SYBEX Sample Chapter

Introducing Maya™ 6: 3D for Beginners

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Chapter 3: Your First Maya Animation

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CHAPTER 3

Your First Maya Animation

In this chapter you're going to start using Maya software and make some things move. You've spent some time learning how the Maya interface works and how some of the windows operate, and that's really all you need to know to get started. This chapter will take you through the creation of the solar system and the mechanics of animating orbits. With the solar system exercise, you'll dive into creating simple objects, setting simple keyframes, and stacking your animation to get planets and moons to orbit each other and the sun. This will expose you to object creation, simple modeling, object components, grouping and hierarchies, basic keyframing, and basic timing. Topics include:

- **Project Overview: the Solar System**
- **The Preproduction Process: Planning**
- **Creating a Project**
- **The Production Process: Creating and Animating the Objects**
- **Using the Outliner**

Project Overview: The Solar System

This project focuses on familiarizing you with the fundamentals of object creation, hierarchy, and pivots. You will create and animate a simple simulation of our working solar system.

This tutorial is good practice for getting used to object hierarchies and selections. It will show you how to set up hierarchies and give you experience in working with the proper nodes within a group to create hierarchically layered animation.

The focus in this example is getting used to working with objects.

The Preproduction Process: Planning

As with any good animation, you need to begin with a good plan. The more research and information you gather, the better equipped you'll be. For this simple animation, you'll need to find out where each of the nine planets are in relation to the sun and each other, how they orbit, and how many moons they have.

Starting with the sun in the center, the planets in order are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. They all orbit the sun in ellipses, but you'll be fine with circular orbits for this exercise. Most planets have a number of moons that orbit them, and one has a large ring that circles around it.

Earth	1 moon
Mars	2 small moons
Jupiter	16+ moons
Saturn	3 large rings and 18+ moons
Uranus	18 moons
Neptune	8 moons
Pluto	1 moon

It may seem overwhelming to create and animate all those objects, but it's a fantastic exercise in getting comfortable with Maya animation. Since the essence of the project is attainable without making every moon, you'll cut most of them out of your scene.

Creating a Project

Start by creating a new project for this assignment. Choose **File → Project → New** to open the New Project window. (Figure 3.1 shows the Windows version; the Mac OS X version has the same fields.) In the Maya software, files are organized in a particular way. The top level of this organization is the project folder. Within the project folder are numerous file folders that hold your files. The two that stand out are the Scenes and Images folders. The Scenes folder stores your scene files, which contain all the information for your scene, and the Images folder stores images you've rendered out from your scene.

The scene files mentioned in this chapter are all included on the CD in a project layout explained here. You can copy the scene files into your own project folders once you create the project.

To create a new project, follow these steps:

1. In the Name field in the New Project window, enter **Solar_System** as the name for your project. In the Location box, type the location where you want to store your projects.

   The default location for Windows is `My Documents\maya\projects`; for Macs, the default location is `Home (/Users/<yourname>)` in the `Documents/maya/projects/default` folder. If you prefer, you can put projects in a folder on your second hard drive to keep them separate from your operating system; this allows for easier backup and is generally a safer environment.

2. On a Windows system, create a folder called Projects (on drive D, for example) through Windows Explorer. On a Mac, select the second drive from the Choose a Folder dialog box (drag the bottom slider all the way to the left to display all your attached and networked hard drives) and create a folder in it called Projects. In the New Project window, click the Browse button and select `D:\Projects` (Windows) or `<Hard Drive Name>/Projects` (Mac) for the location. All the other fields will be filled in for you with defaults; just click the Use Defaults button. Click Accept to create the necessary folders in your specified location. Figure 3.2 shows the complete New Project window in Windows; except for the drive name, the values are the same on a Macintosh.

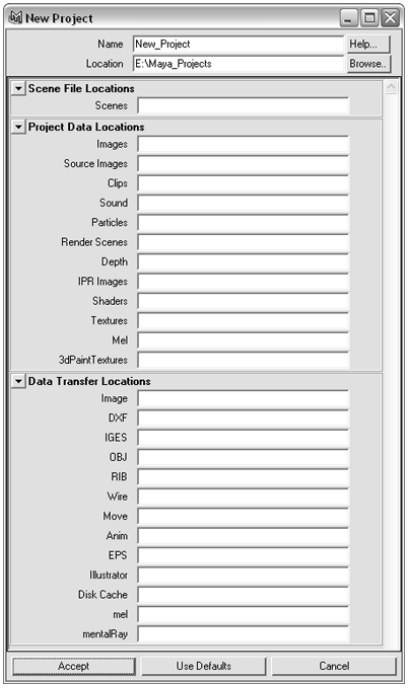


Figure 3.1

The New Project window on a Windows system. Maya automatically creates a new file system structure for your project.

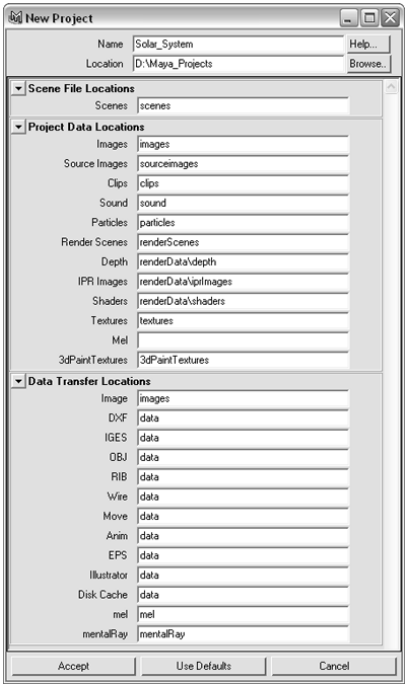


Figure 3.2

The completed New Project window

How much disk space you require depends on the project. Depending on the complexity and extent of your models and animation, your scene files will typically be small. Real disk space starts being consumed when you render out hundreds of frames at a time. You'll need about 10–15MB free for this project.

After you create projects, you can switch between them by choosing **File → Project → Set** and selecting the new project. Maya then uses that project's folders until you switch to or create another project.

The Production Process: Creating and Animating the Objects

As discussed in Chapter 1, production is typically divided into phases to make workflow easier to manage. In this project, you'll first create the sun, the planets, and their moons; then you'll animate their respective orbits and rotations.

Creating the Sun and the Planets

The first thing we're going to do is create the sun and the planets. Follow these steps:

1. Choose **File → New Scene**. Maya will ask if you want to save your current scene. Save the file if you need to, or click No to discard the scene.
2. In the four-panel view, press the spacebar with the cursor inside the top view panel to select and maximize it. (By default, Maya starts with the single perspective view. If that's the case, press the spacebar to toggle back into the four-panel view first, and then select the top view to maximize it.)
3. To create the sun, choose **Create → NURBS Primitives → Sphere**. This will place a NURBS sphere at the origin—that is at a position of 0,0,0 for X,Y,Z. The origin of the workspace will be the center of the solar system.
4. Select nurbsSphere1 in the Channel Box, and type **Sun**.

Keep in mind that Maya is case-sensitive. An object named *sun* is different from an object named *Sun*.

Naming your objects right after creation is a good habit to establish. It makes for a cleaner scene file and a more organized workspace. These are particularly important if anyone needs to alter your scene file.

5. Press R to activate the scale manipulator and uniformly scale it up to about twice its current size. For more precision, you can instead highlight the entry fields (the white window next to the attribute) for the **Scale X**, **Scale Y**, and **Scale Z** channels in the Channel Box and enter the 4 in any of the three fields. A scale of 4 will be entered in all three fields, as shown in Figure 3.3, and your sun will expand in size by a factor of 4. Entering exact values in the Channel Box is a way to scale the sphere precisely. Using the manipulator does the same job but may not be as precise.

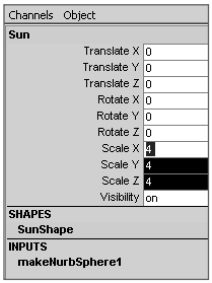


Figure 3.3
The sun's Scale values in the Channel Box

Creating the Planets

Next create the planets. Follow these steps:

1. Create a NURBS sphere for Mercury and name it as such.
2. Press W to activate the move manipulator, and move Mercury a few grid units away from the sun in the positive X direction. (Click the red arrow and drag it to the right.) Leave about two grid units between Mercury and the sun.
3. Since Mercury is the second smallest planet and is tiny compared with the sun, scale it down to 1/20 the size of the sun, or 0.2 in all three axes of scale.
4. Repeat steps 1 through 3 to create the rest of the planets and line them up, each progressively farther out in the X axis. Be sure to keep about two grid units of space between each of them. Scale each one to be proportional as follows:

Venus	0.5
Earth	0.5
Mars	0.4
Jupiter	1.0
Saturn	0.9
Uranus	0.7
Neptune	0.7
Pluto	0.15

Now of course this is not a precise proportion to the solar system, but it will do nicely here. Figure 3.4 shows how your solar system should look now.

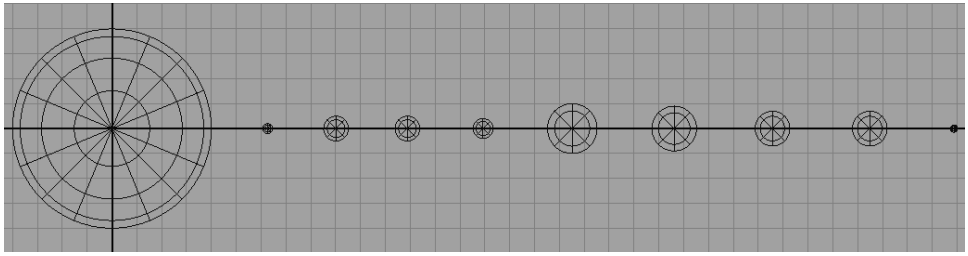


Figure 3.4
Top view—all the NURBS spheres lined up in place

Using Snaps

This would be the perfect time to start using *snaps,* the icons you looked at in the previous chapter.

Icon	Name	Description
	Snap to Grids	Snaps objects to intersections of the view's grid
	Snap to Curves	Snaps objects along a curve
	Snap to Points	Snaps objects to object points such as CVs or vertices
	Snap to View Planes	Snaps objects to view planes

You use snaps to snap objects into place with precision, by placing them by their pivot points directly onto grid points, onto other object pivots, onto curve points, and so on. Here you will slightly reposition all the planets to center them on the nearest grid line intersection. Follow these steps:

1. Select the first planet, Mercury, and toggle on the *grid snaps* by clicking the grid snap icon:  .
2. The center of the move manipulator turns from a square to a circle, signaling that some form of snapping is active. Grab the manipulator in the middle by this circle, and move it slightly to the left or right to snap it onto the closest grid intersection on the X axis.
3. Select the remaining planets, and snap them all to the closest grid intersection on the X axis, making sure to keep about two grid spaces between each of them. Since the sun was created at the origin, and you haven't moved it, you don't need to snap it onto an intersection.

Making Saturn's Ring

You will now create the ring for your Saturn. Follow these steps:

1. Choose **Create → NURBS Primitives → Torus** to get a donut shape. Snap the ring to the same grid intersection as Saturn. This will ensure that both the planet and its ring are on the same pivot point; they share the same center.
2. Select the torus shape you've created, and name it Ring (if you haven't already done so).
3. While the torus shape is still selected, press the spacebar to display the four-panel layout, and maximize the perspective window.
4. Press F to *focus* the perspective display on the ring—and on Saturn as well.
5. Press 5 to get into shaded mode, and with the torus selected, press 3 to increase the resolution display for the ring.
6. Press R to display the scale manipulator, and scale it down to 0 or close to 0 in the Y axis to flatten it.

SAVING MULTIPLE VERSIONS OF YOUR WORK AND *INCREMENTAL SAVE*

As you're working on a project, you may want to save multiple versions of your files at various stages of completion. When working in the professional world, you'll find that clients and art directors often reconsider animations you've created, so it's always good to keep as many versions of an animation as you can. Scene files are reasonably small, and hard disk space is inexpensive. Just keep your scene folder organized well—for example, by keeping older versions of scenes in separate subfolders—and you should have no problems.

Maya 6's incremental save feature is a valuable tool for saving multiple stages of your work, and you may wish to use it as you work through the tutorial projects in this book. Once you've turned on this feature, you can use it to save and create a backup at any stage in your work. If you need to take a break before the instructions tell you to save, you'll be able to start again with the most recent version of your scene file.

Incremental save makes a backup of your scene file every time you save it. To enable it, choose **File → Save Scene ❐** and click the Incremental Save option box. Once you've done this, Maya creates a new folder within your Scenes folder with the name of your current scene file. It then creates a backup of your scene in that folder and appends a number to the filename; for example, `planets_001.mb`. Every time you save your file, Maya creates a new backup. Once you enable incremental save, Maya continues to keep the option turned on until you disable it through **File → Save Scene ❐**.

The scene files for the projects in this book are provided on the accompanying CD to give you a reference point for the major stages of each project; compare your own version to those files to make sure you're following the instructions correctly. (In later chapters, some projects also begin with a scene file from the CD.) These files use a slightly different naming system than the names generated by incremental save (for example, `planets_v1.mb` instead of `planets_001.mb`), and there is no risk of files overwriting each other.

For important real-world projects, you may decide to supplement the incremental save backups by using Save Scene As to create manually named files, perhaps following a similar naming system, at the stages where you've made significant changes. This may make it easier to identify specific versions of a scene for comparison. Whether you do this or use incremental save, it's a good idea to keep written notes about the differences in each version of a scene file; so whenever you make a significant change to a file, you have a record of your work. (If you do name files manually, be sure to use an underscore (_) between the filename and version number instead of a space. Using spaces in your filenames can create problems with the software and with the operating system, especially when you're rendering out a scene.)

You'll notice that the ring is too fat and is cutting into the planet. You need to edit the attributes of the ring to increase the inside radius of the donut shape and create a gap between the planet and the ring.

7. Press Ctrl+A to open the Attribute Editor, and then click the makeNurbTorus1 tab to select its creation node. (See Figure 3.5.)

8. Increase the **Radius** attribute to about 1.5 and decrease the **Height Ratio** attribute to about 0.25 to get the desired effect.

Now all your planets are complete, and you can move on to the moons.

> Changing the original attributes or parameters of an object as you've just done with Saturn's ring is often referred to as *parametric modeling*.

Saving Your Work

Now save your work. Saving frequently is a critical habit to establish. Power failures and other unforeseen circumstances may not happen often, but they do happen. (As mentioned in the sidebar on the previous page, Maya's incremental save feature makes it easy to maintain backups of each stage of your work.) Because you created this as a new project, the Save File window will direct you to the Scenes folder of that project. Save your scene as `planets` in .mb (Maya Binary) format. (If you're working in Maya PLE, you can only save your files as .mp files.)

The file `Planets_v1.mb` in the Scenes folder of the Solar_System project on the CD shows what the scene should look like at this point.

Creating the Moons

For the planets with moons, create a new NURBS sphere for each moon. For simplicity's sake, create a maximum of only two moons for any planet. However, to get more comfortable with this exercise, feel free to make all the moons for all the planets.

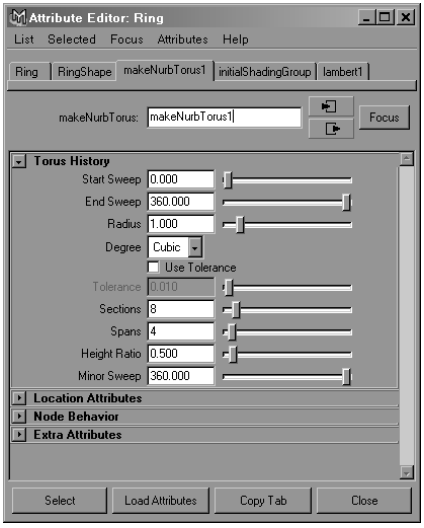
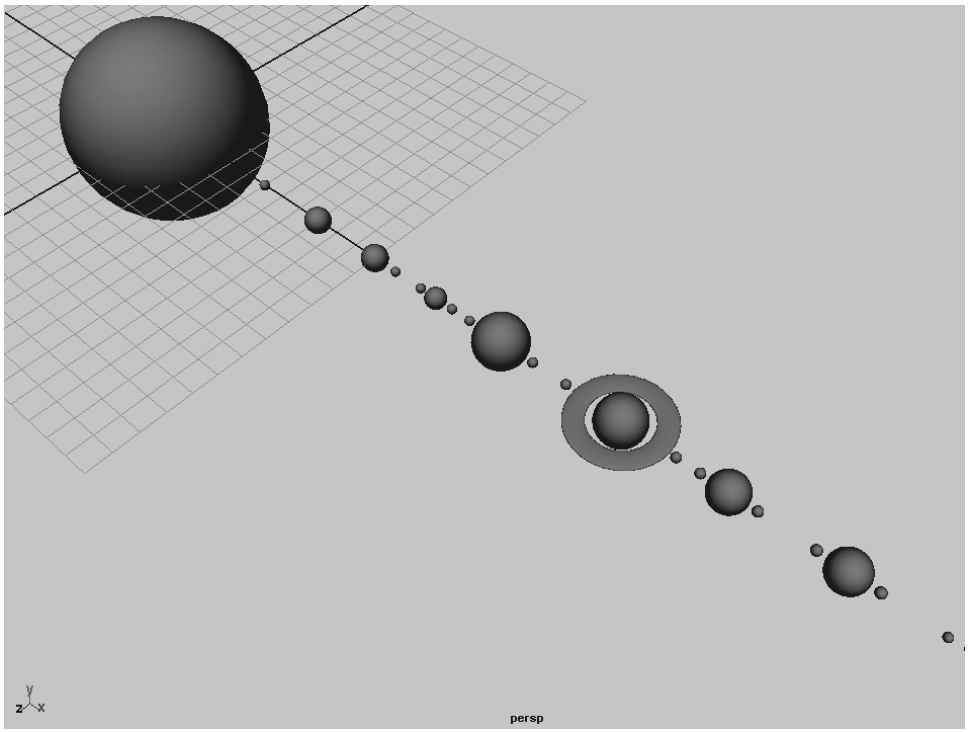


Figure 3.5
Changing the creation attributes of the NURBS torus in the Attribute Editor

The first moon will be Earth's. Use the top view to follow these steps:

1. Create a NURBS sphere and scale it to about half the size of Earth using the scale manipulator. There's really no need to type any values for any of the moons' sizes; you can just visually estimate their sizes.
2. Move the sphere to within half a unit of Earth using the move manipulator by the X axis. There's no need to snap it to a grid point, so toggle off the Snap to Grid icon ( ).
3. Repeat steps 1 and 2 for the remaining moons, placing them each within half a grid unit from their respective planets. When you create two moons for a planet, place one on either side of the planet.
4. Once you're done with all the moons and their placements and sizes, select all the elements in the scene and press 3 to increase the display resolution on all the spheres. When you're done, you should have a scene similar to Figure 3.6 in perspective view.



Applying a Simple Shader

To help distinguish one gray planet from another, attach simple shaders to each of the planets. You can easily take care of this task using the Hypershade window. Follow these steps:

1. Choose **Window → Rendering Editors → Hypershade** to open the Hypershade window. You will notice three default (or initial) shader icons already loaded. (See Figure 3.7.)
2. In the Create Maya Nodes Panel on the left of the Hypershade window and under the Surface heading, click the Lambert icon (a gray sphere) to create a new Lambert shader node. It will appear in the top and bottom of the Hypershade window. Click it another eight times to create a total of nine Lambert shading groups in the Hypershade window.

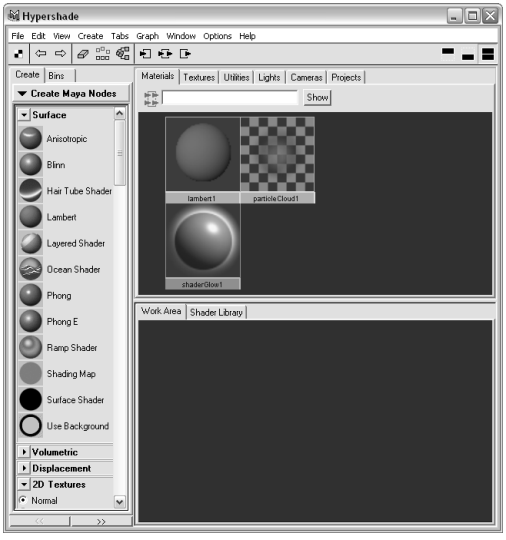


Figure 3.7
The Hypershade window

3. Click the first of the new Lambert nodes (lambert2) in the Hypershade window, and then double-click its icon to open the Attribute Editor. At the top, replace lambert2 with Mercury_Color to identify this material as the one you will use for Mercury.
4. Name each of the remaining eight planets in your animation (Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto).

To rename a node in the Hypershade window, you can also right-click the node's icon and choose **Rename** from the shortcut menu that appears.

Again, keeping a well-named and organized scene is paramount in a smooth animation experience. It's so much more of a chore to root through dozens of unnamed nodes to find the one you want. When you're done with naming all the material nodes, save your work. You may want to take a break.

Once you've created the shaders, you can assign the appropriate colors to each of them according to the planet they represent.

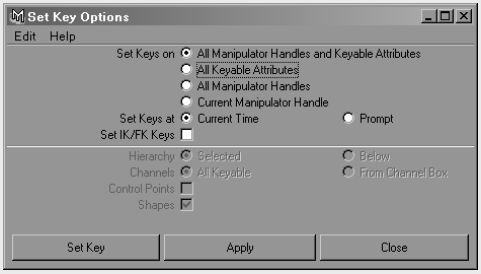
1. Double-click Mercury to open its Attribute Editor if it's not currently open (see Figure 3.8).
2. To change the color of the shader, click the gray box next to the **Color** attribute. This opens the Color Chooser window, from which you can choose a new color from the color wheel or by adjusting values with the HSV sliders. Since Mercury has a brownish red appearance, go with an orange such as in Figure 3.9.

SETTING KEYFRAMES

As with many other functions in Maya, you can set a keyframe in several ways. The best way when you're first starting to learn Maya is to choose **Animate → Set Key** ❐ to display the Set Key Options dialog box:

If you simply choose **Animate → Set Key** instead, Maya sets a keyframe for every single keyable attribute for the selected object. Although this may seem convenient, it makes for a sloppy scene, especially if the scene must be heavily animated.

Having keyframes for attributes that may not actually be animated creates unnecessary clutter. In the Set Key Options dialog box, set the Set Keys On to All Keyable Attributes instead of the default All Manipulator Handles and Keyable Attributes. Set Channels to From Channel Box instead of the default All Keyable. Now, when you choose **Animate → Set Key**, you will set only a keyframe for the channels that you specify explicitly through the Channel Box, giving you greater control and efficiency. All you have to do is highlight the channel you want to keyframe and then choose **Animate → Set Key**. Save your settings by choosing **Edit → Save Settings**, and then click Close to close the dialog box.



3. Change the remainder of shaders as follows:

Mercury	Orange Brown
Venus	Beige Yellow
Earth	Blue
Mars	Red Orange
Jupiter	Yellow Green
Saturn	Pale Yellow
Uranus	Cyan
Neptune	Aqua Blue
Pluto	Bright Gray

Figure 3.10 shows the shading groups. Next you will apply shaders to each of the planets.

4. Select a planet in the perspective window, and RMB click its corresponding material in the Hypershade window to open a marking menu. Drag up to highlight **Assign Material to Selection** and release the button to select it. You can also MMB drag the material from the Hypershade window to its planet, although assigning material in this way is not preferable. Leave the moons the default gray color. When you're finished, you should have a scene similar to Figure 3.11.

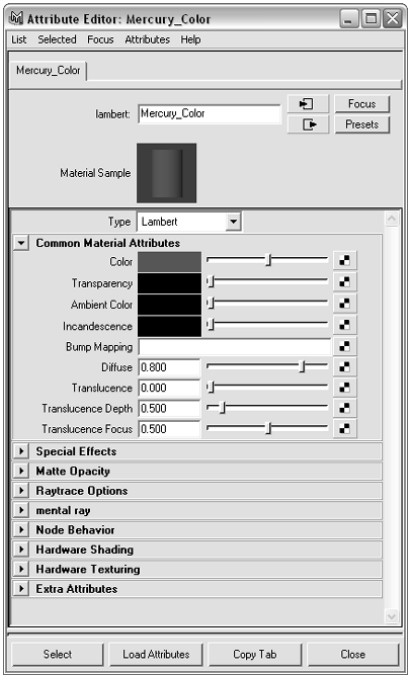


Figure 3.8
Mercury's shading group in the Attribute Editor

Now that you're done with that, you're ready to animate! Just save this file, and if you've enabled incremental save as recommended earlier, it won't be replaced with subsequent saves. If you get lost in your animation and need to start fresh, you won't have to create everything from scratch again. You can just return to a previous version of the file and start your animation again.

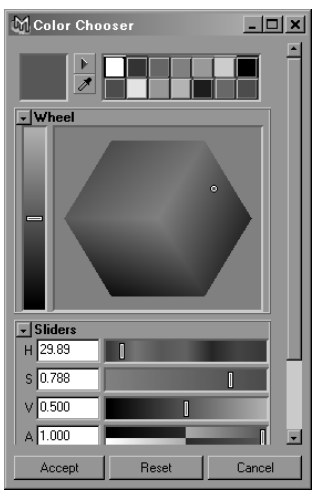


Figure 3.9
The Color Chooser window

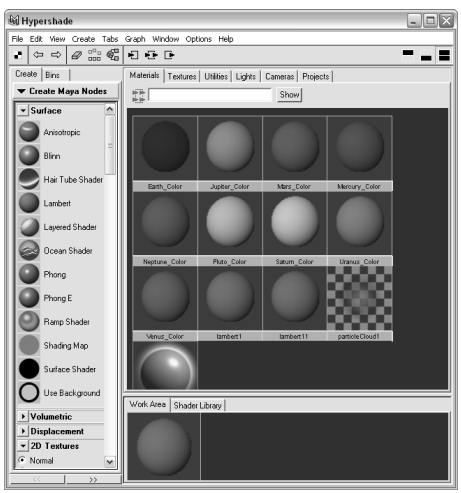
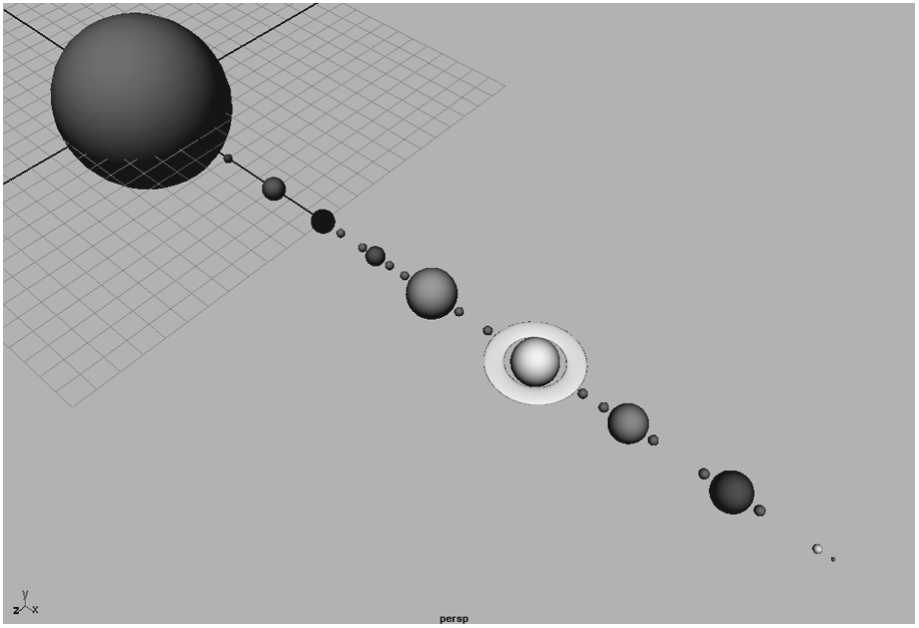


Figure 3.10
The Hypershade window with all the colored planet shading groups

Figure 3.11
The shaded planets in perspective view



Creating the Animation

To begin this phase of the project, load the file `Planets_v2.mb` in the Scenes folder of the Solar_System project on the CD, or continue with your own scene file. The animation you'll be doing for the orbits is straightforward. Basically you will rotate the planets around their own axes, then you'll animate the moons around the planets, and finally you'll send the planets with their moons orbiting the sun.

The premise of this exercise deals with hierarchy and pivot points. A *pivot point* is an object's center of balance of sorts. Every object or node that is created in Maya has a pivot point at its origin. Since most objects, such as the spheres you created for the planets, will appear at the origin upon creation, their pivot points are automatically centered.

Once you move an object, as you have done to position the planets and moons, the pivot point moves with it. Thus, all your planets' and moons' pivot points are already correctly positioned at the center of each planet and moon.

Now you'll set up your scene file's animation settings:

1. Press F2 to open the Animation menu set.
2. With the Range Slider, set your animation to go from 1 to 240.
3. Click the Animation Preferences icon (), click Settings, and set Time to 30 frames per second, or *NTSC video speed*.

4. Verify that Up-Axis is set to Y and not Z. This ensures that you have designated the Y axis to be pointing "up" in the perspective window or pointing out at you from the monitor in the top view. "Y up," as it's called, is Maya's default, but it never hurts to make sure.

Choose **Window → Settings/Preferences → Preferences** to open the Preferences window. Under Settings: Undo, check the circle for Undo to On (if it isn't already), and set the Queue to Infinite. Setting the Queue to Infinite takes a little more system memory, but it's worth it. With this configuration, you can undo (press Ctrl+Z or just Z) as many times as it takes to undo any blunders. To close the Preferences window, click Save.

Mercury's Rotation

Now you're ready to animate Mercury's rotation. Follow these steps:

1. Select Mercury first, and press E to activate the rotation manipulator. Press F to focus on it in the perspective view, or zoom in on it manually.
2. Make sure you are on frame 1 of your animation range. You'll place an initial keyframe here for the first planet.
3. For Mercury, you'll be setting your initial keyframe for the Y-axis rotation. In the Channel Box, click the attribute **Rotate Y** to select it and choose **Animate → Set Key**. The **Rotate Y**'s attribute box should turn orange, indicating a keyframe or other input if you have followed the advice in the sidebar "Setting Keyframes." If you have left it at its defaults, **Animate → Set Key** will set keys on all the attributes, turning them all orange.
4. With the Range Slider, go to frame 240. Grab the rotation manipulator handle by the Y axis and turn it clockwise a few times to rotate the sphere.
5. Choose **Animate → Set Key** with the **Rotate Y** attribute still selected in the Channel Box.
6. To playback your animation, you can *scrub* your Timeline. Scrubbing refers to using the mouse to move the time marker back and forth to watch the animation playback in a window. Click in the Timeline, hold down the left mouse button, and move your cursor side to side to scrub in real time. You'll see Mercury rotating around itself in your active view panel.

Clicking so many things just to set two keyframes may seem like a lot of work, but you're doing this the long way right now; you're not yet using any shortcuts or hot keys. You'll start using those for the next planet.

You have the self-rotation for Mercury worked out, and since there's no moon for Mercury, let's get it orbiting the sun.

Grouping Mercury for a New Pivot Point

You've learned that every object created in Maya is created with a pivot point around which it rotates, from which or to which it scales, and which acts as the placement point for its XYZ coordinates. If the pivot point for Mercury is already at the center of itself, how can you rotate it around the sun?

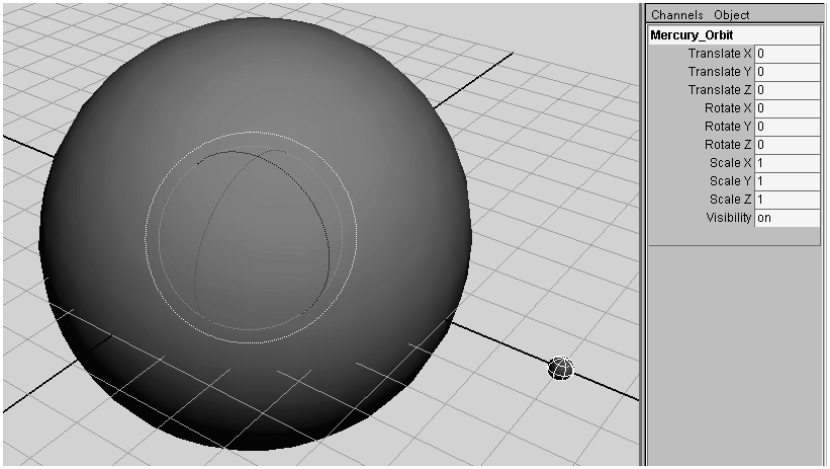
One idea is to move its current pivot point from the center of itself to the center of the sun. That would, however, negate its own rotation, and it will no longer spin around its own center; so you can't do that. What you need to do is to create a new pivot point for this object by creating a new parent node above it in the hierarchy. For more on object nodes and hierarchy, refer to the end of Chapter 2.

To create a new pivot point, follow these steps:

1. With Mercury still selected, choose **Edit → Group**. The Channel Box displays the attributes for the node called group1. In addition, the rotation manipulator handle jumps from where it was originally, centered on Mercury, to the origin—where the zero points of the X, Y, and Z axes collide. Figure 3.12 shows the new Mercury group and its new pivot location.

You essentially created a new Maya object by grouping Mercury to itself, and hence also created a new pivot point, placed by Maya at the origin by default. Since an object's manipulator always centers on its pivot point, yours jumped to the origin. That's fortunate for you, because that just happens to be the center of the sun, exactly where you need it to be for Mercury to orbit it properly.

Figure 3.12
Grouping Mercury to itself creates a new pivot point at the origin.



2. Without unselecting Mercury, click the word *group1* in the Channel Box and change the name of this new group to Mercury_Orbit.
3. Now click anywhere in an empty space in your view window to unselect Mercury_Orbit. Try selecting it again. Notice that when you click Mercury, you only select the planet and not the new parent node Mercury_Orbit, the group that has its pivot point at the center of the sun. This happens because you are in object selection mode.

To select the group Mercury_Orbit, you need to switch into Hierarchy Mode by toggling its icon ( ) on the Status line. Just remember to switch back to Object Mode ( ).

4. Go back to frame 1 of your animation and set a keyframe for Mercury_Orbit's **Rotate Y** attribute by choosing **Animate → Set Key**.
5. Go to frame 240, grab Mercury_Orbit's rotate manipulator handle by the Y axis, and spin it around the sun twice. You could also type **720** in the **Rotate Y** attribute field in the Channel Box.
6. Choose **Animate → Set Key** to set a keyframe at frame 240 for Mercury_Orbit. Scrub your animation to play it back.

One down, eight to go.

Creating Venus

For your next planet, Venus, follow the same procedure as for Mercury, and animate it so that it orbits itself. Then create a new pivot point by grouping it to itself (and calling the new node Venus_Orbit). Last, animate Venus_Orbit to rotate around the sun.

Earth and the Moon

You will animate the third planet in much the same way, except that this time there is the added complication of a moon. In addition, instead of choosing **Animate → Set Key** to set your keyframes, you'll use the keyboard hot key S.

Whenever you press S and an attribute is highlighted in the Channel Box, you are essentially choosing **Animate → Set Key**. Make sure in the Set Key Options dialog box that you have changed Set Keys On to All Keyable Attributes instead of the default All Manipulator Handles and Keyable Attributes and that you've set Channels to From Channel Box instead of the default All Keyable.

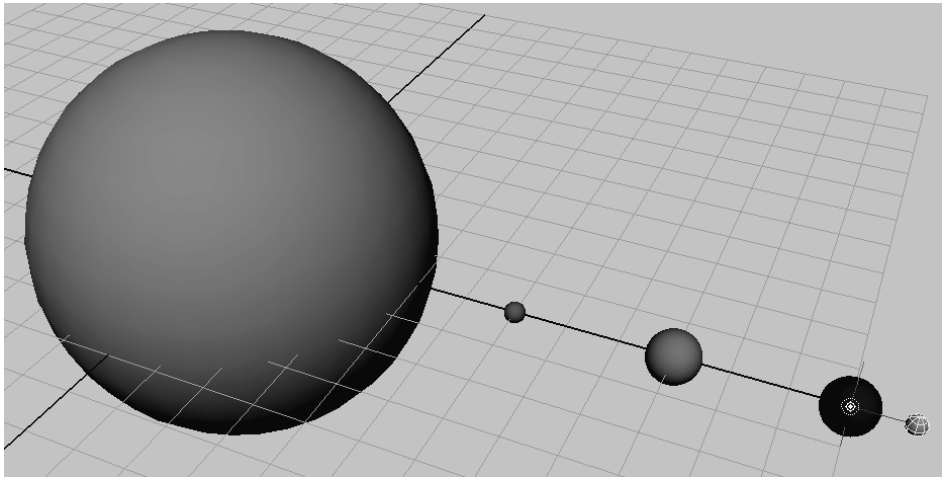
To animate Earth and the moon, follow these steps:

1. Select Earth and give it its self-rotation animation as with Mercury, but this time select the rotation channels in the Channel Box and press S instead of choosing **Animate → Set Key** for rotation keyframes. Again, if you have left the **Animate → Set Key** ❐ at its defaults, pressing S will set keys for all attributes, but if you followed the advice given previously, only the channels will be keyframed.
2. Select the moon and give it its own self-rotation animation by spinning it around itself and keyframing it as you've just done with Earth.
3. To spin the moon around Earth, do what you did earlier in this chapter to spin a planet around the sun. Group the moon to itself by choosing **Edit → Group** and name it Moon_Orbit.

This time, however, you need the pivot point to be at the center of Earth and not at the center of the sun, where it is currently. Follow these steps:

1. Turn on the grid snap, and then press the Insert key to activate the pivot point. The moon's manipulator changes from a rotation handle to the pivot point manipulator. This manipulator acts just like the move manipulator, but instead of moving the object, it moves the object's pivot point.
2. Grab the yellow circle in the middle of the manipulator and move the pivot point to snap it to the grid point located at the center of Earth (see Figure 3.13).
3. Press the Insert key again to return to the rotation manipulator for Moon_Orbit. At frame 1, set a keyframe for the moon's Y-axis rotation. Then, at frame 240, rotate the moon about the Y axis and set a keyframe. Return to frame 1.

Figure 3.13
Moving the moon's pivot point to the center of Earth



GROUPING THE MOON WITH EARTH

To create the animation of Earth's orbit of the sun, you need to make sure that the moon will also follow Earth around the sun. So, instead of just selecting Earth and grouping it to itself as you've done for the other two planets, you need to include Moon_Orbit. Follow these steps:

1. Select Earth and then Shift+click the group Moon_Orbit while in hierarchy mode to make sure you get the topmost node of the moon, and then choose **Edit → Group**. Name this Earth_Orbit. Remember, when you simply select either Earth or the moon in object mode, the Earth_Orbit node is not selected. If you select Earth and then Shift+click the moon, you do select both objects, but you will still not select Earth_Orbit, the group that contains both these objects and has its pivot point at the center of the sun. So make sure you select the right group.

> Make sure you use Hierarchy Mode ( ) when you click the moon object to select Moon_Orbit and not just the moon sphere. Otherwise, you will lose the animation of the moon orbiting Earth.

2. Set a keyframe for Earth_Orbit's **Rotate Y** attribute at frame 1 by highlighting **Rotate Y** in the Channel Box and pressing S for the Set Key command. This assumes you have changed the defaults in **Animate → Set Key** ❐ as discussed earlier.
3. Go to frame 240, spin Earth and the moon around the sun a few times, and set a keyframe there as well.

Now the first three planets are going around themselves and around the sun, with a moon in there too. If you haven't been saving your work, save it now. Just don't save over the un-animated version from before.

CREATING THE OTHER PLANETS' MOONS

Repeat this animation procedure for the remaining planets and moons, but leave out Pluto for now.

> If you find that one of your moons is left behind by its planet or that it's no longer rotating around the planet, you most likely made an error when grouping the moon and planet. Undo until you're at the point right before you grouped them, and try again. If that still doesn't work, start over from the earlier version of the file you saved just before you started animating it.

AUTO KEYFRAME

You can also use the Auto Keyframe feature when animating the planets and moons. Auto Keyframe automatically sets a keyframe for any attribute that changes from a previously set keyframe. For example, an initial keyframe for an attribute such as **Y-Axis Rotation**

needs to be set at some point in the animation. The next time the **Y-Axis Rotation** is changed, Maya will set a keyframe at the current frame automatically.

To turn on Auto Keyframe, click the Auto Keyframe icon ( ), which is to the right of the Range Slider. When the icon is red, Auto Keyframe is active.

To use Auto Keyframe to animate Mars' moon orbiting Mars, follow these steps:

1. Turn on Auto Keyframe.
2. Start at frame 1. Select Mars' moon and set a keyframe for its Y rotation by highlighting **Rotate Y** in the Channel Box and pressing S.
3. Got to frame 240. Rotate the moon around Mars several times. Maya will automatically set a frame for Y rotation at frame 240. Save your file.

Using the Outliner

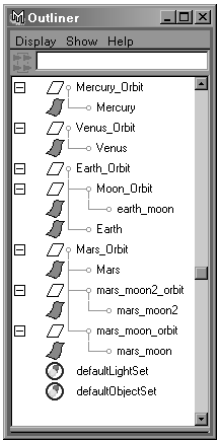


Figure 3.14
The Outliner view of the planet hierarchies

Now, let's look at how to use the Outliner to illustrate the hierarchies for the planets and moons. When all is good and proper, the Outliner should look like Figure 3.14. Choose **Window → Outliner** and take a peek at what you have. If you haven't yet named everything properly, such as the moons, take this opportunity to do so.

Let's take a look at the planet Mars and its layout in the Outliner to better understand the hierarchy for all the planets. All the other planets should be laid out exactly like Mars (except for the planets that have either one or no moons).

At the bottom of the hierarchy are Mars' two moons, mars_moon and mars_moon2. Each of those moons is spinning on its own pivot point. You then grouped each moon to itself, creating the mars_moon_orbit and mars_moon2_orbit nodes, and you placed their pivot points at the center of Mars to animate their orbits of Mars.

Mars is spinning on its own pivot point, but it needed another pivot point to be able to orbit the sun. Since you needed to make the moons go with it around the sun, you selected Mars, mars_moon_orbit, and mars_moon2_orbit (the top nodes of the moons that circle the planet Mars) and grouped them all together, placing that pivot point at the center of the sun. This node you called Mars_Orbit. This is the parent node since it is the topmost node for this group. Where this parent node goes, so follow the children nodes that are grouped under it.

Hierarchy such as this is a cornerstone of Maya animation. It is imperative to be comfortable with how it works and how to work with it.

Correcting Hierarchy Problems Using the Outliner

One of the most common problems you will run into with this project is a planet rotating around the sun without its moon. The following steps will force you to make this error with the planet Pluto, to illustrate how to fix it using the Outliner—as opposed to undoing and redoing it as suggested earlier.

Go to Pluto, start the same animation procedure as outlined earlier, and then follow these steps:

1. Create Pluto's own rotation by spinning it around itself.
2. Do the same for its moon's rotation.
3. Group the moon to itself and grid-snap the pivot point at the center of Pluto to create the moon's orbit of Pluto.

Once Pluto's moon (pluto_moon) is orbiting Pluto, you're ready to group the moon's orbit and Pluto together to create an orbit of the sun for them both.

4. Here is where you make your mistake. In object mode, select the sphere for Pluto's moon, and select the sphere for Pluto. Your error is that you are remaining in object mode instead of switching to hierarchy mode.
5. Choose **Edit → Group** to group them together, and call that new node Pluto_Orbit like the others.
6. Animate Pluto_Orbit rotating around the sun.
7. Playback the animation.

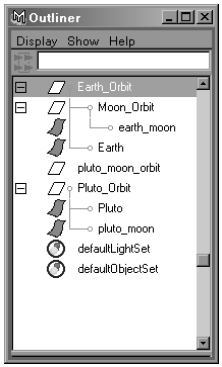


Figure 3.15
Pluto's incorrect hierarchy

Notice that the moon is no longer orbiting the planet. This is because you didn't include pluto_moon_orbit in your group Pluto_Orbit. The animation of the moon going around Pluto is stored in that node, and since it is no longer attached to your Pluto_Orbit, there's no moon orbit of Pluto.

Figure 3.15 shows the hierarchy of Pluto and how it's different from the other planets (with Earth showing as an example). The moon's orbit node has been left out of the group.

Using the Outliner, you can easily fix this problem. You will place the pluto_moon_orbit node under the Pluto_Orbit node. Go to frame 1 of the animation, grab the pluto_moon_orbit node in the Outliner, and MMB drag it to the Pluto_Orbit node so that it has a black horizontal line above and below it to show a connection, as in Figure 3.16.

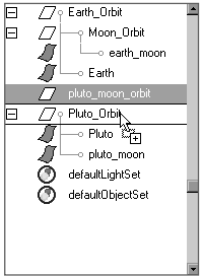


Figure 3.16
Regrouping objects in the Outliner

You have just grouped pluto_moon_orbit under Pluto_Orbit, a practice known as parenting. Now you need to parent pluto_moon under pluto_moon_orbit as well. MMB drag pluto_moon onto pluto_moon_orbit. When you playback the animation, you will see that the moon is rotating around the planet as Pluto and the moon both orbit the sun. Now the layout in the Outliner for Pluto is similar to the other properly working planets.

The file `Planets_v3.mb` in the Scenes folder of the Solar_System project on the CD will give you an idea how this project should now look. The first five planet systems are grouped and animated as reference, leaving the final four for you to finish.

GROUPING TERMINOLOGY

Grouping terminology can be confusing. Grouping Node A under Node B makes Node A a *child* of Node B. Node B is now the *parent* of Node A. Furthermore, any transformation, or movement, applied to the parent Node B will be *inherited* by the child Node A.

When you *group* Node A and Node B, both nodes become *siblings* under a newly created parent node, Node C. This new node is created just to be the parent of Nodes A and B and is otherwise known as a *null node*. To group objects, select them and choose **Edit → Group**.

Parenting nodes together places the first selected node under the second selected node. For example, if you select Node A, Shift+select Node B, and then choose **Edit → Parent**, Node A will group under Node B and become its child. This is the same procedure as MM dragging Node B to Node A in the Outliner as you did with Pluto's moon and Pluto itself.

You can add objects to a group by MMB dragging their listing onto the desired parent node in the Outliner. You can also remove objects from a group by MMB dragging them out of the parent node to a different place in the Outliner.

Summary

The planet animation you created is based on a system of layering simple actions on top of each other to achieve a more elaborate result. If you work slowly and in segments, animation is more straightforward to produce and generally is of a higher quality. Much of your time in actual animation—as opposed to setup or modeling—will be spent adjusting the small things. These small things give the scene life and character. You will find that finishing 85 percent of a scene will take about 15 percent of the time. The remaining 85 percent of the time goes into perfecting the final 15 percent of the scene.