

Job No: 13**Duration:** 16H**Job Title:** Create Basic Animation**Objective:**

To understand the basic concepts behind animation are derived from the traditional “cartoon” animation techniques where a master animation sketches objects at key points in time and then passes those sketches to the junior animators whose job is to draw all the “in-between” positions that transition from one pose to the next.

Students should be able to understand the usage of the following:

- Basic Animation concept
- Use Auto Key mode
- Use Set Key mode
- Path Constraint
- Track View

Introduction:

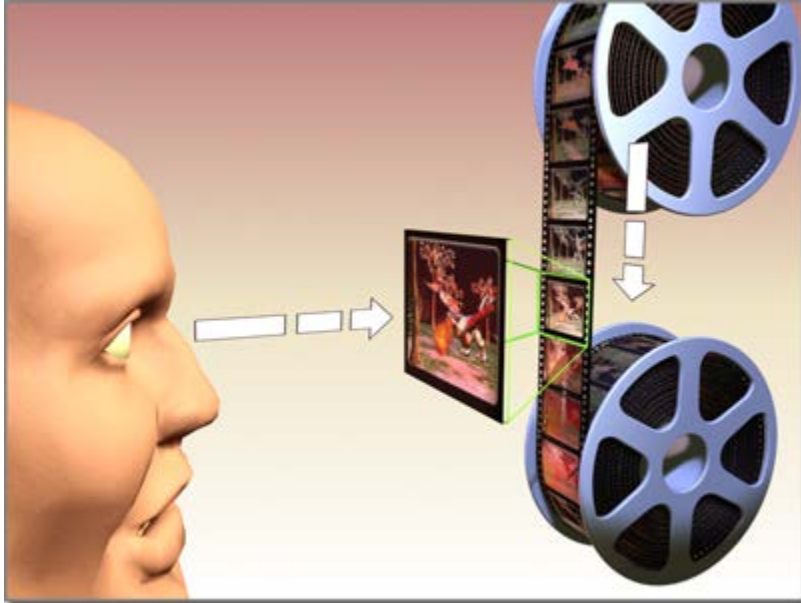
With 3ds Max, you can create 3D computer animation for a variety of applications. You can animate characters and vehicles for computer games and produce special effects for film and broadcast. Additional applications include medical illustration and forensic presentation in the courtroom.

The basic method for creating animation in 3ds Max is quite simple. First you turn on the [Auto Key](#) button, then you move the time slider, and last you transform an object to change its position, rotation, or scale over time.

You can employ animation throughout 3ds Max. You can animate the position, rotation, and scale of an object, and almost any parameter setting that affects an object's shape and surface. You can link objects for hierarchical animation, using both forward and inverse kinematics, and you can edit your animation in [Track View](#).

Animation Concept:

Animation is based on a principle of human sight called *persistence of vision*. If you view a series of related still images in quick succession, you perceive them as continuous motion. Each individual image is referred to as a *frame*, and the illusion of motion comes from the fact that your visual system retains each frame for a short time after you see it.



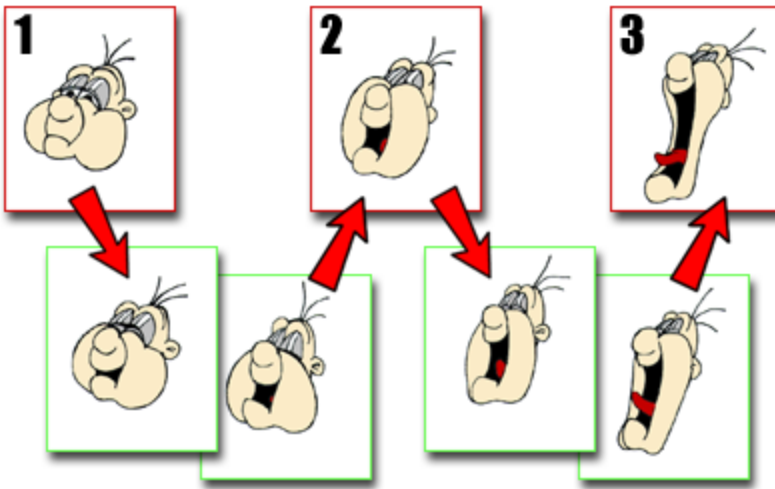
A frame is a single image in an animated film.

Traditional Animation Method:

Historically, the main difficulty in creating animation has been the effort required of the animator to produce a large number of frames. One minute of animation might require between 720 and 1800 separate images, depending on the quality of the animation. Creating images by hand is a big job. That's where the technique of *keyframing* comes in.

Most of the frames in an animation are routine, incremental changes from the previous frame directed toward some goal. Traditional animation studios realized they could increase the productivity of their master artists by having them draw only the important frames, called *keyframes*. Assistants could then figure out what belonged on the frames in between the keyframes. The in-between frames were called *tweens*.

Once all of the keyframes and tweens were drawn, the images had to be inked or rendered to produce the final images. Even today, production of a traditional animation usually requires hundreds of artists to generate the thousands of images needed.



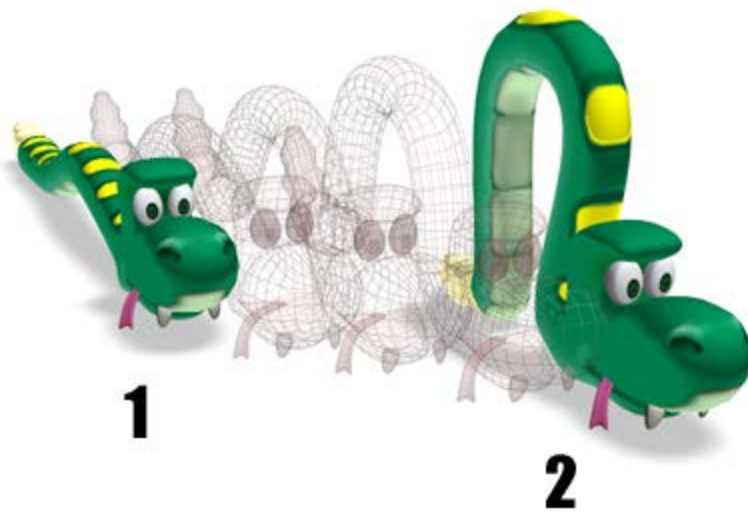
The frames marked 1, 2 and 3 are key frames. The other frames are tweens.

3D Max Animation Method:

This program is your animation assistant. As the master animator, you create the keyframes that record the beginning and end of each animated sequence. The values at these keyframes are called *keys*. 3ds Max calculates the interpolated values between each pair of keys to produce the completed animation.

3ds Max can animate just about any parameter in your scene. You can animate modifier parameters, such as a Bend angle or a Taper amount, material parameters, such as the color or transparency of an object, and much more.

Once you have specified your animation parameters, the renderer takes over the job of shading and rendering each frame. The result is a high-quality animation.

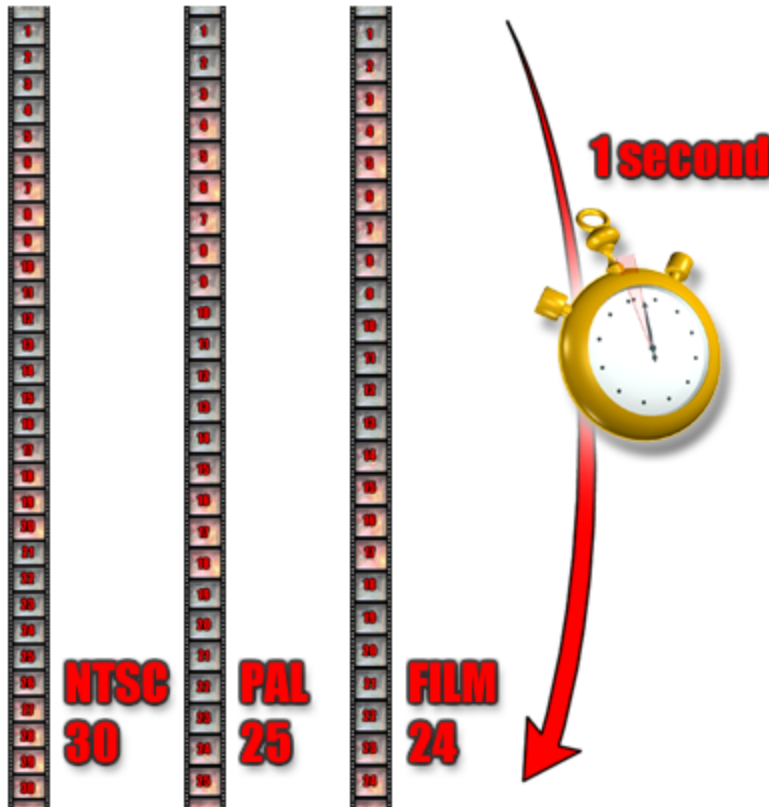


The object's position at 1 and 2 are the keyframed models at different times. The computer generates the in-between frames.

Comparing Frames and Time:

Traditional animation methods, and early computer animation programs, are rigidly locked to the concept of producing animation frame by frame. This is okay if you always work in a single format or do not need to specify an animated effect at a precise time.

Unfortunately, animation comes in many formats. Two of the more common formats are film at 24 frames per second (FPS) and [NTSC video](#) at 30 FPS. Also, the need for accurate time-based animation versus frame-based animation is critical as animation becomes more common for scientific and legal presentation.



Different animation formats have differing frame rates.

3ds Max is a time-based animation program. It measures time, and stores your animation values, with an internal precision of 1/4800 of a second. You can configure 3ds Max to display time in a format best suited for your work, including traditional frames format. See [Time Configuration](#) .

Using Auto Key Mode:

To start creating animation, first turn on the Auto Key button, use the [time slider](#) to go to a particular frame, and then change something in your scene. You can animate the position, rotation, and scale of an object, and almost all other settings and parameters.

When you make a change, 3ds Max creates a key storing the new value for the changed parameter at the current time. If that key is the first animation key created for the parameter, a second animation key is also created at the [Auto Key default frame](#) to hold the parameter's original value.


Keys are not created at the default frame until you create at least one key at a subsequent frame. After that, you can move, delete, and re-create keys at the default frame.

Turning on Auto Key has the following effects:

- The Auto Key button, the time slider, and the border of the active viewport turn red to indicate you are in animation mode.
- When you transform an object or change an animatable parameter, 3ds Max creates keys at the current frame, as indicated by the time slider position.

To see an example of using Auto Key to create animation, play the following video:
>Using Auto key mode

To begin animating an object:

1. Click  (Auto Key) to turn it on.
2. Drag the time slider to a different time.
3. Do one of the following:
 - Transform an object.
 - Change an animatable parameter.

For example, if you have a cylinder that has not been animated yet, it has no keys. If you turn on Auto Key, and at frame 20 you rotate the cylinder 90 degrees about its Y axis, rotation keys are created at frames 0 and 20. The key at frame 0 stores the original orientation of the cylinder, while the key at frame 20 stores the animated orientation of 90 degrees. When you play the animation, the cylinder rotates 90 degrees about its Y axis over 21 frames.


Using the Set key




The Set Key animation method is for the professional character animator who wants to be able to try out poses and then commit those poses to keyframes intentionally. Animators can also use it to set keys on specific tracks of objects.


The Set Key method allows more control than the Auto Key method, because it gives you the chance to try out ideas and discard them quickly without having to undo work. It lets you transform objects and selectively key certain tracks on certain objects through the use of Key Filters and Keyable tracks in Track View.

To use Set Key animation:


1. Click  to turn it on.

 The button turns red to show you are now in Set Key mode. In this mode, you can try out ideas before you commit to them.

2. Open Track View (either Curve Editor or Dope Sheet).

3. On the Track View toolbar, click  (Show Keyable).

4. Turn off all the tracks you don't want to keyframe.

 The red key means the track will be keyed. If you click the red key, it turns to a gray key, which means that track will not be keyed.

Tip You can toggle multiple tracks as keyable by using the Edit menu > Controller submenu > Keyable command.

When you are finished, minimize or close Track View.


5. Click  and use the Set Key Filters dialog to enable the tracks you want keyframed.


Position, Rotation, and Scale are on by default. So is IK Parameters.

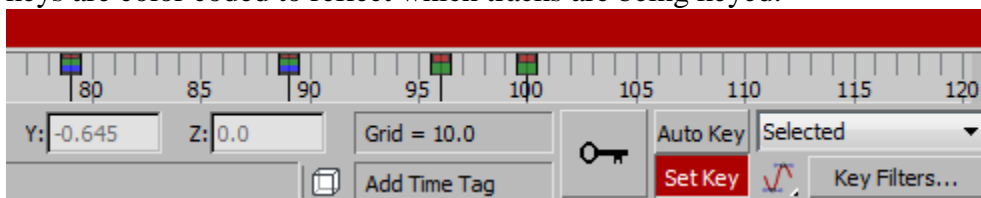
You can use Key Filters to work on individual tracks selectively. For example, if you are in Track View and the Rotation and Position tracks of a character's arm are keyable, you can use the key filters to turn off the Position filter and only work on the Rotation tracks.

6. Move the time slider to another point in time, transform your objects or adjust parameters in the command panels to create animation.

This does not yet create keyframes.

7. Click  (Set Keys) or press K on the keyboard to set a key.



 When the Set Keys button turns red, it sets a key which appears on the time ruler. The keys are color coded to reflect which tracks are being keyed.



If you don't click Set Keys and you move to another point in time, the pose is lost.

Tip To move the pose to another point in time, hold down the right mouse button while dragging the time slider.




To animate a vertex using Set Key:

1. Create an editable spline.
2.  Select a vertex.
3. Turn on .
4. Move the selected vertex.

5. Click  (Set Keys).

Now a controller has been assigned to the vertex. From this point forward, you can animate.

To set a key on every keyable track of an object:

1.  Select the object for which you need to set keys.
2. Turn on .
3. On the Key Filters dialog, click All.
4. Click  (Set Keys) or press K on the keyboard.

Differences between Set Key and Auto Key modes:

Set Key mode differs from Auto Key in a number of ways.

Auto Key In Auto Key mode, the workflow is to turn on Auto Key, move to a point in time, then transform objects or change their parameters. All changes register as keyframes. When you turn off Auto Key mode, you no longer are creating keys. Changes made to objects when Auto Key mode is off are applied globally to the animation. This is referred to as *Layout mode*.

Set Key In Set Key mode, the workflow is similar, but the behavior is fundamentally different. Turn on Set Key mode, then move to a point in time. Before you transform or change object parameters, you determine the tracks you want to set keys on using Keyable icons in Track View and Filters. Once you know what you plan to key, you try out poses in the viewport (transform the objects, change parameters, and so forth).



When you like what you see, click the large Set Keys button or press K on the keyboard to set a key. If you don't do this, no keys are set.

If you move to another point in time, your changes are lost and have no effect on your animation. For example, if you find that you have a posed character, but *at the wrong frame* in time, you can hold down Shift and the right-mouse button and drag the time slider to the correct frame without losing your pose.

Path Constraint:

Assign Controller (object Position track) > Path Constraint
Standard menu: Animation menu > Position Controllers > Path Constraint

Use the Path constraint to restrict an object's movement along a spline or at an averaged distance among multiple splines.





Path constraint positions the service platform along the side of the bridge.

A *path target* can be any type of spline. The spline curve (target) defines a path of motion for the constrained object. Targets can be animated using any of the standard translation, rotation, scale tools. Setting keys at a sub-object level of the path, such as vertex or segment, animates the path while affecting the constrained object.




Procedure:**To assign a Path constraint:**

1. Create a Sphere with a radius of **10** and a Circle with a radius of **60**.
2. With the Sphere selected, choose Animation menu ► Constraints ► Path Constraint.
You are now in select target mode, as indicated by the rubber-band line attached to the mouse cursor.
3. In the viewport, click the Circle shape.



To access the Path constraint's parameters through the Motion panel:

1.  Select the Sphere.
2. Open the  Motion panel.
3. In the PRS Parameters rollout, click the Position button.
The Path constraint's settings are located in the Path Parameters rollout.



Example: To assign a Path constraint through the Motion panel:

1. Create a Sphere with a radius of **10** and a Circle with a radius of **60**.
2.  Select the Sphere.
3. Go to  the Motion panel and click Parameters.
4. Open the Assign Controller rollout and select the Position controller.
5. Click  (Assign Controller).
6. Choose Path Constraint from the Assign Position Controller dialog.
7. On the Motion panel, click Parameters.
8. In the Path Parameters rollout, click Add Path.
9. In the viewport, click the Circle.







To edit weight values:

1. On the  Create panel, click  (Shapes), and create a Line that is about **120** units long.

Tip Use the diameter of the Circle to gauge the length of the Line.


2.  Select the Sphere.
3. On the  Motion panel, open the Path Parameters rollout.
4. Click the Add Path button, then click the line.
The Sphere is now affected equally by both paths since the path weighting defaults to 50
5. Adjust the Weight spinner or enter a numerical value for the weight value.

Example continued: To animate weight values:

1.  Select the Sphere.
2. On the  Motion panel, open the Path Parameters rollout.
3. Turn on  (Auto Key).
4. Select Line01 from the Path list.
5. Drag the time slider to frame 50 and change the Weight of Line01 to **75**.
6. Drag the time slider at frame 100 and change the Weight of Line01 to **10**.
7.  Select the *Circle01* path and change its Weighting to **25**.
8. Turn off  (Auto Key) and  play the animation.


To correct path constrained object flipping:

When an object is assigned a path constraint and the follow box is turned on, the object will rotate as it moves along the path. Sometimes the object is subject to unwanted flipping.

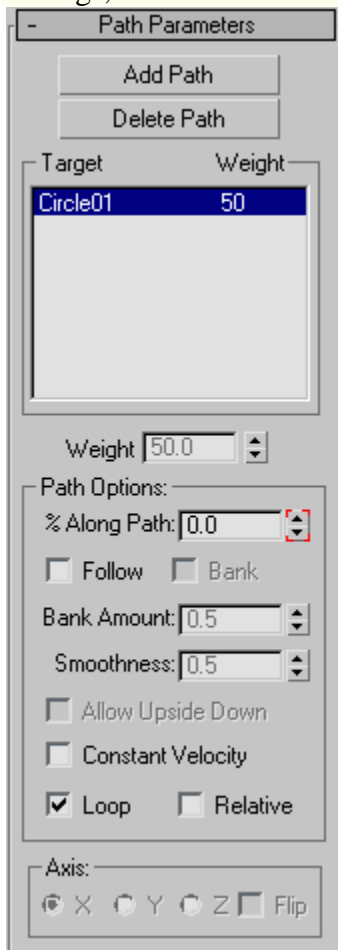
1.  Select the object that is flipping.
2. On the Animation menu choose Constraints ➤ Orientation constraint, then constrain the object to another object's orientation.

3. Use the control object to adjust the flipping. Animate the orientation of the control object, while watching the flipped object at the problematic frames.

Interface Path Parameters rollout:

Once you assign a Path constraint, you can access its properties on the  Motion panel > Path Parameters rollout. On this rollout you can add or delete targets, assign weighting, and animate each target's weight value.

Note: When you assign a Path constraint via the Animation menu, 3ds Max assigns a Position List controller to your object. In the Position List rollout list you will find Path Constraint. This is the actual path constraint controller. To view the Path Parameters rollout with the constraint settings, double-click Path Constraint in the list.



Add Path

Adds a new spline path that influences the constrained object.

Delete path

Removes a path from the target list. Once removing the path target, it will no longer influence the constrained object

[path list]

Shows the paths and their weights.

Weight

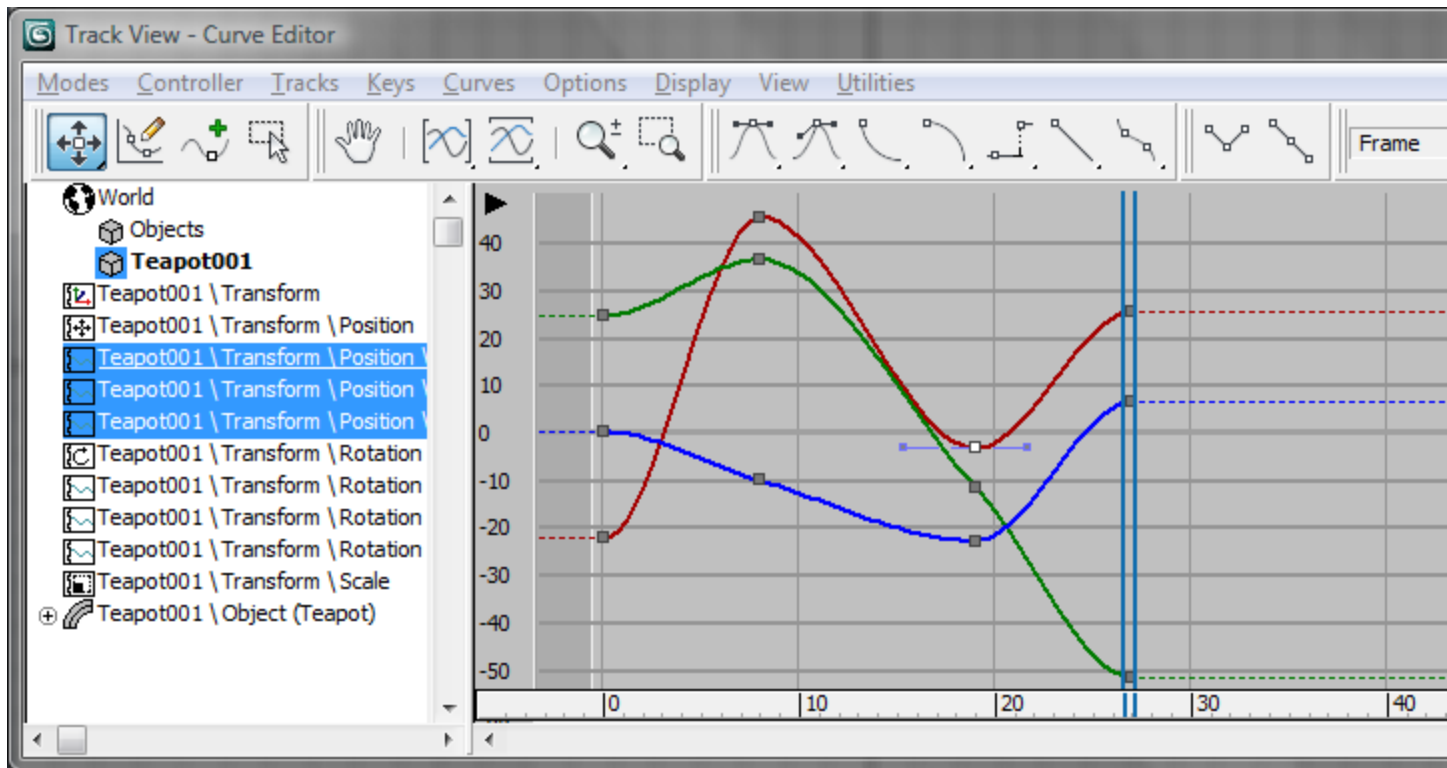
Assigns and animates weight values for each target.

Track View:

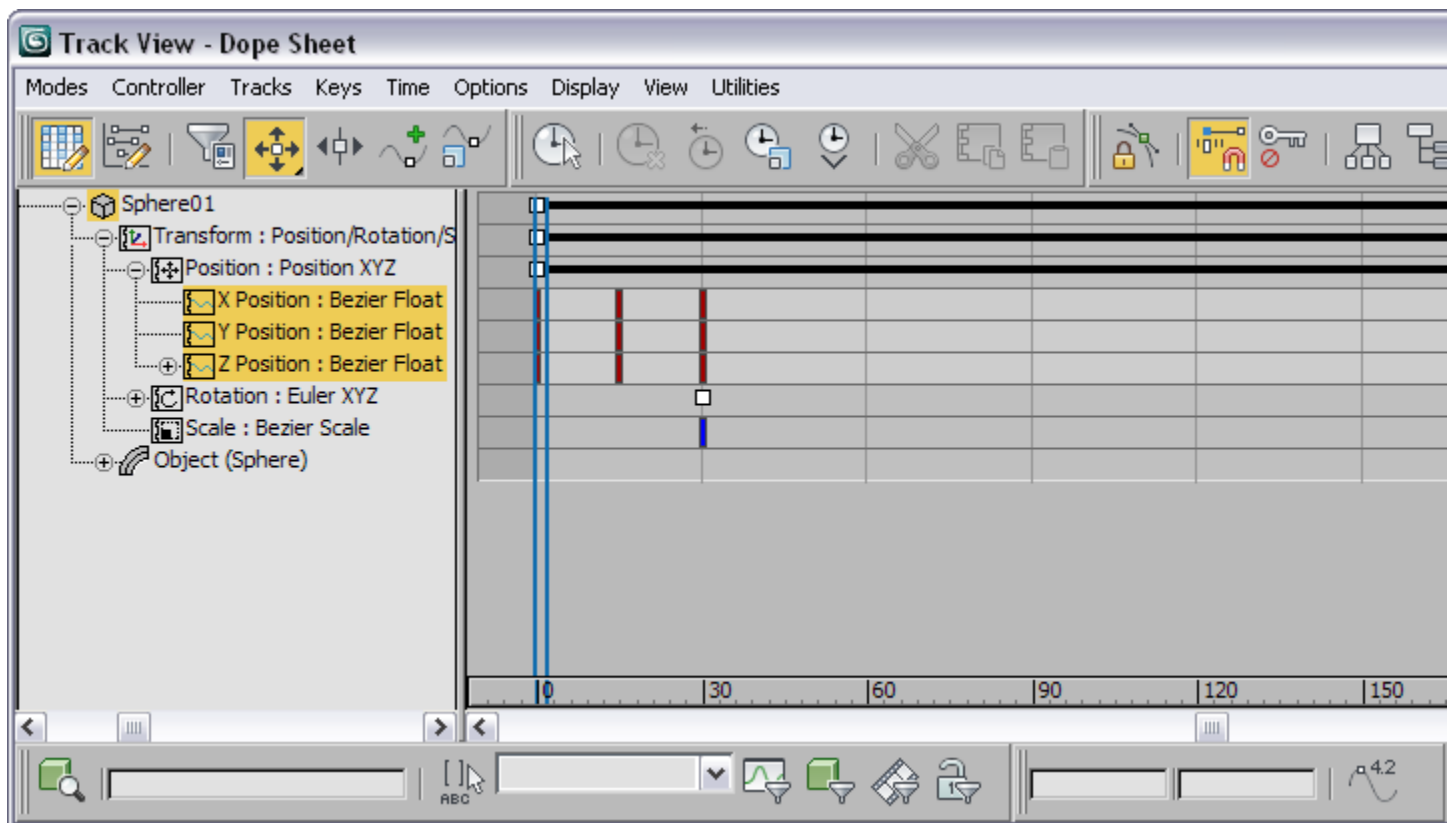


Track View provides two different graph-based editors for viewing and modifying animation data in your scene. You can also use it to assign animation controllers to interpolate or control all the keys and parameters for the objects in your scene.

Track View uses two different modes: Curve Editor and Dope Sheet. Curve Editor mode displays animation as function curves, while Dope Sheet animation appears as a spreadsheet of keys and ranges. Keys are color-coded for easy identification. Some Track View functions, such as moving and deleting keys, are also available on the track bar near the time slider, which can be expanded to show curves as well. The Curve Editor and Dope Sheet open by default as floating windows, but you can also dock them under the viewports at the bottom of the interface, or even open them in a viewport. You can name Track View layouts and store them in a buffer for later reuse. Track View layouts are stored with the MAX scene file.



Track View — Curve Editor



Track View — Dope Sheet (Edit Keys)

Track View can perform a variety of scene management and animation control tasks. Use Track View to:

- Display a list of objects in your scene and their parameters.
- Change key values.
- Change key timing.
- Change controller ranges (see procedure).
- Change interpolation between keys.
- Edit ranges of multiple keys.
- Edit blocks of time.
- Add sound to your scene.
- Create and manage notes about the scene.
- Change the behavior of the animation outside the range of keys.
- Change controllers for animated parameters
- Select objects, vertices, and hierarchies.
- Navigate the modifier stack in the Modify panel by clicking the modifier items in the Track View Hierarchy.