and starting with physics

video link



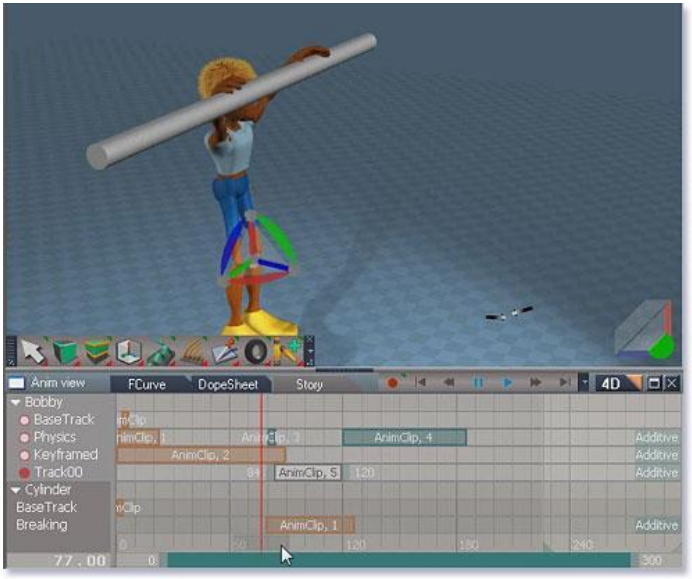
Video –adding some keyframing to the sequence from physics

video link



Video –animating the bar using physics and the F Curve editor

video link

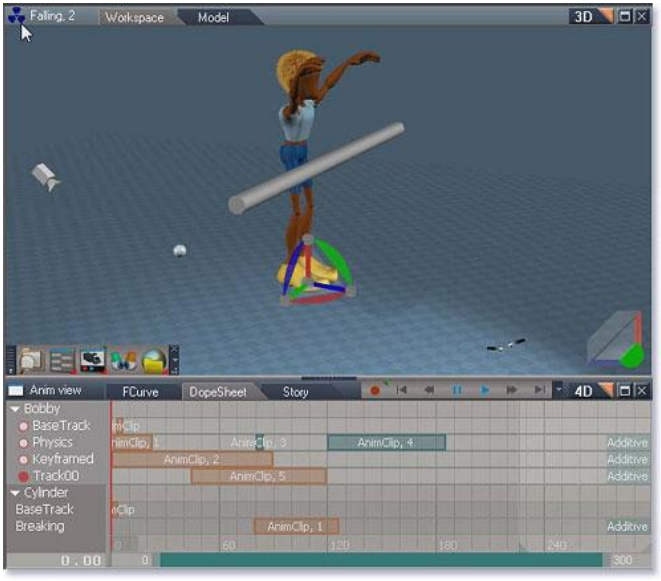


Video – more physics and more keyframing, to match the animated bar

video link

Video – some keyframing using IK Handles to breathe more life into the character

video link



Video – how to render your animation using the real-time renderer

video link

Video – the end result (with quick voice over!)

video link

9.4 Morphs

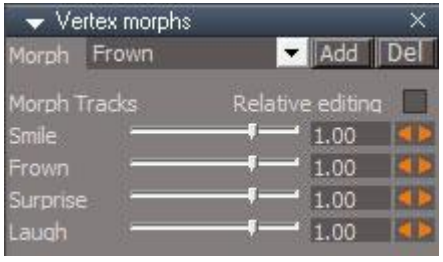
Morphs give you the ability to store and blend between different states of a model. These different states are created using the regular Point Editing tools - for example, you could use point editing to create a smile on a character, storing it as a morph. Then you create a new morph, point editing to make a frown. Then you can blend between those two expressions (and many more of course), either creating the perfect expression for your character in a still image, or recording your results in an animation.

9.4.1 The Morph Panel

To begin working with morphs, you will need to create the first morph for an object. To do this, click on the Add Morph icon in the character editor tools, and this will open the morph panel, create a new morph for the object, and take you into edit mode on that morph.

Once you have at least one morph added to an object, then the morph panel will open automatically when you click on that object, without the need to click on the Add Morph icon again.

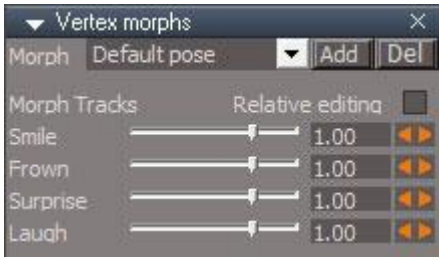
Note that left clicking on the Add Morph icon not only opens the morph panel, but always adds a new morph and takes you into Point Edit mode to define the morph. You can always right click the Add Morph icon to open the morph panel without adding a new morph.



Morph Panel in "edit" mode, as an individual morph is selected

In effect, the morphs panel has two modes. When an individual morph is selected, as seen on the left, then it is in "edit" mode. This lets you work with Point Edit tools to define the shape associated with that one particular morph.

While the sliders for all morphs are still visible when editing a particular morph, they have no effect.



Morph Panel in "pose" mode, when Default Pose is selected.

When Default Pose is selected, then you are in "pose" mode, which lets you mix and blend between all the different morphs for that object.

In this mode, the strength of each morph is controlled by the sliders on the panel. You can move and change any slider, to mix how much of an effect it has on the current pose. This is true even if different sliders affect the same area of the model. For example if two or more morphs affected the mouth, you can still move each slider – trueSpace will work out how to blend those two morphs together.

When you have clicked on Add Morph to make your first morph, you are taken to the "edit" mode for that new morph, and Point Edit is automatically enabled. You can now use the Point Editing tools to manipulate your model. Any changes you make are not being made to the underlying base mesh, and instead are defining the "morphed" state of the model – however, you cannot use tools which add or delete geometry, e.g. adding vertices, edges, faces or loops; quad divide or smooth divide; triangulation; poly draw; etc. Changes from adding or deleting geometry cannot be stored as morphs, and will affect the underlying model - (however any existing morphs will continue to work as well as is possible with the new geometry.

For example, if you were to edit the vertices around the mouth to make a smile, then your underlying model still has the same expression as before. The new state that you have created by editing the mouth is only stored under this new morph. This means your edits are non-destructive to the underlying model, except for those Point Edit operations that cannot be stored as morphs, i.e. those that add or delete geometry.

- **Add** – This creates a new morph, with a default name, and takes you into Edit mode for that new morph. Any edits you make are automatically stored as part of the morph (there is no option to edit and then "save" your changes to the morph).

  To rename a morph, you need to type over its name in the drop down selection box. As soon as you click on another field, the new name will be displayed in the morph track list.

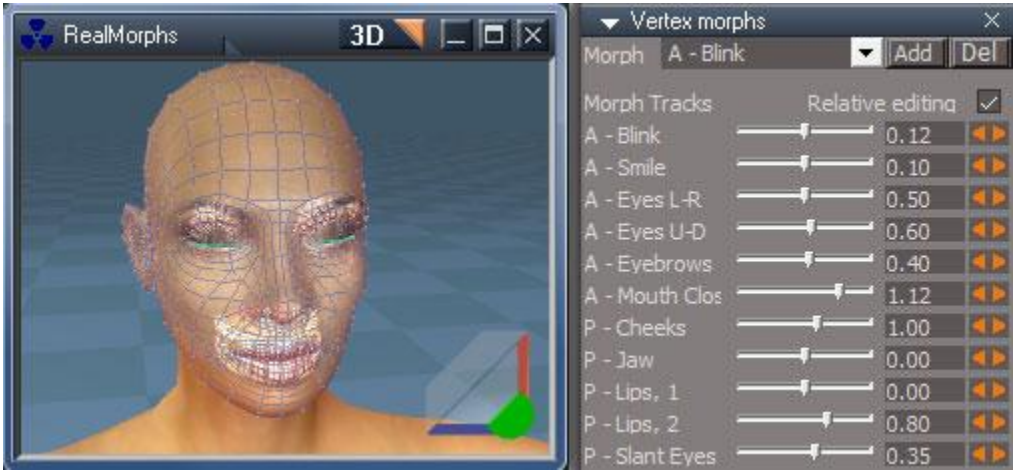
- **Delete** – To delete a morph, first select it from the drop down list, and then click on the "Del" button. *Deleting a morph cannot be undone, so be sure you want to delete it!* On deleting the morph, you will be returned to the Playback mode of the morph panel with the Default Pose selected.

- **Relative Editing** – With Relative Editing unchecked, the effects of other morphs will be hidden when you edit a morph. With Relative Editing checked, the current state of other morphs as set in the Default Pose will remain visible while you edit a morph. You must check or uncheck this before editing a morph, i.e. when Default Pose is selected - you cannot change its state once you are editing an existing morph.

Editing An Existing Morph

You can edit an existing morph by selecting its name from the drop down list. This puts you into Edit mode and any changes you make will automatically update the morph. Remember that Relative Editing can only be checked or unchecked before entering edit mode.

Note that there are no Point Edit selections stored with a morph. For example, if a morph moved the mouth to make it into a smile, reselecting the morph for editing later will not reselect the vertices for the mouth.



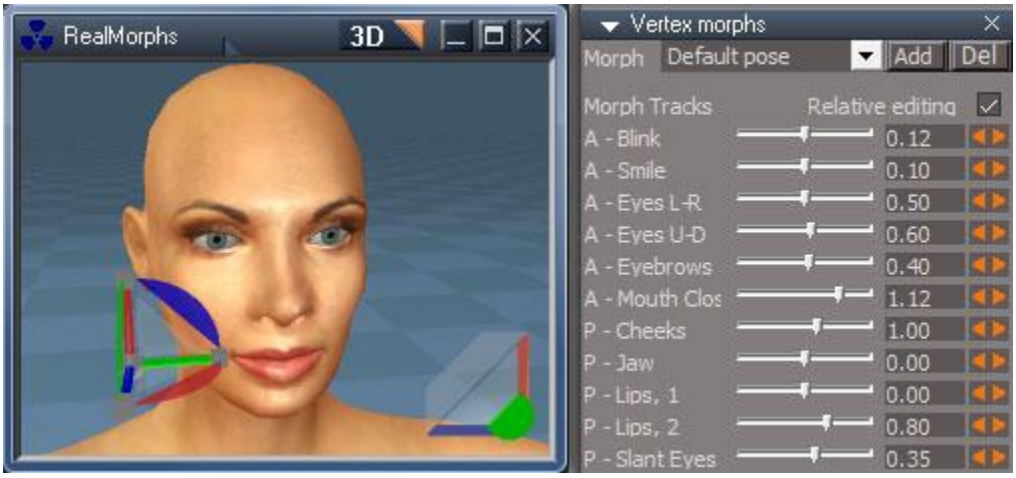
A morph panel for the trueSpace avatar, editing the Blink morph, with the faces for the bottom of the eyelids selected for editing.

Playing Back Morphs

Once you have created one or more morphs, you can play these back using the Default Pose option from the drop down list. Now you can use the sliders to control the amount of influence each morph has on the object.

A value of 0 means the morph has no influence (the object will appear in its original state). 1 means that the morph has full effect, taking exactly the form set when you edited the morph. Values between 0 and 1 will show increasing effects of the edits you made, while values of greater than 1 will exaggerate those edits.

Values of less than 0 will reverse the effects of the edit (surfaces “pulled out” will instead become “pressed in”, etc) – this lets you quickly create opposite poses from just one morph, for example expanding the chest for breathing out will let you create a breathing-in motion that shrinks the chest by using the same morph with a negative value.



The morph panel in "pose" mode, used to set a starting neutral expression.

The morph panel in "pose" mode, with some edits to the sliders to make the character begin a smile. Note that extreme values or changes are not required when working with facial expressions.

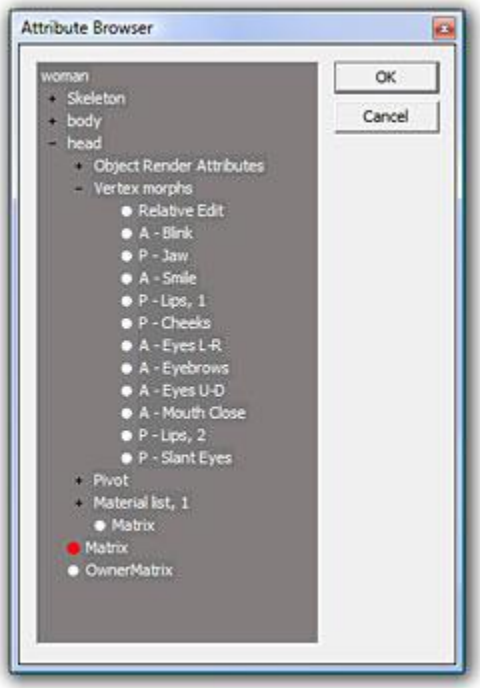
Morphs, Subdivision Surfaces, And Adding New Geometry

You can apply Subdivision Surfaces (SDS) to a mesh that has morphs applied. The morphs will continue to work on the control cage, and so will deform the smoothed SDS object.

While not always recommended, and results may be uncertain, you can also edit a model to add or delete geometry even if the model has existing morphs. Remember that Point Edit operations that add or delete geometry apply to the base mesh and affect all morphs and cannot be stored under an individual morph. After adding or deleting geometry, the morphs will continue to function, and trueSpace will work out how new geometry is affected by the morphs, e.g. if you draw new edges across a face that was moved in a morph, then that morph will move that new edge along

with the original face. It is not guaranteed that results will always be as expected though, particularly for major changes to geometry, and recommended workflow is to complete all geometry edits before starting to create morphs.

Recording Morphs



Making animations with morphs is easy. The first step is to enable key-framing for them so that they will be recorded. Right click on the record icon in the Animation Editor to open the keying panel, then right click and choose Browse Attributes.

In the Attribute Browser, you can then enable or disable recording for each individual morph, under the Vertex Morphs section for the object.

For more information on the Attribute Browser and Keying Panel on page 9.

Once enable, simply move to a keyframe location, adjust the morphs to obtain the desired result, and press record to capture that pose. Then move to the next keyframe location, adjust the morph sliders, and press record again. trueSpace will then blend the pose between those two keyframes, making it easy to have your character go from a smile to a frown, and much more!