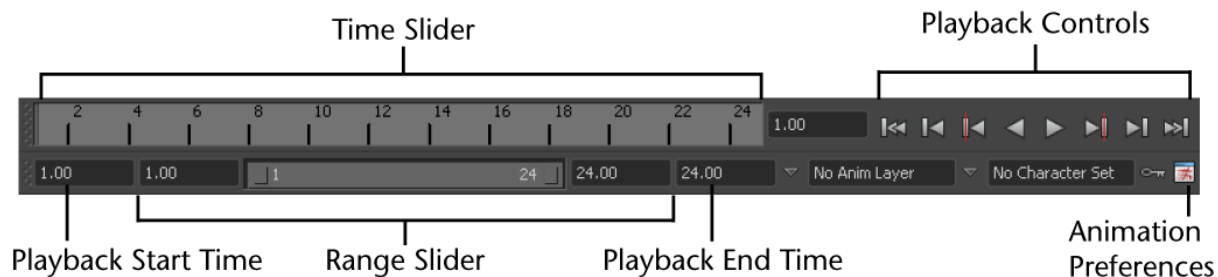


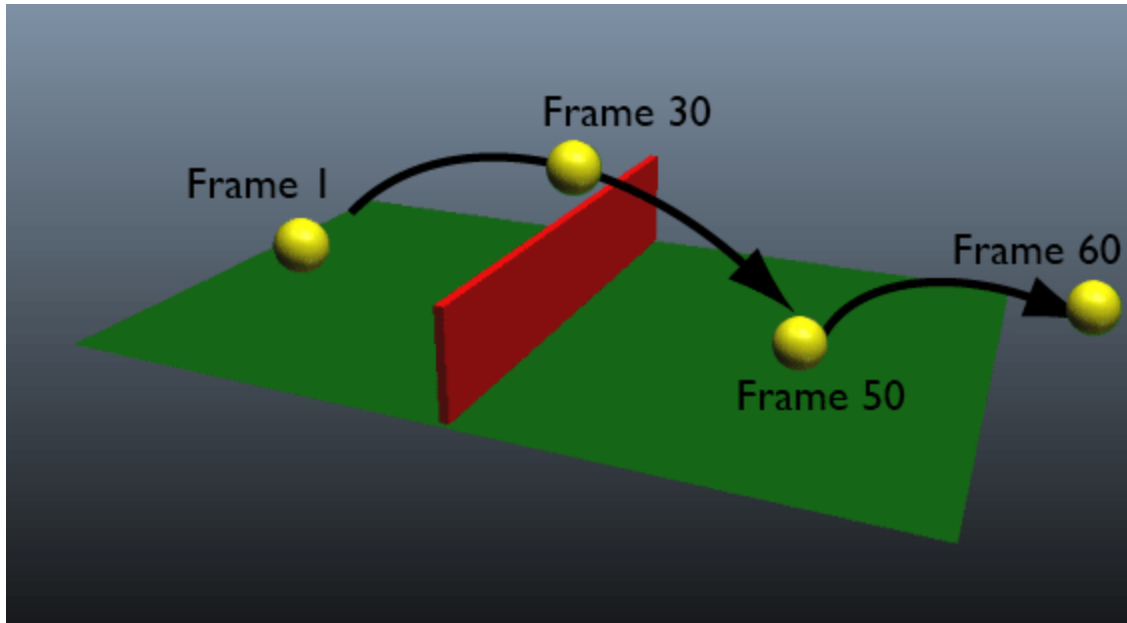
Maya 2014 - Basic Animation & The Graph Editor

- When you set a **Keyframe (or Key)**, you assign a value to an object's attribute (for example, translate, rotate, scale, color) at a specific time. Most animation systems use the frame as the basic unit of measurement because each frame is played back in rapid succession to provide the illusion of motion.
- The **Frame Rate (Frames Per Second, or FPS)** that is used to play back an animation is based on the medium that the animation will be played back (for example, film, TV, video game, and so on.) When you set several keys at different times with different values, Maya generates the attribute values between those times as the scene plays back each frame. The result is the movement or change over time of those objects and attributes.



Animation UI Elements

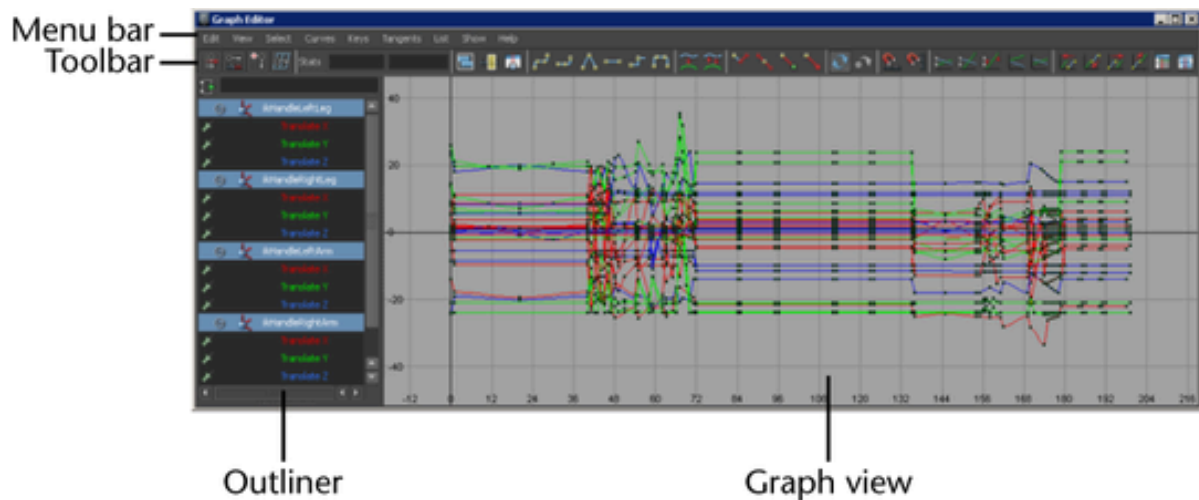
- **Time Slider:** displays the playback range and keys you've set for a selected object.
 - Keys are displayed as **red lines**.
 - The box at the right of the Time Slider lets you set the current frame (time) of the animation.
- **Playback Controls:** control animation playback.
 - Go to Start of Playback Range, Step Back One Frame, Step Back One Key, Play Backwards, Play Forwards, Step Forward One Key, Step Forward One Frame, Go to End of Playback Range
- **Animation Preferences Button:** displays a window for setting animation preference settings such as the playback speed.
- **Auto Key Button:** Enable/Disable **Auto Key**, automatically creating new keyframes each time an attribute that already has at least one keyframe is adjusted.
- **Range Slider:** controls the range of frames that play when you click the play button.
 - A frame rate of 24 frames per second (fps) is the frame rate used for motion picture film. For video, the frame rate can be 30 fps (NTSC) or 25 fps (PAL) depending on the format being used.



Setting Keyframes:

- With your object selected:
- **S: Animate > Set Key**
 - Keyframe all transform attributes for selected object.
- For example, to animate a ball bouncing over a fence:
 - **Select the ball** and **Set a keyframe** at **Frame 1** for the initial ball position
 - **Move** the ball up along the **Y axis** and **Forward** along the **X Axis** and **set another keyframe** at **Frame 30**
 - **Move** the ball again along the **X and Y axes** and **set keyframes** for **Frame 50** and **Frame 60** to simulate a parabolic bouncing motion.
 - Notice that the last two keyframes and X+Y coordinates are closer together, reflecting how the ball decelerates along with gravity and friction.
 - Don't worry about the ball movement not looking right; we will go over adjusting the ball's motion path later.
- When previewing your animation, you may notice that it runs through all of your frames very fast. To adjust how your animation is played back in Maya:
 - **Animation Preferences Button > Time Slider Tab > Playback Speed**
 - **Play Every Frame**
 - **Real-time(24 fps)**
 - **Half (12 fps)**
 - **Twice (48 fps)**
 - **Other (custom speed, such as 25, 30 or 60fps)**

- To preview your animation in an external video file (called a **Playblast**):
 - **Window > Playblast (options box)**, or
 - Right Click Time Slider > Playblast:**
 - **Format: Quicktime Movie or Image Sequence**
 - **Encoding:** File format
 - **Quality:** 0-100
 - **Display Size, Scale, Frame Padding**
 - **Save to File: Click Browse** to save to your computer
 - **Click Apply or Playblast** and your animation preview should pop up!



The Graph Editor Interface

- Maya automatically interpolates the motion between keyframes, creating what's known as an **Animation Curve**.
- These curves are displayed visually with the **Graph Editor**, accessible under **Window > Animation Editors > Graph Editor** or by selecting the **Persp/Graph** layout from the **Side Toolbar**.
- With the ball we created before selected, we can see all of the keyframes we set earlier displayed in a list on the left and graphically on the right.
- All of the basic **Transform Attributes (Translate, Rotate, Scale, Visibility)** show up on the left **Outliner** since we used **Keyframe All**, but only the attributes with keyframes will show up in the left.
- **Shift+Select** specific attributes to display only the important ones in the Graph Editor
- **F: View > Frame > Frame Selection (in the Graph Editor Menu Bar):** Frame the selected attributes of the currently selected object in the Graph Editor.
- **A: View > Frame > Frame All (in the Graph Editor Menu Bar):** Frame all attributes of the currently selected object in the Graph Editor.

- As with the Move/Rotate/Scale tools, the Animation Curve associated with a given axis is color-coded for ease of use: **X is Red, Y is Green and Z is Blue**

Editing, Moving, Copying and Pasting Keys

- With one or more keys selected:

- Adjust either the **Time** or **Value** of the key manually using the number fields in the top bar of the Graph Editor

- You can also switch to the **Move Tool (W) & Drag Vertically** to adjust the value and **Drag Horizontally** to adjust the time.

- Under the **Edit Menu** in the Graph Editor:

- **Cut:** Cut the selected key(s)

- **Copy:** Copy the selected key(s)

- **Delete:** Delete the selected key(s)

- **Paste:** Paste the selected key(s)

- **Paste Options:**

- **Copies:** Increase to paste multiple copies

- **Paste Method:**

- **Insert:** Insert the copied key(s) into the currently selected curve

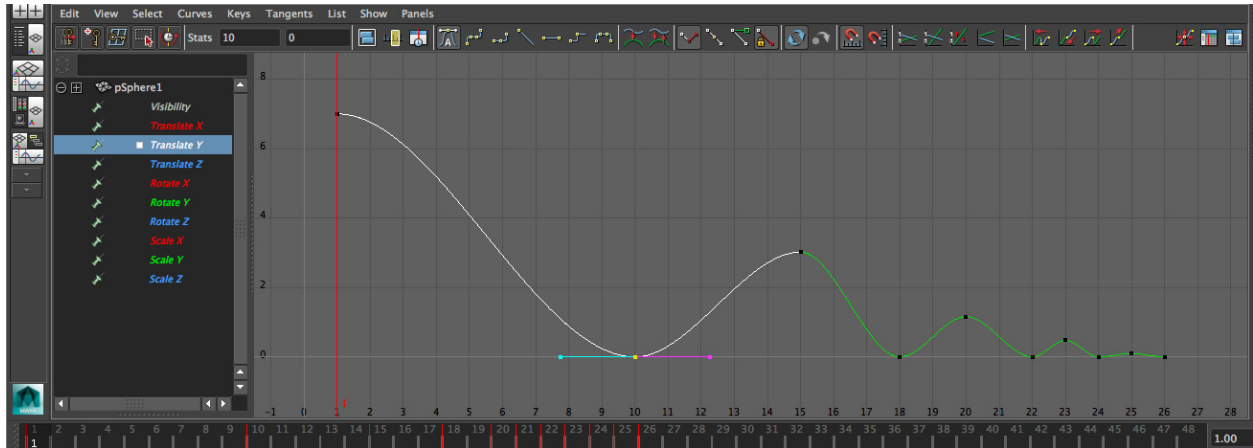
- **Merge:** Merge the copied key(s) with the currently selected curve. Use this option if you wish to copy a single key value from one part of your curve into a different location

- **Scale:** Scale the selected key(s)

- **Method:**

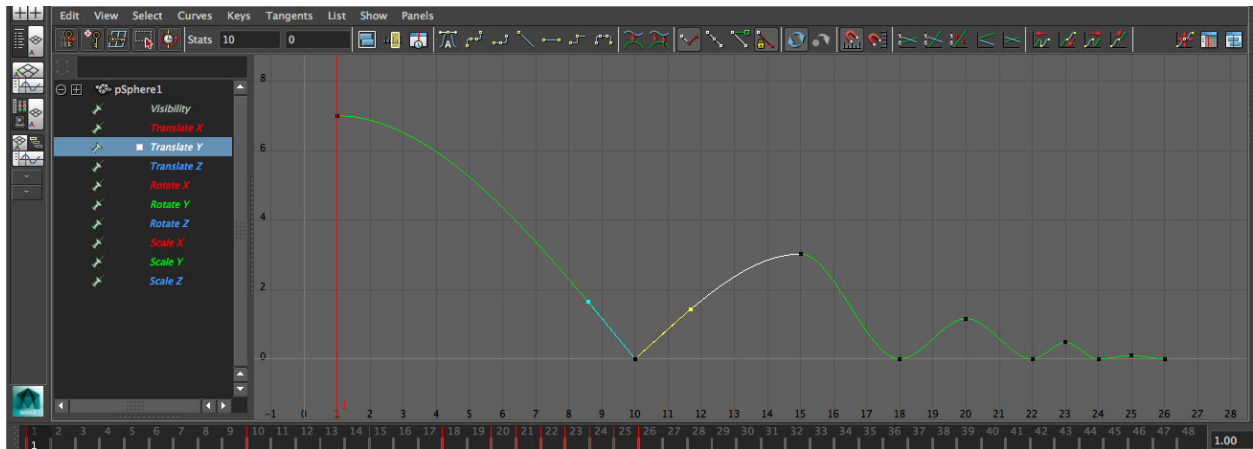
- **Scale/Pivot:** Scale the selected key(s) value and time by a specified **Amount** and **Pivot Point** (in time)

- **Start/End:** Scale the selected key(s) value and time by specifying **New Start & End Times**.



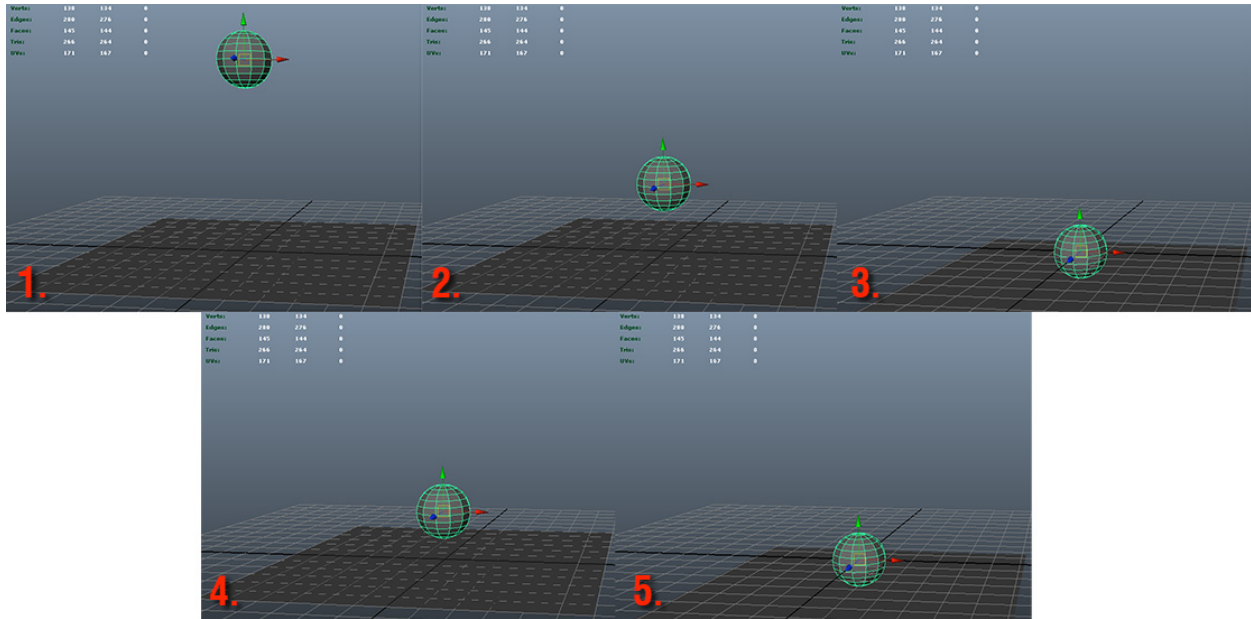
Editing Animation Curves and Tangents

- The Graph Editor displays our Animation Curves along X and Y axes:
 - The **Y Axis** displays the **Animated Attribute's Value**
 - The **X Axis** displays the **Keyframe Range** of the selected attributes
- **Left Click** or **Marquee Select** a keyframe along an animation curve to select it.
- With the keyframe selected, you should see two pink **Keyframe Tangents** extending from either side of it. These Tangents indicate the direction of the curve either following or preceding the selected keyframe.
- **Left Click** or **Marquee Select** the points at the end of the Keyframe Tangents to select that specific Tangent.
- With a Tangent selected, **Drag Up & Down** to adjust the animation curves attached to that specific keyframe.



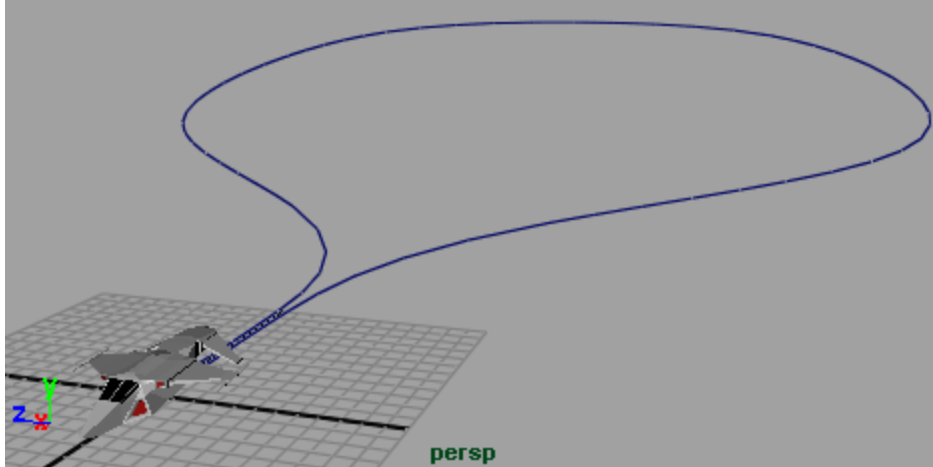
- By default, both Tangents are facing in opposite directions from each other to preserve a smooth curve. Click the **Break Tangents Button** at the top of the Graph Editor and you can now adjust each Tangent to face in a different direction.
- Clicking the **Unify Tangents Button** once again makes the two Tangents move in synchronicity.

- Keep in mind that if you first Break Tangents and then Unify Tangents, the handles will continue to point in different directions unless you unify their direction by selecting one of the Tangent options below.
- There are additional options for handling Tangents beyond the default **Auto Tangents** that are accessible from the buttons at the top of the Graph Editor:
 - **Spline Tangent:** An animation curve that is smooth between the key before and the key after the selected key. The tangents of the curve are co-linear (both at the same angle).
 - **Linear Tangent:** An animation curve as a straight line joining two keys.
 - **Clamped Tangent:** Animation curve that has the characteristics of linear and spline curves. The keys' tangents will be splines unless the value of two adjacent keys are very close. In this case, the out tangent of the first key and the in tangent of the second key will be interpolated as linear.
 - **Stepped Tangent:** animation curve whose out tangent is a flat curve.
 - **Plateau Tangent:** ease animation curves in and out of their keyframes like spline tangents, but also flatten curve segments that occur between equal-valued keyframes like clamped tangents. The plateau tangent normally behaves like a spline tangent, but ensures that the minimum and maximum values along a curve are all at keyframes.
- Experiment with different Tangent Types while previewing your animation to find the one that best fits the animated motion.
- **Go to the Curves Menu** at the top of the Graph Editor to switch from the default **Non-Weighted Tangents** to **Weighted Tangents**, which give us a bit more control over our Tangents:
 - **Weighted Tangents** smooth out the curves between keyframes so that they connect more fluidly.
 - **Tangents > Free Tangent Weight:** Drag your Tangents to adjust how much a curve is weighted towards a particular keyframe.
 - **Tangents > Lock Tangent Weight:** Lock your Tangent Weight at its current value.



Set Driven Keys

- **Driven Keys** are a way of connecting the attribute of one object with another by setting a keyframe that “drives” another one. As an example, let’s animate a ball bouncing off of a table, similar to before but only on the **Y Axis**.
- With our animation created, go to **Animate > Set Driven Key > Set...**
 - First, **select** the ball and click on **Load Driver**. It will now appear as the object “driving” the animation of another.
 - **Select** the **Translate Y** value from the top list of Transform Attributes.
 - Next, select the plane off of which the ball bounces and click on **Load Driven** to set it as the “driven” object.
 - Again, select the **Translate Y** from the list of Transform Attributes.
 - **Move the time slider** to a keyframe just BEFORE the ball collides with the plane and click the **Key Button** to add a **Driven Key**.
 - **Move the time slider forward** to when the ball is actually colliding with the plane.
 - **Move the plane down on the Y Axis** and click the **Key Button**. With this Driven Key set, the plane moves downwards when the Y value of the ball gets close enough.
- Play the animation to see how one object’s attribute reacts to another through the use of driven keys. You can even manually drag the ball up and down and it will move accordingly!



Animating Along A Motion Path

- Using **Motion Paths**, we can draw out a **NURBS Curve** and use it to define the direction of movement for our animated objects:
 - First, draw out a Path using either the **CV Curve Tool** or the **EP Curve Tool** under the **Create Menu**.
 - **Select** the object you wish to animate along the path and then **Shift+select** the path. Go to **Animate > Motion Paths > Attach to Motion Paths Options** and define the following attributes:
 - **Time Range: Start/End**
 - **Start time:** First frame of path animation
 - **End time:** Last frame of path animation
 - **Follow:** On
 - **Front Axis:** Direction in which your object is facing while moving
 - **Up Axis:** Y
 - **World up type: Scene up**
 - When you click **Attach**, the object is repositioned to the beginning of the curve and travels along its length for the duration you specified.



- You can also fine tune a motion path by adding keyframes:
 - **Select** your object and go to the **Channel Box**. Under the **motionPath1 Input Node**, you have several attributes that are keyframable:
 - **U Value**: Position of object along the Motion Path, ranging from 0 (start of path) to 1 (end of path).
 - **Front, Up & Side Twist**: Orientation of object along the Motion Path, ranging from -180 degrees to 180 degrees rotation along all three axes.
 - To animate any of these attributes:
 - First, go to a specific keyframe within your animation **Time Range**
 - Secondly, change the specific attribute's value (**U Value, Twist**)
 - Thirdly, **Right Click** and select **Key Selected**
 - You now have extra Keyframes along your Motion Path that you can adjust to change your object's speed and path orientation over time.



The Grease Pencil

- A throwback to the art of hand-drawn animation by drawing on transparent paper, the **Grease Pencil** is new to Maya 2014 and allows us to plan out our animations by sketching on top of keyframes.
- **View > Camera Tools > Grease Pencil** (or click the button at the top of the viewport):
 - Go to the frame over which you would like to create a sketch
 - Click the **Add Frame Button** to activate the Grease Pencil
 - A 1024x1024px transparent image is attached to the current camera
 - When you save your scene, your **Grease Pencil Images** are automatically saved by default to:
 - ...\Documents\maya\projects\default\sourceimages\3dPaintTextures
 - Set your brush size to either **Pencil, Marker** or **Soft Pencil**
 - Change the color by clicking on the **Change Color Button**

- **Left Mouse Drag** or use your **Stylus Pen** to draw in the current view
- Click the **Eraser Button** (or use the opposite end of your Stylus) to erase brush strokes in the current viewport
- Click on the **Show Pre-Frame Ghost** and **Show Post-Frame Ghost** buttons to overlay images from other keyframes:
 - **Right Mouse Hold** the Ghost Buttons to show frames from up to 1, 2, 3, 4 or “Other” number of surrounding keyframes
- Remove a Grease Pencil Image with the **Delete Keyframe Button**
 - **Right Click Time Slider > Grease Pencil > Delete Frames > All:**
Remove all Grease Pencil Keyframes
- **Alt + Shift + >:** Go to Next Grease Pencil Keyframe
- **Alt + Shift + <:** Go to Previous Grease Pencil Keyframe