

AUTODESK®  
3DS MAX®   
8

# Tutorial Guide

Volume III

Autodesk®

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# 14

## Basic

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### Creating and Animating a Flying Logo

In this tutorial, you'll learn to create a flying logo for a fictitious company named Worldwide Designs. Using shapes, modifiers, lighting effects and Video Post, you produce an animated logo.



Skill Level: Beginner

Time to complete: 15 minutes

#### Features Covered in This Tutorial

- Creating and rotating a globe.
- Bending 3D text.
- Setting up a volume light.

- Creating fog.

Time to complete: 1 hour

#### Files for This Tutorial

The files for this tutorial are in the *tutorials\worldwide\_designs* folder.

Note: All the necessary files to do the tutorials can be found on the Tutorial Files CD that ships with 3ds Max 8. Before doing the tutorials, copy the *tutorials* directory from the CD to your *3dsmax8* local installation.

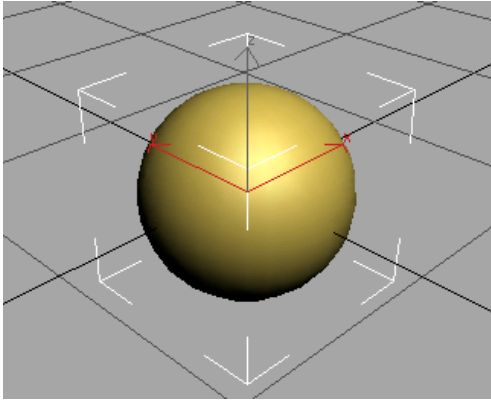
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### Creating the Earth Using Textures

You will create a sphere and apply a texture map to create the illusion of a globe.



#### Create the earth object:

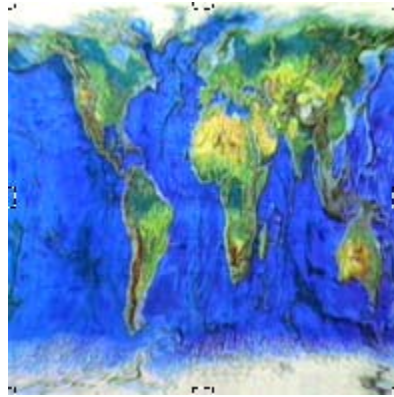
1. Start or Reset 3ds Max.
2. Open the Create panel and click Sphere.
3. In the Perspective viewport, move your cursor over the center of the grid, then drag out a sphere.



4. On the Parameters rollout of the Modify panel, change Radius to **5.0**.
5.  In the Viewport Navigation Controls, click Zoom Extents Selected.
6. On the Name and Color rollout, change the name of the sphere to **Planet Earth**.

#### Create the earth material:

1.  On the toolbar, click the Material Editor button or press **M** on the keyboard to open the Material Editor.  
The Material Editor opens in a floating window. The first material is active, highlighted in white.
2. Rename the material **Planet Earth**.
3.  Click the Assign Material To Selection button.
4. In the Material Editor, open the Maps Rollout, then in the Maps column, click the Diffuse Map labeled *None*.
5. In the Material/Map Browser, on the right hand column **double-click** Bitmap. In the Select Bitmap Image dialog, navigate to and open `|tutorials|worldwide_designs|earthmap.bmp`.




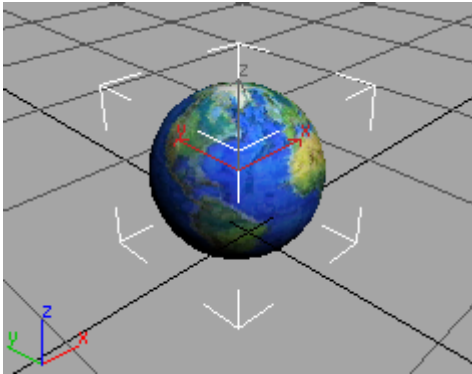
*Bitmap texture for the planet*

The material in the Material Editor now displays the earth map on a sphere.



*Texture displayed on material sample*

6. Double-click the sample sphere if you want to see the material in a larger window.
7.  On the Material Editor toolbar, click the Show Map In Viewport button.



*Texture map displayed in the viewport*

8. Save your scene as **wwdesigns.max**.

## Animating the Rotation of the Globe


You'll only have to set one rotational key to create the illusion of the earth spinning. You build the animation over a hundred frames and rotate the sphere a full 360 degrees using a TCB Rotation controller and the Rotation Windup command. This creates the effect of an endless looping animation.

### Setup:

- Continue from the previous lesson, or open `|tutorials|worldwide_designs|tut_wwdesigns_globe.max`.

### Keyframe the earth rotation:

1. Select the sphere and open the Motion panel. In the Assign Controller rollout, select Rotation : Euler XYZ in the Transform Rotation list.  
 Note: Euler XYZ rotation controllers are the default, but here you will switch to a different rotation controller that lets you use the rotation windup command.

2.  Click the Assign Controller button to open the Assign Rotation Controller dialog. Select TCB Rotation from the list
3. At the bottom of the Key Info rollout, turn on Rotation windup


**Important:** You must turn on Rotation Windup or else the animation won't work correctly.

4.  Turn the Auto Key button on.

The Auto Key button turns red and the active viewport is outlined in red to remind you that now you are in Auto Key Animation mode.

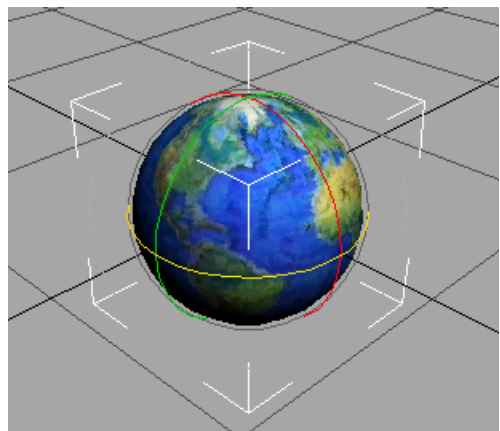
5. Move the time slider to frame 100.
6. Press the A on the keyboard to turn on Angle Snap.

This will make it easy to rotation an exact amount.

7.  On the toolbar, turn on Select And Rotate.


The rotate gizmo displays on the sphere in the viewport.


Tip: Press the + key on the keyboard to increase the size of the transform gizmo.



*The rotation gizmo displays on the sphere*

8. Move your mouse over the blue Z axis ring of the Rotate gizmo in the viewport. Rotate the planet about the Z axis, watching the value change in the coordinate onscreen readout in the viewport. Stop when you see **360**.

9.  Turn off the Auto Key button.

10.  Play the animation.

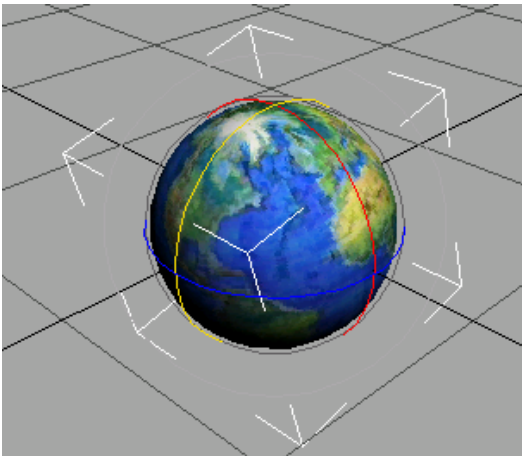
The sphere rotates smoothly in a counterclockwise direction.

The next step is to rotate the earth's axis to give it a realistic tilt.

11. While Select And Rotate is still active, move your cursor over the rotate gizmo in the viewport. When the Y axis turns yellow, rotate the earth approximately **-15** degrees about the Y axis so the earth is tilted.

Because the Auto Key button is off, this rotation affects the entire animation.

12. Save your work as **mywwdesigns02.max**.



*Tilted earth*

You'll notice the square selection brackets are tilted along with the texture, but the transform gizmo remains the same. That is because it is displaying the View Coordinate system.



## Adding the Text for the Logo

You'll now create the flying logo by modeling the three dimensional text using spline objects. Later, you'll add an extrude modifier and a Bend modifier to create the desired text effect.

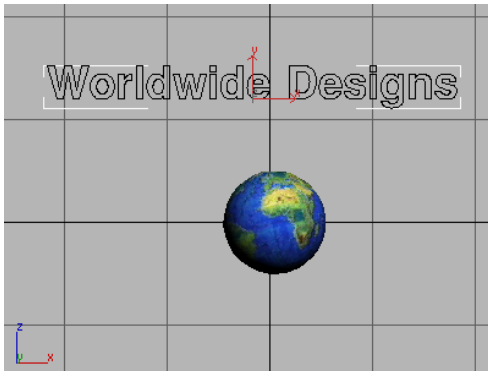
### Setup:

- Continue from the previous lesson, or open *|tutorials|worldwide\_designs|tut\_wwdesigns\_globe\_rotating.max*.

### Create a text object:

1. Activate the Front viewport, then right-click the viewport label and choose Smooth + Highlights to see the earth in shaded mode.
2.  Zoom back in the viewport so the globe is small but visible.
3.  Open the Create panel > Shapes and in the object type rollout, click Text. Click above the earth in the viewport to place the default text.
4. In the Parameters rollout, go to the Text field and type **Worldwide Designs**.  
 Tip: You can also copy and paste text into this field.
5. Click the Font drop-down arrow, and change the font to something boxy like *SansSerif Bold*. If you don't have that font, use anything else that's not too narrow.  
 Tip: You can type the first letter of the font to quickly find it in the list.
6. Change the Text Size from 100 to **5.0**.





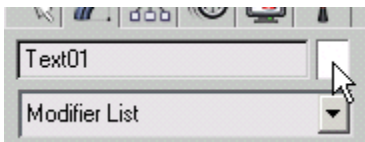
*Worldwide Designs Text*

7.  Click the Zoom Extents to zoom in the Front viewport.

#### Add extrude and bend modifiers:

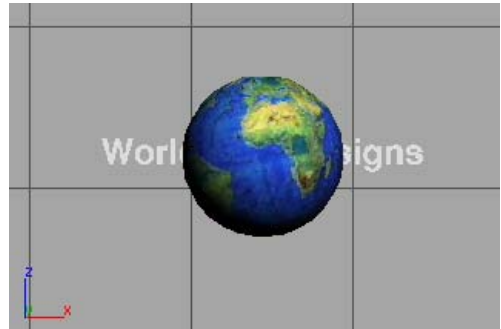
Now add Extrude and Bend modifiers.

1. With the Text selected, choose Modifiers > Object-Space Modifiers > Extrude. In the Parameters rollout, set the Extrude amount to **0.5**.
2. Click the color swatch next to the name of the text, Text01. In the Color Selector, choose white.



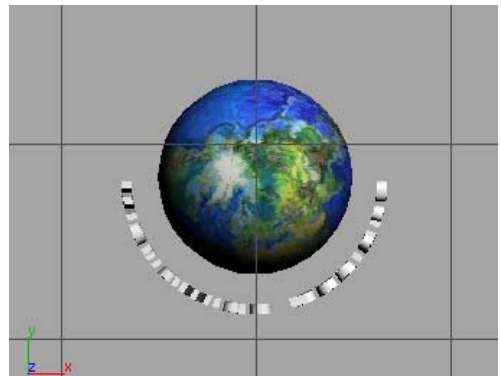
The text turns white in the viewport.

3. In the Front viewport, move the text down so that it intersects with the sphere (globe). The text still looks too big, so select the Text in the modifier stack, and then change Size to **3.0**.



*The text moved to bisect the earth sphere*

4. Click Extrude in the modifier stack and apply a Bend modifier from the Modifier List > Object-Space Modifiers.  
You'll use this to bend the text around the earth.
5. In the Parameters rollout, change the Bend Axis to **X**, then set the Bend Angle to **180**.
6. Activate the Top viewport. Zoom in on the earth and text if necessary.
7. Move the text down in the Top viewport, as shown in the illustration.



*The text is moved down in the Top viewport*

8. Right-click the Top viewport label and choose Smooth + Highlights.
9. Save the scene as **mywwdesigns03.max**.

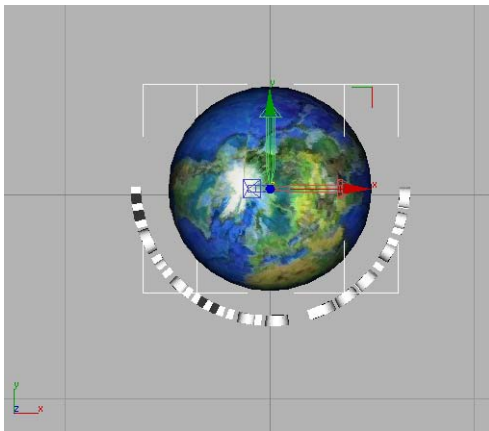
### Adjust the pivot point:

1. With the text selected, open the Hierarchy panel, then in the Adjust Pivot rollout, turn on Affect Pivot Only.

The pivot point of the text object is displayed as a tripod.

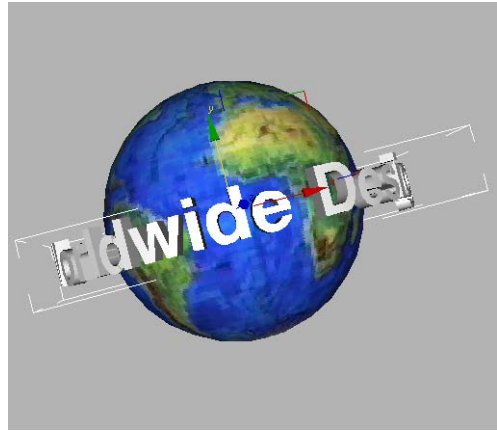
2. On the Tools menu, choose Align, then click the earth sphere object in the viewport. This displays the Align Selection dialog.
3. In the Align Position (Screen) group, turn on X, Y, and Z.
4. Set both the Current Object and Target Object to Pivot Point. Click OK.

The pivot point is aligned to the center of the earth sphere object.



*Pivot point of text object aligned to planet earth object*




5. Turn off Affect Pivot Only.
6. In the Front viewport, rotate the text about the Y axis so that it matches the tilt of the planet.  
As you rotate the text, you can refer to the onscreen coordinate readout in the viewport.
7. On the toolbar, set the Reference Coordinate System to Local.



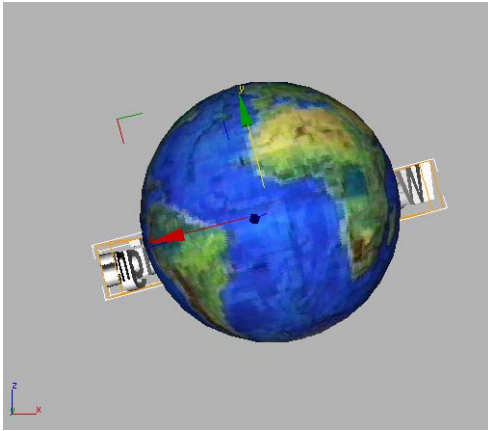
*Rotated text matches the tilt of the earth*

Now you can finally animate the text rotating around the planet. You'll set it going in the opposite direction from the way the earth spins.

### Animate the text:

1.  Make sure *Text01* is still selected, then open the Motion panel. In the Assign Controller rollout, select **Rotation** in the Transform Position list.
2.  Click the Assign Controller button to open the Assign Rotation Controller dialog. Select TCB Rotation from the list
3. At the bottom of the Key Info rollout, turn on Rotation Windup.
4.  At frame 0, turn on the Auto Key button and rotate the text around the Y axis until the text is behind the sphere.

No key will be created, yet.



*Rotation for text at frame 0*

5. Move the time slider to frame 100, then rotate the text around the Y axis **-360** degrees.


Notice that you have keys at frame 0 and frame 100 now.

6. On the Key Info rollout, set Continuity to **0**.


If Continuity is not displayed in the Key Info rollout, click the Rotation button in the PRS Parameters rollout.



This allows the text to rotate around the earth at a continuous rate of speed.

7. On the Key Info rollout, move to key number 1 using the arrows, then set Continuity to **0**.

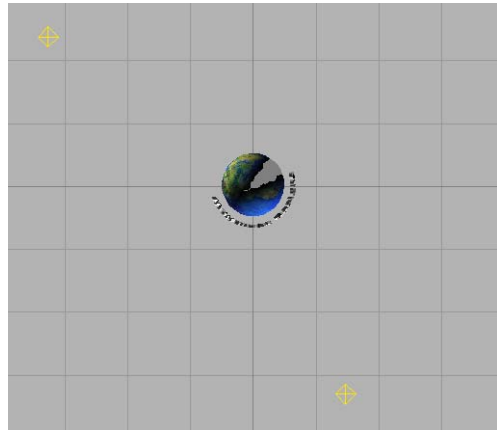
8.  Turn off the Auto Key and play the animation. The rotation of the text and earth sphere should be smooth and loop continuously.

You can now add a couple of lights for dramatic effect.


9.  Activate the Top viewport and Zoom out so you see some empty space around the Earth.

10.   In the Create panel, choose Lights and click Omni. Then in the Top viewport, set

a light in front of and another light behind the planet.



*Add lights for drama.*

11.  Save your work as **mywwdesign04.max**.

## Adding a Background and a Material

You'll make the scene more interesting by simply adding a background that makes the earth sphere appear to be in outer space. You'll then add a shiny gold material to the logo text for more impact.

### Set up the scene:

- Continue from before, or open *tut\_wwdesigns\_globe\_text\_rotating.max*.

### Add a background:

1. Open the Rendering menu > Environment.
2. Click the Environment Map button. In the Material/Map Browser, double-click Bitmap. Navigate to `|tutorials|worldwide_designs` and choose *stars10.jpg*.

This is a large high resolution starfield background.

3. Move the time slider to frame 50.



4. Activate the Perspective viewport and click the Quick Render button.

The image renders with the Earth in front of the stars.

**Warning:** If you've set your rendering resolution to something too small you won't see the stars in the rendering. You need to render at 640 x 480 to really see the stars in this background image file.

The next step is to make the logo text more interesting.

#### Add a material to the text:



1. On the main toolbar, click the Material Editor button. Click an unused sample sphere.



2. Click the Get Material button. In the Browse From group, click Mtl Library, then double-click **Metal\_Dark\_Gold [Standard]**.

The sample sphere displays a shiny gold material.



3. Make sure *Text01* is selected, click the Assign Material to Selection button.



4. Click the Show Map in Viewport button.

The text is now gold.

5. Render the scene.



*Golden text*



6. Save your work to an incremental file name. Choose File > Save As. Click the incremental save button.

Now, you'll add a spotlight that will illuminate each letter of the logo as it rotates.

## Adding a Spotlight

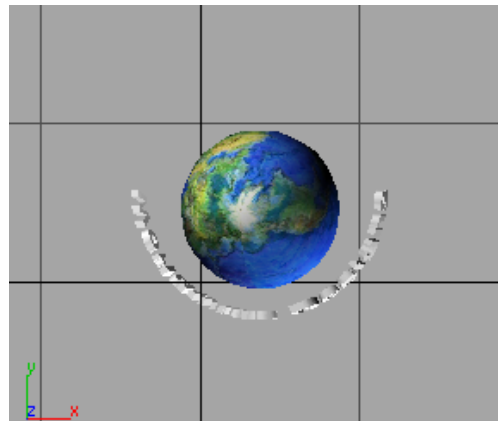
- Continue from before or open *tut\_wwdesigns\_globe\_text\_bground.max*.

#### Create a spotlight:

You'll add a target spotlight that casts a focused beam of light onto each letter of the logo as it rotates. The target in this case is the earth so that you can easily align the beam of light to the logo text.

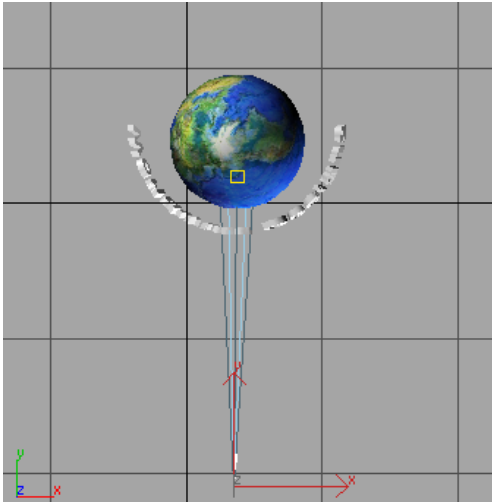
1. In the Top viewport, slide the time slider to frame 50 so that the logo text is rotated around the lower half of the earth sphere.

Note: The illustrations display the text in white, not gold.



2. Go to the Create panel > Lights and click Target Spot.

3. In the Top viewport, click below the logo text and drag upwards until the light cone touches the edge of the sphere.
4. Go to the Modify Panel. The Spotlight name appears at the top of the panel. On the Spotlight Parameters rollout use the Falloff/Field spinner to narrow the beam of light. Try changing the Field to 7.0.




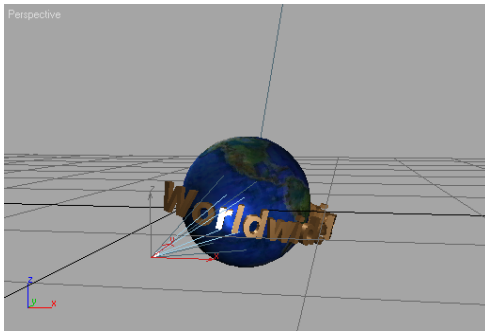
5. Select the spotlight target.  
Tip: If it's difficult to select the spotlight target, type **H** on the keyboard. In the Select Objects dialog, select Spot01.Target.
6. Select Tools menu > Align and click the earth sphere.
7. In the Align Position (Local) group, click X, Y and Z Positions. For Current Object and Target Object, click Center. Click OK.  
The spotlight target is now aligned to the center of the sphere so that the light shines on the text logo.
8. Select the spotlight source, *Spot01*. Open the Modify panel and click Exclude from the General parameters rollout.

9. Select the object Planet Earth from the Scene Objects list, then click the >> button. Click OK.  
This prevents the spotlight from illuminating the earth sphere.
10. Right-click the Perspective viewport label and select Views > ActiveShade to see how the light illuminates the text.



It's quite likely that further adjustment needs to be made so that the spotlight target illuminates only one letter at a time.

11. Right-click in an empty place in the viewport and select Close from the upper-left quadrant menu.
12.  With the Modify panel still active, scroll the rollouts until you can see the Spotlight Parameters rollout. In the Light Cone group, make sure Circle is turned on.
13. Experiment with different values for Hotspot/Beam and Falloff/Field until the size of the light beam is focused on only one letter.





Target spot illuminating the letter R

#### 14. In the Perspective viewport, play the animation.

If you prefer that the logo text scroll more slowly, you'll add an additional 100 frames to the animation.

#### Add frames to the animation:

1.  Click the Time Configuration button.
2. In the Time Configuration dialog, set Length to **200**.
3.  On the toolbar, click the Select by Name button. In the Select Objects dialog, select **Planet Earth** and **Text01**.  
The keys appear in the track bar.
4. On the track bar, select the key at frame 100 and slide it to frame 200.
5. Play the animation again. The logo text and the earth sphere rotate more slowly.
6. Save your work to an incremental file name. Choose File > Save As. Click the + button.

## Adding a Volume Light and Volume Fog

You'll now add a fog effect to the spotlight and create a light foggy haze around the planet. Volume Light provides light effects based on the interaction of lights with atmosphere, such as fog.



#### Set up:

- Continue from before or open *tut\_wwdesigns\_globe\_add\_vol\_lite.max*.

#### Create a Camera from View


If you're continuing from before, you'll notice that there is no camera in the scene yet. You can create one by doing the following:

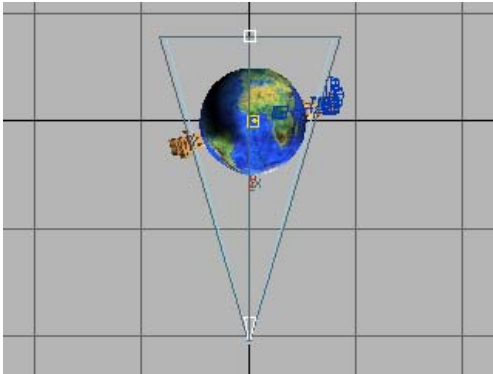
1. Activate the Perspective Viewport. Adjust it as you like to frame your shot.
2. On the Views menu, click Create Camera from View.

The Perspective viewport label changes to Camera01.

#### Add another spotlight

Now you'll create another spotlight shining from underneath the globe.

1. Activate the Front Viewport, and zoom back so you have more room.
2.  On the Create panel click the Lights button. Turn on Target Spot and drag out a Spotlight below the planet. Set the target slightly above the planet object in the Front Viewport.
3. Adjust the hotspot so it is wider than the planet, but not as wide as the ring of text.



You'll use this spotlight to creating a halo of light beams behind the planet. You'll turn on a few options for the lights to give a good result for the effect.

On the Modify panel turn on Shadows On.

4. On the Intensity/Color/Attenuation rollout, increase the Multiplier to **4.0**.

#### Add a volume light:

You can assign the volume light directly in the modify panel, or you can assign it using Rendering menu > Environment.

1. Activate the camera viewport.
2. Go to the Rendering menu > Environment.  
The Environment and Effects dialog appears.
3. In the Atmosphere rollout, click Add.
4. In the Add Atmospheric Effect dialog, select Volume Light and click OK.
5. In the Volume Light Parameters rollout, click Pick Light.
6. Click on the *Spot02* light in the viewport or press the **H** key and pick the *Spot02* object from the list.

*Spot02* appears in the field next to the Remove Light button.

7. Press **F10** to do a test render.

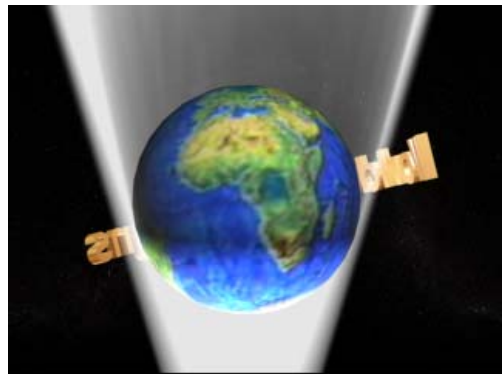
Tip: As you repeat the process of entering values and rendering, you will find that the field cannot be active for the rendering keyboard shortcut to work.

When you enter something in a field, press enter and click outside the field, then press **F9** to render last.



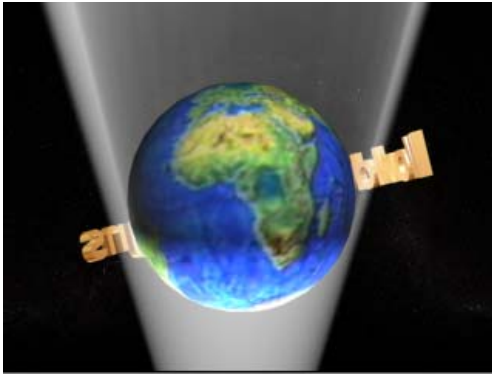
By playing individual values you can adjust the effect.

8. In the Volume group change the Density to **20**. Press **F9** to Render Last.

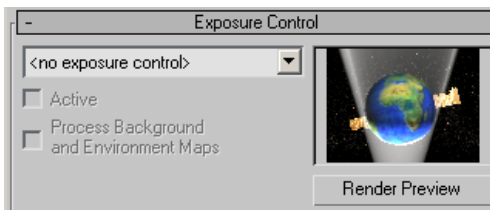


Turn on Exponential and press **F9**

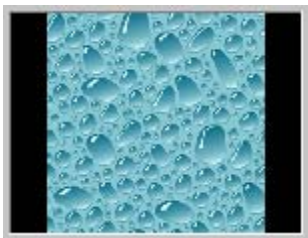




9. You can also see the changes you've made, in the Exposure Control rollout, by clicking the Render Preview button.

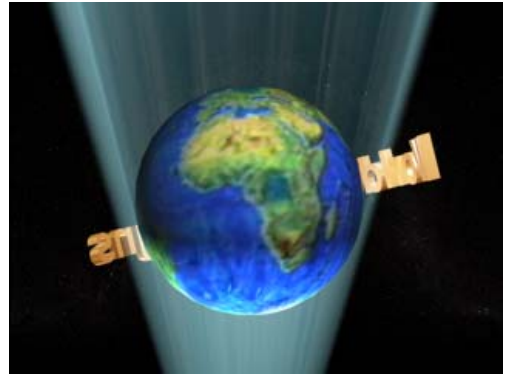


10. Press **H** on the keyboard and select *Spot02*, if it isn't selected already. On the Modify panel, open the Advanced Effects rollout.
11. In the Projector Map group click the button marked None. Double-click Bitmap in the Material Map Browser and then choose *Droplets.tga*.



Adding a projector map will dramatically add detail to the volume effect.

12. Press **F10** to Render.



13. On the Modify panel turn on Decay, setting it to Inverse.

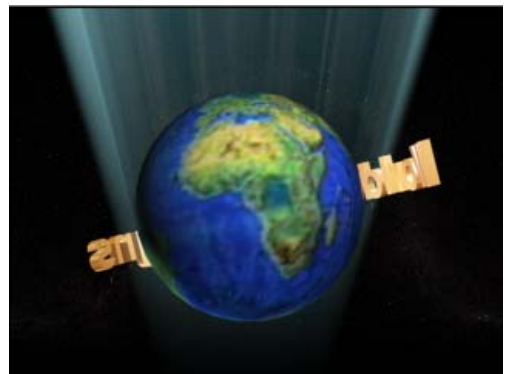
In the Near Attenuation group turn on Use and Show. Set the Start to **11.0** and the End to **32.0**

In the Far Attenuation group turn on Use and Show. Set the Start to **33.0** and the End to **43.0**

Note: These are suggested values, yours may vary.

14. Press **F9** to render again.

15. For a more dramatic effect you can exclude the globe from the Spotlight. On the General Parameters rollout, click Exclude. In the Include/Exclude dialog, highlight the Planet object name and use the right-pointing arrow to move it to the right window, then click OK.





16. On the Intensity/Color/Attenuation rollout adjust the Near and Far Attenuation values so the effect tapers off within the viewport.




17. If you'd like to hide the effect below the globe, reposition the Spotlight and Spotlight target. Move it in small increments and repeatedly render until you have found a location you like. By tilting the spotlight slightly, rather than using it straight up, you can get a more interesting effect.

18. Save your work as **mywwdesign07.max**

### Add volume fog:

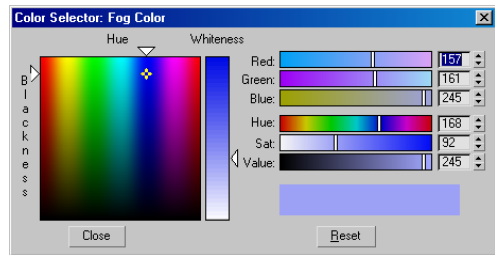
You'll now create an additional fog effect around the earth. But first, you need to create a type of helper object called an Atmospheric Apparatus that will serve as a container for the fog.

- On the Create panel, click Helpers, and select Atmospheric Apparatus from the drop-down list.
- Click SphereGizmo.
- In the Top viewport, select the center of the earth and drag outwards to create the SphereGizmo. Make it a little bit larger than the size of the earth.
-  With the SphereGizmo still selected, click the Modify tab. In the Atmospheres and Effects

rollout, click Add. In the Add Atmosphere dialog, highlight Volume Fog and click OK.

Now you need to setup the volume fog parameters.

- In the Atmospheres and Effects rollout window, select Volume Fog. Click Setup.
- In the Volume Fog Parameters rollout, click Pick Gizmo. Select the SphereGizmo, if it doesn't already appear in the dialog. SphereGizmo01 appears in the field next to the Remove Gizmo button.
- In the Volume group, click the white color swatch. In the Color Selector dialog, pick a light bluish purple color. Drag the whiteness selector to lighten the color. Click OK.



The color you selected is now displayed in the Color swatch.

- In the Volume group turn on Exponential and increase the Density to **100.0**.
- In the Noise group, select Fractal. This gives the fog a less uniform appearance.
- In the Noise group change the High Threshold to **0.1**.  
Change the Levels to **6.0**.  
Change the Size to **1.0**.
- Press **F9** to render
- Make more adjustments to get the look of a cloud cover.



13. On the toolbar click Select and Link. Link the SphereGizmo to the globe. Play the animation. The fog spins with the globe.
14. Save your work as **mywwdesigns08.max**


## Adding a Flare Effect

Using Video Post, you can add events that occur in a finished video. In this case, you are using Video Post to add a flare effect that simulates a bright star behind the earth sphere to give the animation more of an outer space look.





### Create a dummy object:

You'll first need to create a dummy object that will serve as the "placeholder" for the flare effect.

1. Proceed with the file you saved in the last lesson or open *tut\_wwdesigns\_globe\_fog.max* from the *|tutorials|worldwide\_designs* directory.
2.  On the Create panel, click Helpers > Dummy.
3. In the Top viewport, drag out a square above the earth sphere. Position the dummy so it is visible behind the globe in the Camera viewport.
4. In the Name and Color rollout, name the dummy **Flare Dummy**.


### Add a flare effect:

You'll now use Video Post to easily create an effect that will add interest to your animation.

1. Choose Rendering menu > Video Post.  
The Video Post dialog appears.
2.  From the Video Post toolbar, click Add Scene Event. In the View group, name the Label **Camera01**. Click OK.
3.  Click Add Image Filter Event. . Select **Lens Effects Flare** from the drop-down list. Click OK.

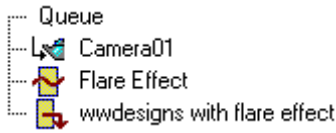
The animation will be created using the Camera01 viewport.

For the Label, enter **Flare Effect**

4.  Click Add Image Output Event. Enter **wwdesigns with flare effect**. Click the Files button. For the output file name, enter **wwdesigns0000.tga**. In the Targa Image Control dialog turn on 24 bit in the Bits-per-pixel option.

By naming the file with four zeros at the end of the name, the program knows that you want to render an ordered sequence. Setting up your work this way will let you render a high resolution still image sequence.

The Video Post now lists all the events you just created in a queue.



5. In the Video Post Queue, double-click **Flare Effect**. In the Edit Filter Event, click Setup.

You'll now set some settings in the Lens Effects Flare dialog that will create a bright star with rays behind the earth.

6. Click Preview.

A generic preview window displays a flare effect.

You can change this to display your scene.

7. Click VP Queue to see the earth and the logo text.

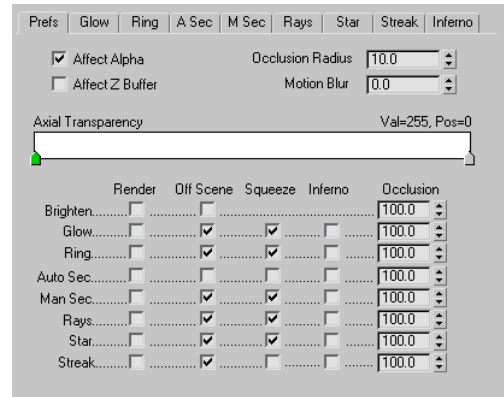
Tip: If the logo text is behind the earth, move the time slider in 3ds Max to a frame where the logo text is in front of the earth. Click Update in the Lens Effects Flare dialog to update the preview.

8. In the Lens Flare Properties group, click Node Source.

9. In the Select Flare Objects list, choose **Flare Dummy**. Click OK.

Now that the dummy object is set as the source, you can now make changes to some settings.

10. To better see each effect, go to the Prefs panel and in the Render column, turn off all the effects. Now turn each one separately and look in the preview to see the effect by itself.



11. To create the appearance of a bright star in the background, turn on Rays and Star.

You'll change a few settings to make the distant star a little more noticeable.

12. Go to the Rays panel. Set these values:

- Size=450
- Angle=45
- Num=300

Click Update to see the changes.

If you cannot see any effects, move the Flare dummy object in the viewport and then click Update in the preview window again until the rays are in the desired location.

13. Go to the Stars panel. Set these values:


- Size=100
- Sharp=10

Turn on Random. Click Update.

14. Turn on Glow on the Prefs panel.



You're now ready to render your animation. Click OK to exit the dialog.

15.  On the Video Post toolbar, click Execute Sequence.
16. In the Time Output group, turn on Range. Enter **1** in the first field and **200** in the second field. In the Nth Frame field enter **2**. Click Render.  
Video Post now renders every other frames of your animation and adds the effects you created in a post-production video. Since you've selected every second frame, the rendering will go faster and the animation will play more quickly.  
Depending on the speed of your computer, the rendering may take some time. While you wait, you can watch the animation progress in the frame buffer window and in the Video Post rendering progress dialog.
17. In 3ds Max, go to Render menu > RAM Player.  
The RAM player lets you load high resolution still image sequences into memory and play them back.
18. On the RAM player toolbar, click Open Channel A. Navigate to the image sequence you rendered, and select the filename of the 1st image. At the bottom of the dialog, turn on Sequence, then Open.



The files load into the RAM Player.

19. When the files are loaded, play the animation using the Play controls on the RAM player toolbar.

Once the files are loaded into the RAM player, you can save them out as a movie file. Choose Save Channel A, and then select the file type and file name you want.

## Summary

In this tutorial, you have created a flying logo. You have created a globe using primitive objects and texture maps. You have created and animated text to develop the logo treatment, and added gold metal material and spotlights for dramatic effect. You have added atmospheric and volume light effects, as well as a lens flare using Video Post. Finally you have rendered your animation to a still image sequence and assembled it into a movie using the RAM player.

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## Animating Still Life

This tutorial, intended for those new to 3ds Max, offers a quick introduction to the world of 3D while you play with some traditional elements of art. Using basic features of the program, you'll create a composition of an orange and an apple, a windowsill and wall, a bottle and a knife. You'll also add lights and a camera, and view the scene from different angles. The final steps introduce you to some basic animation.



*Animated still life*

When you learn to paint, you start with a still life, perhaps a bottle and some fruit arranged on a table. In this tutorial, you'll make a "not-so-still life" that is animated.

The idea for this tutorial was taken from the Salvador Dali painting "Nature Morte Vivante," in which the traditional elements of a still life are painted flying through the air. You'll use the same idea for your first animation project in 3ds Max.

Skill Level: Beginner

Time to complete: 20 minutes

## Features Covered in This Tutorial

As you do this tutorial, you'll be learning a number of things at once:

- How to open a scene
- How to model objects and apply realistic materials
- How to navigate the viewports and interface of 3ds Max
- How to move and animate objects
- How to render

## Tutorial Files

All the necessary files for this tutorial can be found on the Tutorial Files CD in the `tutorials\still_life` directory. Before starting the tutorials, copy the `tutorials` folder to your local `3dsmax8` installation.

## Navigating a Scene

In this lesson, you'll open an existing scene of a still life and learn to adjust the view and navigate the viewports.

### Navigating the scene

1. Choose File menu > Open.

Find the `3dsmax8\tutorials\still_life` directory on your hard drive and highlight `still_life_start.max`, then click Open.

Note: The files for this tutorial can also be found in the `tutorials\still_life` folder of the Tutorial Files CD. Copy that directory to your hard drive to open local copies, rather than opening the files directly from the CD.



*Perspective viewport*

The Perspective viewport should be active, indicated by a yellow border. If it's not, right-click to activate this viewport.


2.  Click the Zoom button in the viewport navigation controls at the lower-right corner of the screen.

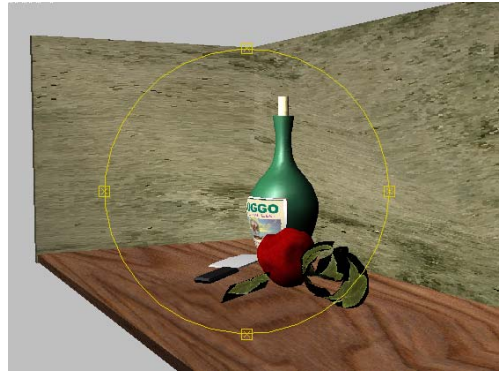
The button turns yellow to show it's active.

3. Press and drag downwards in the viewport.  
Your view zooms back so you can see the corner in the scene.



*Zooming back reveals the corner.*

4.  Click Arc Rotate in the viewport navigation controls at the lower-right corner of the screen. It highlights when active.  
A yellow navigation orb appears in the viewport.
5. Move the cursor *inside* the yellow circle. Press the left mouse button and move the mouse.  
The viewport arc rotates, changing the perspective view.




*Rotating the viewport*

Tip: Avoid pressing outside the yellow navigation orb, unless you want to roll the entire viewport.

6. Use the orb to spin your view so you can see the scene from every angle.

You'll notice that the backside of the corner is dark. This is because there are already hidden lights in this scene prepared to cast shadows in your rendering.

7. Right-click in the viewport to dismiss the yellow circle.

8.  Click Pan in the viewport navigation controls and move the mouse in the viewport.

The viewport pans with your movement.

Note: You can also start a pan operation by holding down the middle mouse button or wheel as you pan. If the middle mouse button doesn't pan the viewport, check your mouse driver settings.

9. To return the viewport to its original orientation, press **SHIFT+Z** repeatedly to undo the viewport changes all the way back to the beginning.

Next you will create a camera and a Camera viewport. The Camera viewport is similar to the



Perspective viewport, but with more functionality. It can be animated, and effects can be added to it.

### Creating a camera


1. Right-click the Top viewport to activate it.

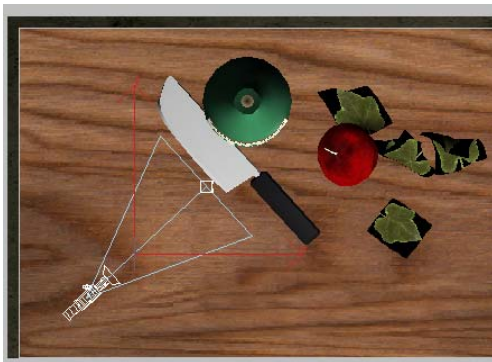
The Top viewport is outlined in yellow.

2. Right-click the Top viewport label (the word Top at the upper left corner of the viewport). On the menu that appears, choose Smooth + Highlight.

The viewport display changes from wireframe to shaded.

Tip: You can press **F3** to turn a wireframe viewport display into shaded display.

3.  On the Create panel, click the Cameras tab, then click Target.
4. In the Top Viewport, on the lower left-hand corner of the wooden shelf, press and drag to create a camera pointing toward the knife (see the following illustration).



*Camera created in Top viewport*

Press **CTRL+D** to make sure the new camera is not selected.

To see what the camera sees, you need to change one of the viewports into a Camera viewport. You'll replace the Front viewport with a Camera viewport.

5. Right-click the Front viewport to activate it. Then press **C** on the keyboard.

The Select Camera dialog appears.

Click Camera02, then OK.

The camera you created is Camera02. There was already a Camera01 hidden in this file.

Tip: When a scene contains more than one camera and none of the cameras is selected, pressing **C** will cause the Select Camera dialog to appear. If there is just one camera in the scene, or if just one camera is selected, pressing **C** will change the active viewport to the indicated camera.

6. Press **F3** to change the wireframe display into Smooth + Highlight shading.



*The view from Camera 02*

If you look at the navigation controls, you'll see they have changed. Tools and controls are context-sensitive, so the active Camera viewport has shifted the navigation controls.

7. Experiment with the various camera navigation controls, to zoom, pan, arc-rotate, and so on in the Camera viewport.

Tip: To undo Camera viewport changes, press **CTRL+Z**, or click Undo at the left end of the Main toolbar. Unlike the Perspective viewport, Camera viewport changes are based on the movement of the camera.

Next you will render the scene.

## Rendering the scene

You've looked at the scene from many different angles now. But the viewport only tells part of the story. You need to render the viewport to an image to see the full effect.



1. On the toolbar, press the Render Scene button.

The Render dialog appears.

2. Look at the very bottom of the dialog. Make sure the Viewport: field says Camera02, then click Render.

The virtual frame buffer appears, and the rendering takes place line-by-line from the top to the bottom of the image.



*Rendering from Camera02 zoomed in*

3. Change the Camera viewport to Camera01. Make sure the Camera viewport is active and no cameras are selected, then press **C** and select Camera01 from the list.

4. Render again.

Observe the rendering. You'll see shadows on the wall, reflections in the knife blade and bottle, and transparency on the leaf objects. None of these were visible in the viewport display.



*Rendering from Camera01*

5. Right-click the Camera viewport label, and choose Views > Front to change the Camera viewport back to a Front viewport.

Next, you'll create an orange to add to the scene. Then you'll animate the objects so they fly into place.

## Creating an Orange

Here you'll create a sphere primitive, color it orange, and name it. Then you'll add a realistic orange peel material to it, so the rendering will have the speckled appearance of fruit skin.

### Create a sphere:



1. On the Create panel, click the Geometry tab, then in the Object Type rollout, click Sphere.

The button highlights to show that it is active and ready to use. Before you make the sphere, you'll make two changes in the Create panel.

2. At the bottom of the Parameters rollout, turn on Base To Pivot.

Base To Pivot lets you create a sphere with its pivot point at its bottom.



To create the sphere so the orange is resting on the wooden slab, like the rest of the objects in the scene, you'll use the AutoGrid function.

3. On the Create panel, directly below Object Type and above the primitive object names, turn on AutoGrid.

AutoGrid creates a grid on the surface of any object, so you can create another object directly in contact with the surface.

4. In the Perspective viewport, move your cursor between the apple, the bottle, and the knife blade.

After a moment, a tooltip will appear showing you what object you are over. The tooltip should say *wooden board*.

5. Create a sphere by pressing down on the left mouse button and dragging away from where you started. As long as you hold the mouse button down, you can adjust the size of the sphere. When you release the mouse button, the sphere is complete.

Tip: Don't worry if your object is a different color from the one in the illustration.



Create a sphere using AutoGrid

6. In the Create panel > Parameters rollout, change the Radius field to **20** and press ENTER.

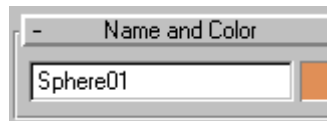
The sphere changes size in the viewport. In 3ds Max, it's typical practice to rough out an

object with the mouse, then reset one or more of its parameters to your specific requirements.

### Change the color and name of the sphere:

By default, 3ds Max chooses colors at random for new objects, so the sphere is probably not orange. You can change the color of the sphere in the viewport to simulate an orange.

1. In the Create panel > Name And Color rollout, click the small, colored square next to the default name, *Sphere01*.



The Object Color dialog is displayed.

2. Select an orange color and click OK.

The sphere in the viewport turns orange.

3. Double-click the name *Sphere01* to highlight it.
4. Type in **orange** to change the name of the sphere. Press ENTER to set the new name.

Note: Pressing ENTER is the explicit way to make a change to a parameter. 3ds Max also accepts the change as soon as you click anywhere on the screen.

### Move the orange:

You might want to move the orange so it is slightly in front of the apple. To do that, you'll use the Transform gizmo.



1. On the main toolbar, click the Select And Move button.

A tripod of red, blue, and green arrows appears. This is the transform gizmo. As you move your cursor over the arrowheads, the axis label and arrow stem will turn yellow. When they are yellow, you can press and drag to move the object in one direction only. If you move your

cursor over the inner corners of the transform gizmo, the plane turns yellow. This lets you move in only one plane at a time.

- Using the transform gizmo, move the orange so it is in front of the apple.

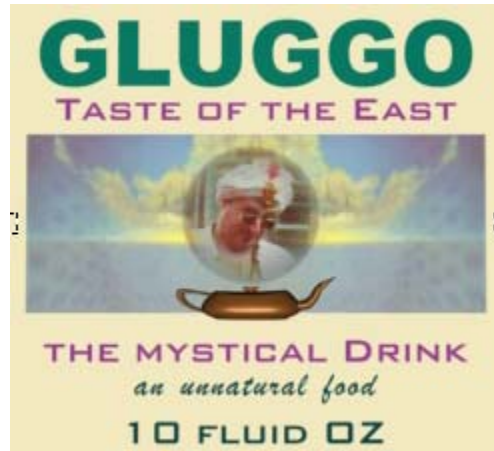


*Transform gizmo used to move the orange*

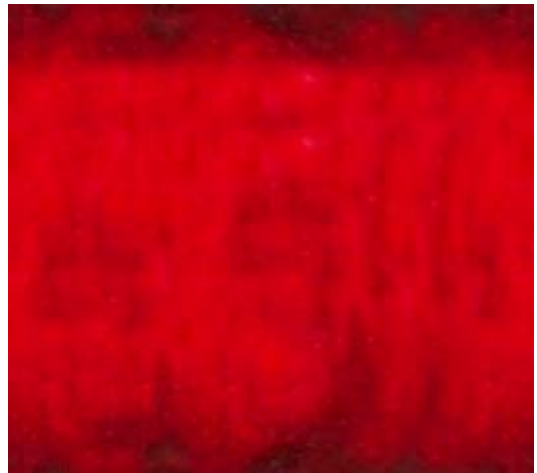
The rendering looked so interesting because of the materials that have been applied to the geometry. Next, you will apply a material to the orange using the Material editor.

## Adding a Material to the Orange

Materials use bitmap images to texture objects in your scene. The bottle label, the leaves, and apple all get their appearance from bitmap texture mapping on the objects in the still life scene. Bitmaps can also be used as other kinds of maps, such as opacity maps (on the leaves, for example).




*Bottle-label texture*



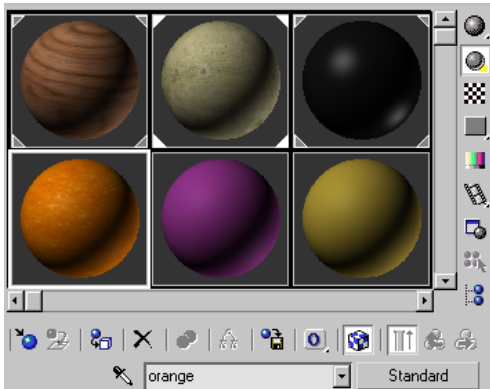
*Apple texture*

### Add an orange material:

-  On the toolbar, click the Material Editor button.

Tip: You can also press **M** on the keyboard to launch the Material Editor.

The Material Editor opens as a floating window.



*Material Editor displays materials.*

2. Locate the material that looks orange in the Material Editor.

It should already be selected, surrounded by a white outline to show it is active. If it isn't active, click it to select it.

Notice that the name of the material *orange* appears in the Material Name field.

This orange material has already been constructed for you. It uses a bitmap as a texture and as a bump map.



*Orange texture map*

3. Drag the *orange* material from the Material Editor sample onto the orange in the viewport.

The orange in the viewport now displays with a speckled fruit skin.

4. Press **F9** on the keyboard to render again. If you like, you can zoom in on the orange, render, then undo the viewport change by pressing **SHIFT+Z**.



*Rendered close-up of orange*

You can find more information on Modeling and Materials in the Modeling and Materials chapters of the online tutorials.

Next you will see how easy it is to create animation using the Auto Key method in 3ds Max 8.

## Animating the Still Life Objects

In this lesson, you will animate the objects. You learn how to make objects fly off screen, much like the network logos you see on television.

You'll do this with keyframe animation, using Auto Key mode. You set the important or key positions for the objects in the scene at different points in time. 3ds Max figures out all the in-between positions.


The procedure consists of three steps. At frame 50, you will rotate the bottle and the knife to create rotation keys for them. You will then position the apple and the orange so they are floating in the air. Then, using the track bar, you will shift the keys around to reverse the animation.


There are three ways to create keyframes. One is to turn on the Auto Key button, move to any point in time, and transform (move, rotate, or scale) the object. A second method of setting keyframes is to right-click the time slider, and then set keys using the Create Key dialog. There is also a Set Key animation mode designed for professional character animators.

You'll use the Auto Key button in this exercise.

#### Animate the position of the orange:

1. Continue with your own scene, or open *still\_life\_with\_orange.max*.


2.  Click the Auto Key button.

 The button turns red. You are now in automatic animation mode.

Tip: The time slider also turns red, and the viewport is outlined in red to remind you that you are in Auto Key mode.

3. In the Perspective viewport, move your mouse over the orange.

After a moment a tooltip appears that says *Orange*.

4.  On the toolbar, click the Select Object button, if it isn't already active, then click to select the orange.
5. The Time Slider is the bar located directly above the Time Scale display below the viewports. Move the time slider to frame 50.
6. Right-click the orange and choose Move from the transform quad menu

In all viewports, you see the transform gizmo.

7. As you move your mouse over the Transform gizmo, the different axes highlight one at a time. When the Z-axis highlights, click and hold the left mouse button, and drag the orange straight up in the Perspective viewport until it is almost out of view. Release the mouse button.



Because you're working in animation mode, you have now set a key for the orange. Notice that the key appears as a red square in the line below the time slider.

8. Move the time slider back and forth from frame 0 to frame 50, and watch the orange rise up from the wooden counter.

Note: If you still have one of the viewports set to Camera01, you will see the animated view of Camera01.

#### Animate the rotation of the bottle:

1. Return to frame 50.
2. In the Perspective viewport, click the bottle to select it, or press **H** and select the bottle by name.
3. Right-click the bottle in the viewport and choose Rotate from the transform quad.

The transform gizmo appears over the bottle.





As you move your cursor over the transform gizmo, different axes display as yellow. The axes are color-coordinated (red, green, and blue equals X, Y, and Z, respectively).

4. Rotate about the Y-axis approximately **127** degrees so the bottle is upside down, with the bottle bottom up in the left-hand corner of the viewport. (See illustration).

You can see the X,Y,Z values displayed in yellow above the transform gizmo as you rotate the bottle. These values also appear in the Coordinate Display below the viewport.

Tip: You can enter values directly in the coordinate fields for precision in your work.



*Bottle rotated 127 degrees about Y-axis*

5. Again move the time slider back and forth from frame 0 to frame 50 to observe the animated effect.

You'll repeat this for the knife and the apple.



6. Return the time slider to frame 50. Then select the handle of the knife in the viewport, or press **H** and select the object name *handle* from the list.

The knife blade is linked to the handle, so when you animate the handle, you'll be animating the knife blade as well.

7. Rotate should still be in effect. If it isn't, click Rotate on the Transform toolbar. Use the transform gizmo to rotate the knife handle around in the viewport. Then right-click and choose Move from the quad menu. Move the handle in Z, then in X, and then in Y so the knife is closer and larger than before in the viewport.
8. Repeat for the apple.



*Rotated still life objects*

9.   In the animation playback controls, press the Go To Start button, then press the Play Animation button.

Watch the animated objects fly up in the air.

10. Turn off Auto Key.

Develop the habit of turning Auto Key off after animating, otherwise you might accidentally create unwanted animation.

### Reverse the animation:

It's a simple procedure to reverse this animation. You'll move keys in the track bar to accomplish this.

1. Press **H** on the keyboard.

The Select object dialog appears.

2. Hold down the CTRL key and click the bottle, apple, orange, and handle in the list. Then click Select.


The objects are displayed with selection brackets in the viewport. The keys for all the animated objects are displayed on the track bar.

3. In the track bar, drag a selection rectangle around the keys at frame 0.

The keys turn white on the track bar to show they are selected.

4. Hold down the SHIFT key and drag the keys from their position at frame 0 to frame 100

This creates a copy of the keys from frame 0 to frame 100.

5.  Press the Play Animation button in the VCR controls to see the animation you've created

The still life objects fly up and around at frame 50 and then return to their positions at frame 100. The animation loops because the position and rotations at frame 0 and 100 are the same.

6. Save your scene as **my\_still\_life\_animated\_loop.max** to your folder on your local drive.

### Experiment with changing the animation:

You can change the animation so the objects fly in from off screen.

1. With all four objects still selected, select the keys at frame 0 as before. Delete with the DEL key.

An animation range bar appears below the keys in the track bar. If you do not see an animation range bar appear, place the cursor over the Scale Time button and right-click. Choose Configure from the menu and then choose Show Selection Range.

2. Click and drag the range bar to the left, so the animation starts at frame 0 and ends at frame 50.

Again play the animation.

Tip: Depending on how you rotated your objects, you might need to recreate the rotation keys if the objects no longer spin the way you want them to. To do this, go to frame 0 and, with the Auto Key button on, rotate the objects again.

3. Again save your scene to your local folder, this time as **my\_still\_life\_animated\_flyin.max**.

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## Rendering the Animation

Rendering multiple frames for a complete animation is time consuming, even on fast machines. Each frame is individually processed. Realistic materials, shadow casting, and other factors can slow the process as well. When you're ready to take a break, you can render this animation, then come back after a short time and see the results.

### Render your animation:

To complete this tutorial, render the animation you made earlier. The rendering time is probably under 15 minutes, depending on the speed of your machine.

1. On the menu bar, do the following:

- Choose File > Open to load your saved animations, either *my\_still\_life\_animated\_loop.max* or *my\_still\_life\_animated\_flyin.max*. Or you can open *still\_life\_animated.max*.
  - Choose Rendering menu > Render to display the Render Scene dialog.
2. If you did not save the completed files back to the same tutorial directory, when you select one of your files to open you might encounter a Missing Map / Photometric Files dialog. If you do run into this problem, press the Browse button. The Configure Bitmap / Photometric Paths dialog will appear. Click the Add button. In the Choose New Bitmap Path dialog, navigate to the directory where you loaded the original file. Click the Use Path button. On the Configure Bitmap / Photometric Paths dialog, click OK. On the Missing Map/Photometric Files dialog, click Continue.
  3. In the Render Scene dialog > Output Size group, change the default (640 x 480) to 320 x 240.  
  
This smaller size has only one-quarter the area of the default, making it much faster to render.
  4. In the Time Output group, turn on Active Time Segment.
  5. In the Render Output group, click the Files button. In the Render Output File dialog, name your animation **mystill\_life\_animated.avi**. Click Save to save the animation to the *images* subdirectory.

**Warning:** You must either add the extension *.avi* in the file name, or else select AVI as the file type. If you don't tell the program what type of animation format to save in, the rendering won't work.

Tip: When working professionally it is better practice to not render directly to a movie file format. You should instead render to a sequence of still image files such as TGA or TIF and then

assemble them into a movie using Video Post or the Ram Player. For more information on this method see the Rendering chapters in the online tutorials.

6. In the Video Compression dialog, do the following:
  - If necessary, change the compressor to Cinepak Codec. There are lots of different codecs to choose from. Cinepak generally gives satisfactory results.
  - Set the Compression Quality high, between **90** and **100**.
  - When you're done, click OK.
7. On the Render Scene dialog, notice that the field next to the Files button now shows the location of *mystill\_life\_animated.avi*.
8. At the bottom of the Render Scene dialog, from the list labeled Viewport, select Perspective.  
  
You always want to be sure you're rendering the right viewport.  
  
Tip: Usually you will use a camera viewport, rather than rendering the Perspective viewport. In this case, since the animation was created in the Perspective viewport, you'll use that.
9. Click Render to begin the rendering process.  
  
Watch a few frames to make sure nothing is terribly wrong. The Time Remaining estimate will give you an idea of how long the rendering will take.

#### Play the rendered animation:

1. When your animation is finished rendering, chose File menu > View Image File.  
  
By default, the View File dialog opens in the *images* subdirectory.
2. Highlight *mystill\_life\_animated.avi* and click Open to display the Media Player.
3. Play your animation from the Media Player.

4. If you like the animation, you can render it again at 640 x 480. This will take 4 times as long as the smaller resolution, probably around 30 minutes. Or you can load the other animation file and render that one.

You'll find finished AVI files of both animations (the fly-in and the loop) in the *|tutorials|still\_life* folders if you want to skip the rendering entirely.

## Summary

You have created an animated still life and learned to find your way around the 3ds Max user interface. You've learned viewport navigation, created an orange using primitives, and assigned materials. You've also learned to move objects, animate and render your animation.

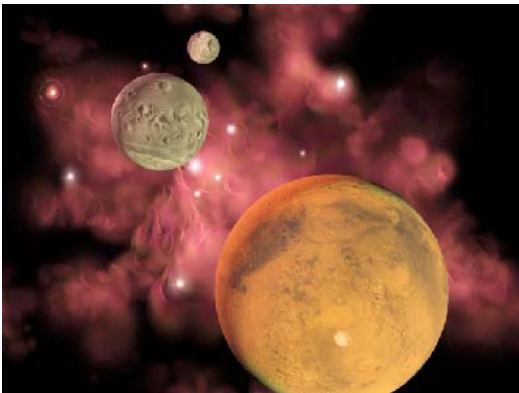


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## Modeling a Space Scene

In this tutorial, you will create a planet and its moons, and an asteroid.



Skill Level: Beginner

Time to complete: 45 minutes

### Features Covered in This Tutorial

- Creating primitive objects
- Moving objects in the scene
- Using a modifier to alter an object's shape

### Tutorial Files

All the necessary files to do the tutorials can be found on the Tutorial Files CD in the *|tutorials|intro\_to\_modeling* folder. Before starting any tutorials, copy the *|tutorials|* folder from the CD to your *|3dsmax8|* local installation.




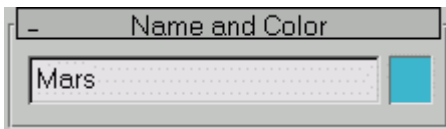
## Modeling the Planets

In this lesson, you will create the planet Mars and its moons. You will also make changes to the objects in the Create panel.

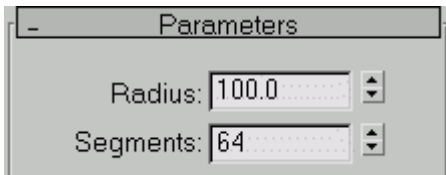
If at any point the object parameters disappear, choose the Select Object tool from the main toolbar and reselect the object. Then open the Modify panel and make your changes there.

### Create the planet:


1. Choose File > Reset. Click Yes in the dialog to reset.
2.  Open the Create panel. Make sure the Geometry button is on, and click Sphere in the Object Type rollout.
3. In the center of the Perspective viewport, drag to create a sphere of any size.
4. In the Name And Color rollout, change the name of the object from Sphere01 to **Mars**.



5. In the Parameters rollout, change the Radius to **100** and set the Segments to **64**.



Increasing the number of segments makes the planet look smoother. This is especially important for close-up shots, where every detail is revealed.


6.  Click Zoom Extents Selected from the Zoom Extents flyout.


The sphere moves back and to the center of the viewport.

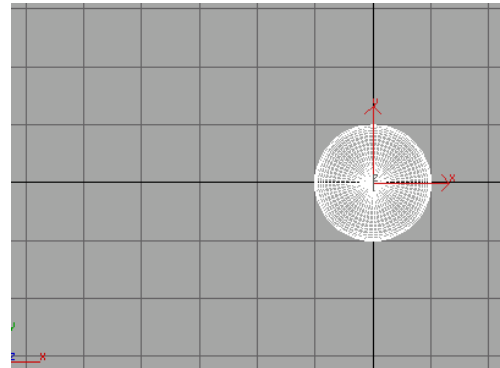
Note: The grid is no longer visible because the size of the grid is fixed and is too small to be displayed after the zoom was performed.

### Create the moons:

Mars has two moons named Deimos and Phobos. Instead of making additional spheres, you can create the objects by cloning.

1.  Right-click in the Top viewport and click Zoom. Place the zoom cursor on the X axis, just to the right of the sphere.
2. Drag downward to zoom out. Stop when Mars looks half its previous size.

Tip:  If necessary, click Pan to move the scene so that you can see Mars in its entirety.

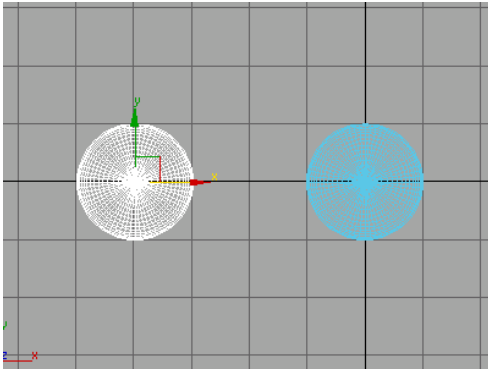


3.  Click Select and Move from the toolbar.

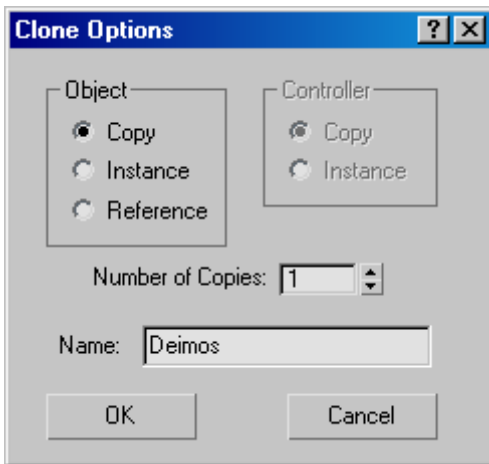
The Transform gizmo appears in the viewport.


Note: If the transform gizmo does not appear, press the keyboard shortcut, **X**, to make it appear.

4. Hold down **Shift** on the keyboard and drag the gizmo's X axis to the left and then release the mouse button.



5. In the Clone Options dialog, leave Copy selected and change the name of the new object from Mars01 to **Deimos**. Click OK.

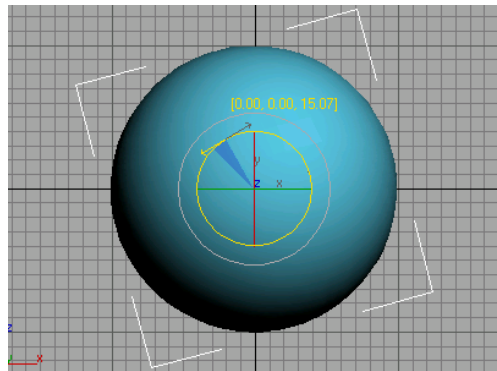


6.  Open the Modify panel and change the Radius parameter of *Deimos* to **22**. Since this object is smaller than Mars, reduce its segments to **24**.
7. Shift-clone the second moon from the Deimos moon using the same process, only this time position the clone closer to Mars. When the Clone Options dialog appears, name this second moon **Phobos**.
8. Set the radius of *Phobos* to **11** so that it is half the size of *Deimos*.




9. Right-click in the Front viewport and pick Select and Rotate from the toolbar.
10. Click *Mars* and rotate it around the Z axis by moving the mouse over the blue transform gizmo ring until it turns yellow. Drag down the left side of Mars until it's rotated about 15 degrees.

Tip: Watch the shaded rotation indicator in the gizmo as you rotate or watch the Z axis field in the coordinate readout below the time bar.



*Mars tilted in a shaded viewport*

11.  Click Zoom Extents All so each viewport displays the planet Mars and its moons, Deimos and Phobos.
12. Save the file as **my\_mars.max**.

To see Mars and the planets with texture maps, open *mars\_texturemapped.max* in the *tutorials\intro\_to\_modeling* folder.

To learn more about materials and mapping, refer to *Introduction to Materials and Mapping* (page 1–114).

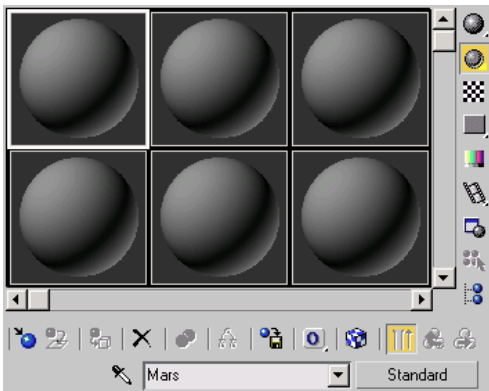
### Map the planet Mars:

To create the illusion of physical texture, you'll build a new material, assign an image as a diffuse map, and then use the same image as a bump map.

1. Continue from the previous lesson.

If you opened *mars\_texturemapped.max* from the *tutorials\intro\_to\_modeling* folder, click File > Open and reload your scene, *my\_mars.max*.

2. Press **M** on the keyboard to open the Material Editor.
3. Select the upper left sample sphere. In the name field, highlight the text then change the name of the material to **Mars**.



*The selected sample sphere and new material name.*

4. In the Shader Basic Parameters rollout, change the shader from Blinn to Oren-Nayar-Blinn.

This gives the sphere a softer look.

5. In the Oren-Nayar-Blinn Basic Parameters rollout, click the blank square button next to the Diffuse color swatch to select a map for the diffuse component. In the Material/Map Browser, choose Bitmap and click OK.

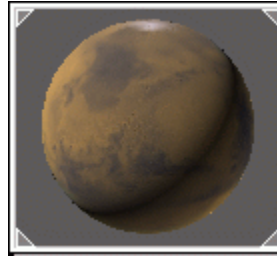
The Select Bitmap Image File dialog opens.

6. Select the map *mars.jpg* from the *tutorials\intro\_to\_modeling* folder and click Open.

The map appears on the sample sphere.

7. Drag the *Mars* material to the planet *Mars*.
8. Right-click the Front viewport label and choose Smooth + Highlights, if it's not already set.

The planet turns gray. In the Material Editor, the corners of the material sample slot turn white, indicating that the material is being used in the scene.



9.  Click the Show Map In Viewport button in the Material Editor.

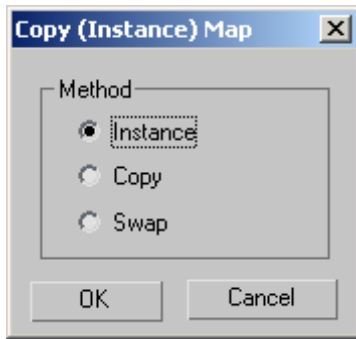
The *Mars* map appears on the surface of the planet in the scene.

10. Highlight the text in the name field and rename the new map in the drop down list to **Mars-Bitmap**.

11.  Click Go To Parent.

The Material Editor navigates up the material hierarchy from the map level to the material level.

12. Close the Oren-Nayar-Blinn Basic Parameters rollout by clicking its title bar. Then click the Maps rollout to expand it. The button next to Diffuse bears the label "Mars-Bitmap (mars.jpg)."
13. Drag the map button from the Diffuse component to the Bump component. When the Copy/Instance Map dialog appears, choose Instance and click OK.



By choosing Instance, any change you make to the bitmap parameters of one map, will automatically be reflected in the other.

14. Set the Bump amount to **−50**.



15. Render the scene.

The surface of Mars appears bumpy.



#### Map the moons:

1. Click and drag the Mars material sample in the Material Editor to an unused sample slot. Rename the new material to **Deimos**.
2. In the Maps rollout, click the button labeled "Mars-Bitmap (mars.jpg)" to navigate to the maps hierarchy.
3. Rename the Mars-Bitmap in the list to **Deimos-Bitmap**.

4. In the Bitmap Parameters rollout, click the Bitmap button to replace the *mars.jpg* image with a new one. In the Select Bitmap Image File dialog, find and select *deimos.jpg*, then click Open.

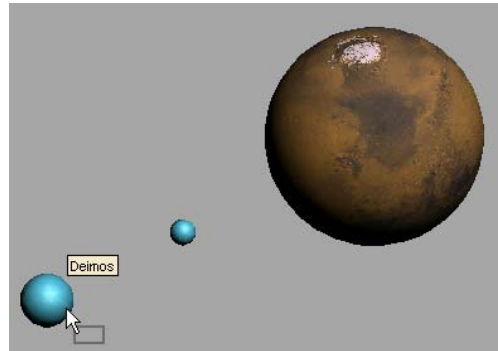


5. Click the Go to Parent button, or select Deimos in the List drop-down, to navigate back up the maps hierarchy.

In the Maps rollout, notice that the Bump map uses the *deimos.jpg* file. This is due to the Instance you made when building the Mars material.

6. Click and drag the Deimos material to the Deimos object in the scene.

Tip: If you're not sure which sphere is Deimos, watch for the object label to appear when you drag your cursor over an object.

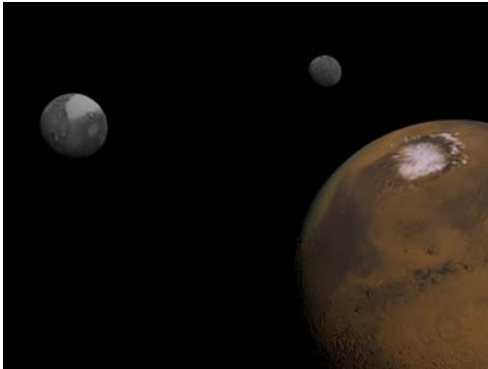


The object label confirms you're about to apply the material to Deimos.

7. Repeat these steps for the moon, Phobos. Use the *phobos.jpg* file as the new diffuse map.
8. Right-click the Perspective viewport and use the view navigation tools to arrange your scene.



9. Render the scene.



10. Save your scene as **my\_mars\_and\_moons.max**.

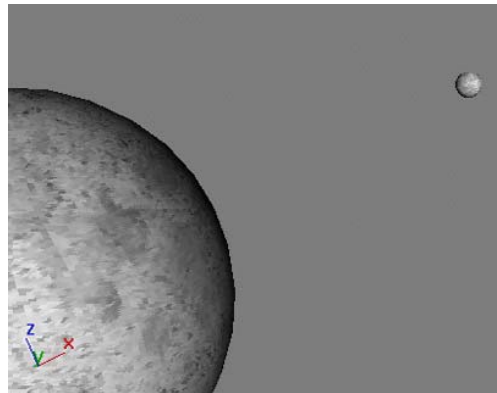
## Creating an Asteroid


Modifiers can be used to alter the shape of a primitive object. In this lesson, you will use a modifier to distort a sphere into an irregular shape to form an asteroid.

### Set up the lesson:

1. Open *asteroid1.max* from the `|tutorials|intro_to_modeling` folder.

In a single viewport, you see two spheres, one large and one small.




2.  Click the Min/Max Toggle in the viewport controls to show four viewports.


Tip: You can also toggle the Min/Max view by means of the keyboard shortcut, **ALT+W**.

### Create an asteroid using the Noise modifier:

1. Select the larger sphere.
2. In the Name And Color rollout, change the name from Sphere01 to **Moon**.
3. Select the smaller sphere and rename it **Asteroid**. Press ENTER.
4. Press **P** to switch the Camera viewport to a Perspective viewport.

5.  Make sure the Asteroid object is still selected. On the Zoom Extents flyout, choose Zoom Extents Selected.

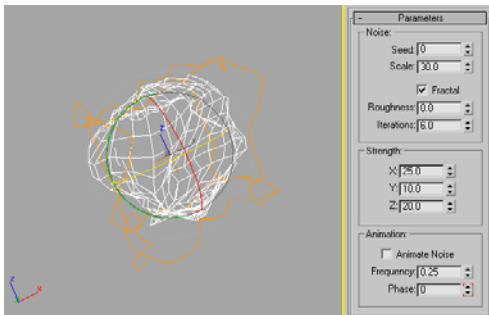
The asteroid is zoomed in to fill the Perspective viewport.

6.  Open the Modify panel. In the Modifier List, choose Noise from the Modifier List.

The Noise modifier creates random distortion on an object's surface.

7. In the Noise Parameters rollout, turn on Fractal and set the Scale to **30**. Then set these values for Strength: X to **25**, Y to **10**, and Z to **20**.

The object deforms to look like an asteroid.



#### Experiment with the asteroid:

1. Change the Seed value.

This changes the random displacement of the surface, giving you a totally different shape.



*Changing the Seed yields different shapes.*

2. Try applying some other modifiers to the object, such as Bend, Taper, Twist, and Stretch. Experiment with the parameters to see the variety of shapes you can make.
3. Save your file as **my\_asteroid.max**.

## Summary

In this tutorial, you learned how to model a scene using primitives and modifiers. You also learned how to add materials to the objects. These tools are the building blocks for any scene in 3ds Max.

## Creating a Realistic Hourglass

In this tutorial you will learn to model a realistic hourglass using primitive objects and modifiers. You'll use cylinders and hose objects combined with Free-Form Deformation (FFD), Taper, and Slice modifiers. You'll even create the flow of sand using a particle system.



Skill Level: Beginner

Time to Complete: 40 minutes

### Features Covered in This Tutorial

- Using Taper, and FFD modifiers to shape the hourglass.

- Using an animated Slice modifier to create the shifting sand level, in the upper globe of the hourglass.
- Using a Particle system to create the falling sand in the lower globe of the hourglass.
- Using an animated hemisphere to create the sand piling up.

### Tutorial Files

All the necessary files to do the tutorials can be found on the Tutorial Files CD, in the `tutorials\hourglass` folder. Before doing the tutorials, copy the `tutorials` directory from the CD to your `3dsmax8` local installation.

### In This Tutorial

*Creating a Tapered Cylinder (page 3–35)*

*Adding a Free-Form Deformation (page 3–38)*

*Adding the Caps Using Auto Grid (page 3–41)*

*Adding the Posts Using Hose Objects (page 3–43)*

*Adding Materials (page 3–44)*

*Creating Glass and Sand Materials (page 3–46)*

*Animating the Sand Level with Slice Modifiers (page 3–48)*

*Animating the Falling Sand (page 3–50)*

*Creating the Sand Build-Up (page 3–53)*

*Adding a Camera (page 3–55)*

*Adding Default Lights to the Scene (page 3–57)*


*Rendering Your Work (page 3–58)*


## Creating a Tapered Cylinder


You'll start by building the chamber that will contain the sand using a cylinder and then add a taper modifier. Using the symmetry and curve

parameters, you'll create the approximate shape of an hourglass.

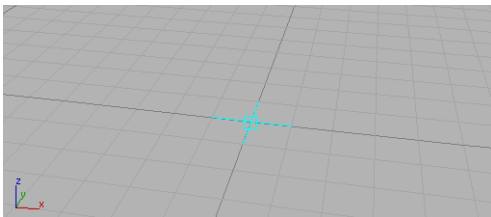
1. Restart 3ds Max by choosing File > Reset.

2.  Click the Min/Max Toggle button found in the view navigation tools at the lower right corner of the user interface. This switches from a display of four, small viewports to a single, large one. The currently active viewport is the one that is enlarged, in this case the Perspective viewport.

3.  On the Create panel click Cylinder.

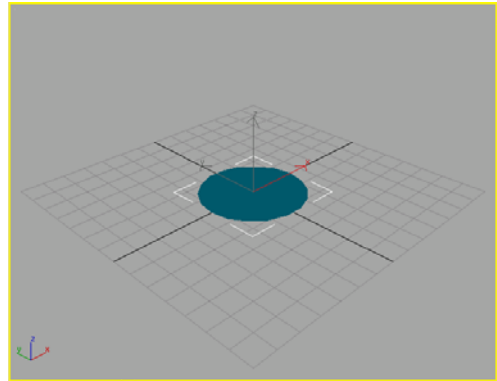
4.  Right-click the Snap Toggle button to open the Grid and Snap Settings dialog and make sure the Grid Points snap setting is active and all other snap settings are turned off. Close the Grid and Snap Settings dialog.

5. Press **S** on the keyboard to turn on Snaps. As you move your cursor in the viewport you will see the blue snaps icon displayed as you pass over the grid points.



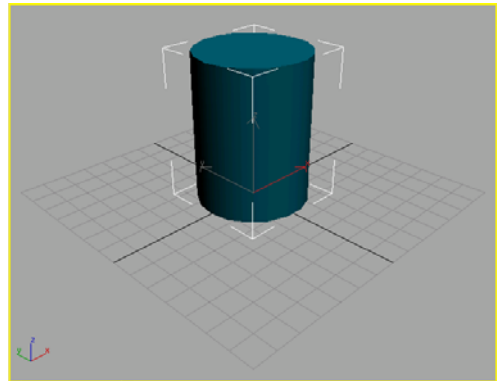
*Snap Cursor.*

6. When your cursor is snapped to the center of the grid, click the mouse button and drag outward to begin creating a cylinder. Press **S** again while you are dragging to toggle snap off. Using Snap in this fashion lets you create the cylinder exactly in the center of the grid, but you can make the radius any amount you want by turning snap off in the middle of the action.





*Drag outward to set the cylinder's radius.*

7. Drag out any radius you want, then release the mouse button and drag upward. Now you are setting the height. Click to finish.



*Drag upwards to set the cylinder's height*

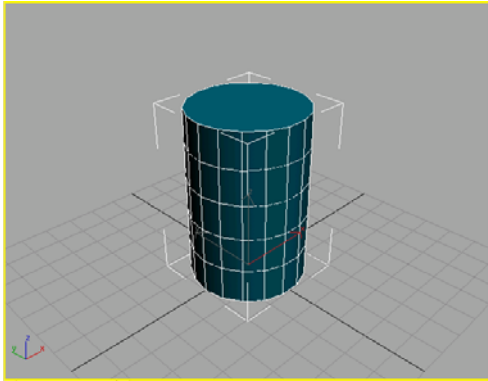
It doesn't matter what radius and height you create now because you will later change them.

8.  Click the Zoom Extents button to center the scene in the viewport.
9.  On the Modify panel, in the Parameters rollout, change the Cylinder Radius to **20** and the Height to **60**. You can either type the values or use the spinner.

Tip: Use the Tab key to move from field to field as you type the values.

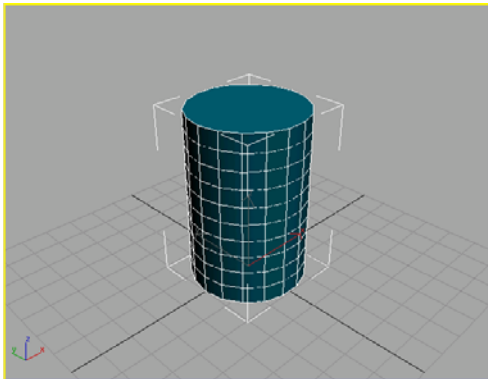


10. Right-click the Perspective viewport label and choose Edged Faces from the menu. You should see the height segments as well as the shaded faces.



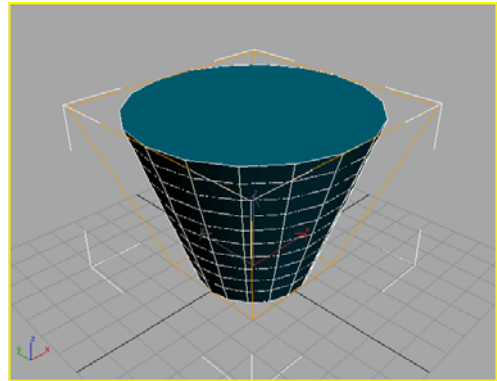
*Edged Face display*

11. Increase the cylinder's Height Segments to 10.




*Additional height segments displayed on the cylinder.*

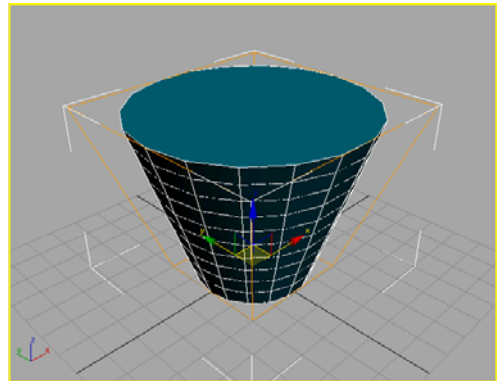
12. From the Modifiers menu, select Parametric Deformers > Taper. The Parameters rollout shows the default Amount setting of 1.



*The cylinder tapers in the viewport.*

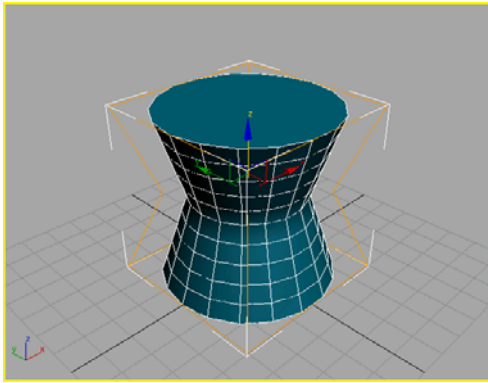
13.  In the modifier stack, click the plus button to expand the stack, then click Center.

The Center tripod is visible in the viewport, as well as the orange taper gizmo.



*Taper center*

14. On the Parameters rollout, in the Taper Axis group turn on Symmetry, then move the center gizmo upwards in the viewport. Use the transform gizmo to move in the Z direction. Move your cursor over the transform gizmo. When the blue Z axis turns yellow, drag upwards to move the taper center about halfway up the height of the cylinder. Release the mouse button to place the gizmo center.



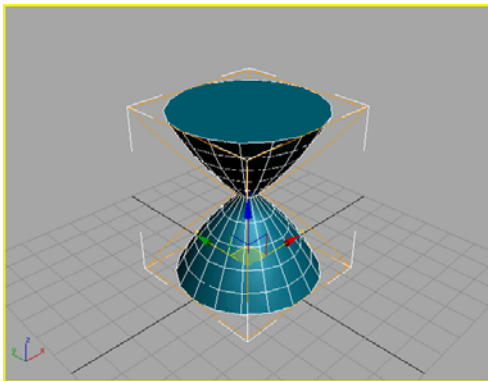
*Move the Taper center.*

15. Type **30** in the Z field of the Coordinate Display at the bottom, just to the left of the Set Keys button. This places the gizmo precisely at the center of the cylinder's height.

16. In the modifier stack, select Cylinder. This lets you make changes to the original cylinder parameters.

On the Parameters rollout of the Modify panel, reduce the radius of the cylinder to **3**.

17. Click Taper in the modifier stack, then on the Parameters rollout increase the Taper Amount to **10** and set the Curve amount to **10**.



*Increased taper and maximum curve amount.*

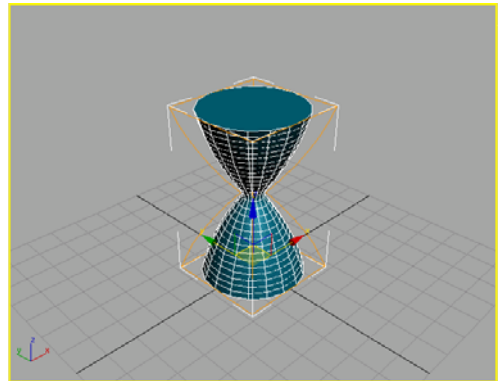
Two more adjustments will make this look more like an hourglass.

**Tip:** If you don't see the taper when you highlight the Cylinder, turn on the Show End Result on/off toggle button at the bottom of the modifier stack display.

18. Select Cylinder from the modifier stack and increase the Height Segments to **29**.

By creating an odd number of height segments, you create a small band around the center of the hourglass.

19. Select Taper from the modifier stack and reduce the amount of Taper to **5**.



*The chamber is taking shape.*

20. Save your work. Choose File > Save and save your scene as **MyHourglass.max**.

Although the object is beginning to look more like an hourglass, it still needs some refinement. In the next lesson, you'll add an FFD modifier that will allow you to narrow the passage where the sand will flow from the upper chamber to the lower one.

## Adding a Free-Form Deformation

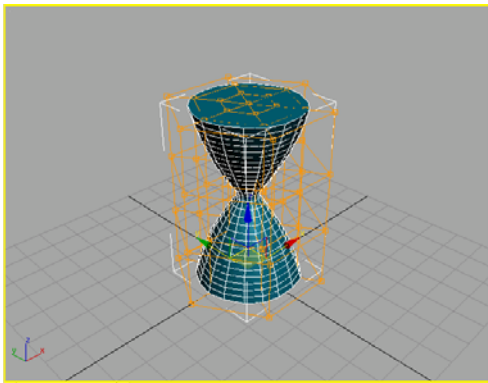
The Free-Form Deformation (FFD) modifier provides a lattice of control points that let you deform geometry.

Continue from the previous lesson or load *sands\_of\_time1.max* found in the *tutorials\hourglass* directory.

1. On the Modify panel, open the Modifier List and choose FFD(cyl).

Tip: To quickly locate *FFD(cyl)*, press **F** from the keyboard to cycle through all the modifiers that begin with the letter 'F'.

The FFD gizmo is applied to the tapered cylinder.



*Free-Form Deformation Lattice enclosing the cylinder.*


2. On the FFD Parameters rollout, in the Dimensions group, click Set Number Of Points. On the Set Dimensions dialog, increase the Height to **15** and click OK.

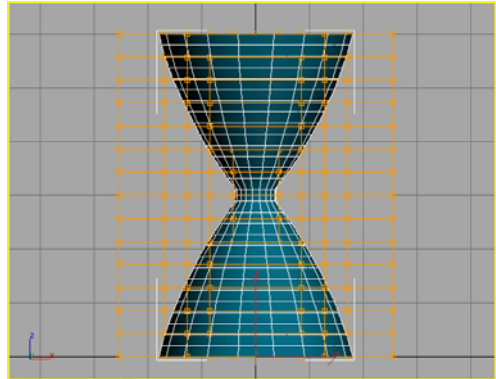
Now there are many more lattice control points to work with.

3. Click the Min/Max Toggle to reset the display to four viewports. Then right-click the Front view.


Note: Activating a viewport by right-clicking in it will not deselect any selected objects. Left-clicking will activate the desired viewport but deselect any objects.

4. Right-click the Front viewport label and turn on Smooth + Highlights and Edged Faces.


5.  From the view navigation tools, click Zoom Extents so that you can zoom in on the FFD Lattice.

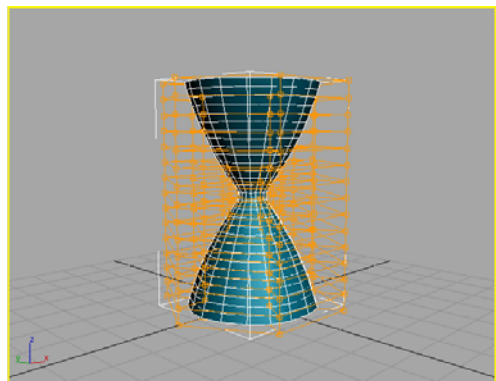


*Front view of lattice.*

6.  On the modifier stack, click the plus button next to FFD(cyl) to expand it. Select Control Points.

Tip:  If the modifier stack is blank, click the Select Object button on the toolbar, and select the cylinder.

7.  From the view navigation tools, turn on Arc Rotate, then rotate the perspective viewport so you can see the grid behind the hourglass.



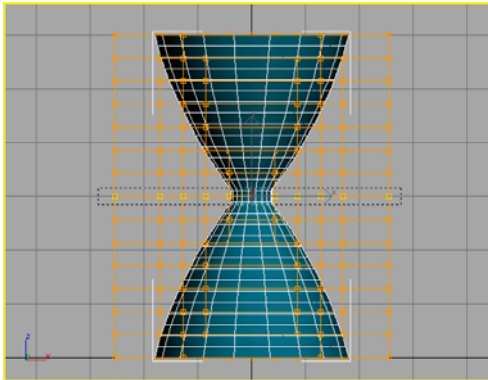
*View grid behind the hourglass.*

It's important to use a 3/4 view so that you will be able to see the transform corners when they appear.


Now, you'll select the vertices in the Front view, so you're sure to get horizontal rows, then scale the vertices using the transform gizmo in the Perspective view.

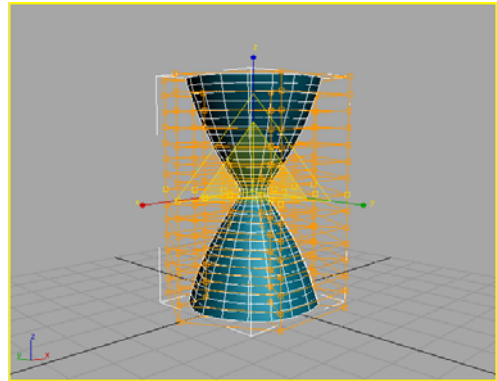
8. In the Front viewport, drag a selection rectangle around the middle horizontal row of control points.

The control points become outlined in yellow to show they are selected. You are selecting the points in the Front viewport



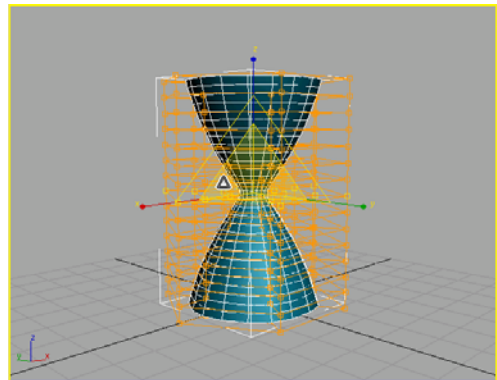
*Select the middle row of FFD control points.*

9.  On the toolbar, turn on Select and Uniform Scale. Right-click in the Perspective viewport to activate it without losing the selection you made in the Front viewport.
10. Press the plus key on the keyboard three times to increase the size of the transform gizmo. Now you can see the three sets of transform corners and plane handles.

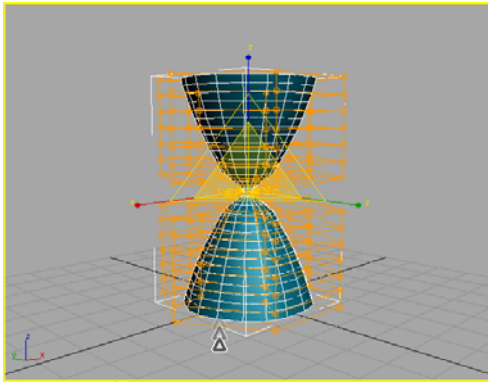


*Scale the transform gizmo display.*

11. To scale the vertices of the lattice in the Perspective viewport, move your mouse over the inner set of triangular plane handles. When the scale cursor appears, click and drag downward. As you move the cursor, watch the coordinate display change. Release the mouse button when the X, Y, Z fields display 30.



*Scale cursor appears over the inner plane handle.*



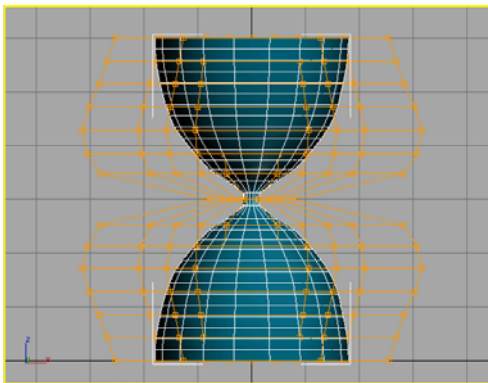
*Drag downward to deform the center.*

To refine the shape of the hourglass, you'll need to repeat this process on all the horizontal rows of control points, scaling two rows at a time. This is a two-step process:

- Selecting the rows of vertices in the Front viewport.
- Scaling in the Perspective viewport.

To select the control points, drag a selection rectangle around a row, then press the CTRL key and select the corresponding row in the opposite half of the hourglass. Select each pair of rows then scale them in varying amounts to create the hourglass shape.

Here is the shape you are trying to achieve.

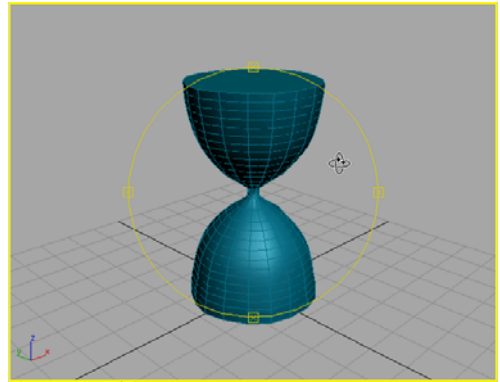


*FFD lattice scaled from the front.*

12. When you are finished, turn off the Control Points level in the modifier stack left-click in the Perspective viewport to deselect the object.



13. Turn on Arc Rotate, click inside the yellow circle, then drag the cursor around to view the object from different angles. It's good to look at objects from all sides while you work.



*Sculpted object.*

14. Save your work as **MyHourglass1.max**.

The next stage in transforming the hourglass involves adding the caps and posts.

Tip: You could more easily create an hourglass by drawing a shape and then using a Lathe modifier to make it 3D. Because the purpose of this tutorial is to learn about modeling with primitive objects and using FFDs, we have taken a different approach.

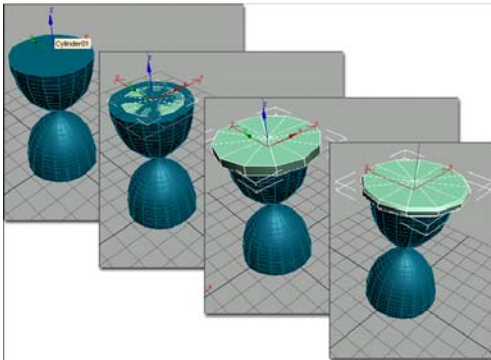
## Adding the Caps Using Auto Grid

The Auto Grid tool lets you create an object aligned to the surface of another one. For this part of the exercise, you'll use Auto Grid to create a cap for the top of the hourglass.



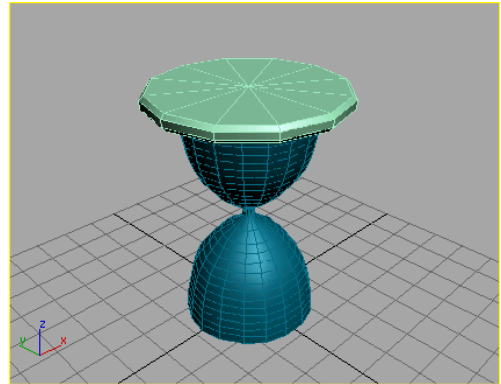
1. Turn on Arc Rotate, then drag the cursor around to view the object so that the top part of the hourglass is clearly visible.

2. On the main menu, choose Create > Extended Primitives > Chamfer Cylinder.
3. At the top of Object Type rollout on the Create panel, turn on the Auto Grid Toggle.
4. Move your cursor over the top of the hourglass. A small tripod should appear, which follows your mouse. Press and drag outward to set the radius of the Chamfer Cylinder, then release the mouse button and continue dragging upward to set the height and chamfer.



*Use Auto Grid to create one object on the surface of another.*

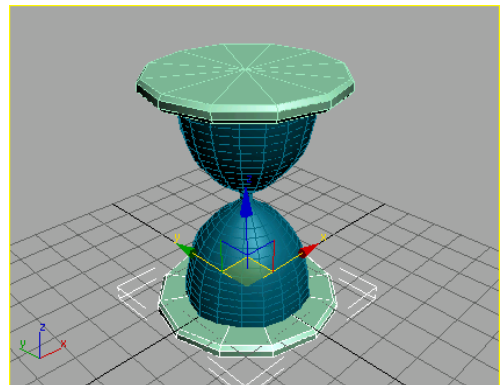
5. In the Parameters rollout, set Fillet to 1.  
Next, you need to align the Chamfer Cylinder so that it is centered over the hourglass.
6. Make sure the Chamfer Cylinder is still selected. From the Tools menu choose Align, then click the Cylinder (the hourglass object) in the Perspective viewport.
7. In the Align Selection dialog, turn on X Position and Y Position, then click OK.  
The Cylinder Cap is now centered over the top of the hourglass shape.
8. In the Parameters rollout, adjust the radius so there is room for the posts. Try a Radius of 26. Depending on how you scaled the FFD controls, you might need to change the radius.



*Add the cap of the hourglass using Chamfer Cylinder.*

Although you can repeat the process to create the bottom cap, we'll use a simpler method.

9. Select the Chamfer cylinder, then on the Tools menu, choose Mirror.
10. On the Mirror dialog, in the Clone Selection group, turn on Instance. Set the Mirror Axis to Z, and use the spinner to adjust the Offset to -60. Click OK.



*Create a clone by using Mirror with Offset.*

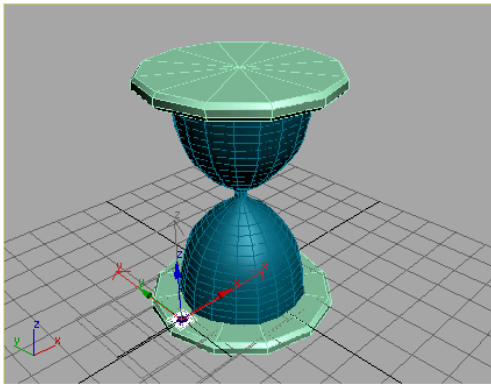
11. Choose File > Save As to save your work as **MyHourglass2.max**.



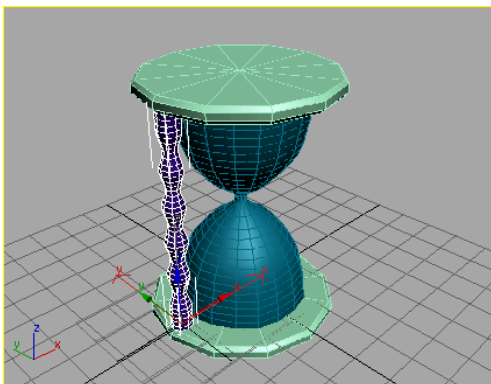
## Adding the Posts Using Hose Objects

You can build the posts using an extended primitive called a Hose object. This makes it simple to create nice looking posts.

1. On the menu bar choose Create > Extended Primitives > Hose.
2. From the Create panel > Object Type rollout, turn on the Auto Grid Toggle, if it's not already on.
3. Move your cursor over the bottom chamfer cylinder. The Auto Grid tripod displays. Press and drag to set the radius of the hose.

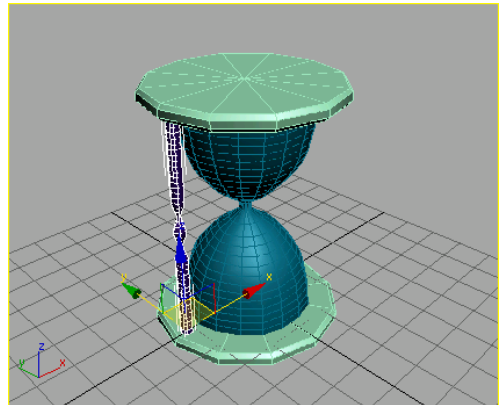


4. Release the mouse button and drag upward to set the height of the post.



Now you can adjust the hose parameters to modify its appearance.

5. In the Common Hose Parameters, set the following values:
  - Starts: **37**
  - Ends: **64**
  - Cycles: **2**
  - Diameter: **-36**
6. In the rollout, scroll down to the Hose Shape group. Make sure Round Hose is turned on, and then set the following values:
  - Diameter: **3.5**
  - Sides: **6**



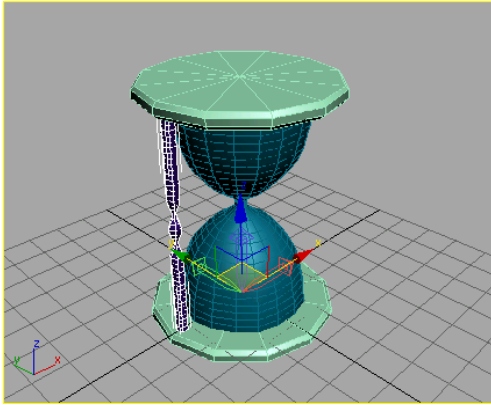
*Hose object used to create a post.*

With the post created, you can now clone it using one of several ways. Here you will align the hose object's pivot point to match the pivot point of the chamfer cylinder. Then you'll use SHIFT+Rotate to create the other posts.

7. On the Hierarchy panel, in the Adjust Pivot rollout, click to turn on Affect Pivot Only.
8. On the menu bar choose Tools > Align, then click the bottom chamfer cylinder.
9. In the Align Selection dialog, turn on X Position and Y Position in the Align Position



group. Click OK. The pivot is now positioned as shown in the illustration.

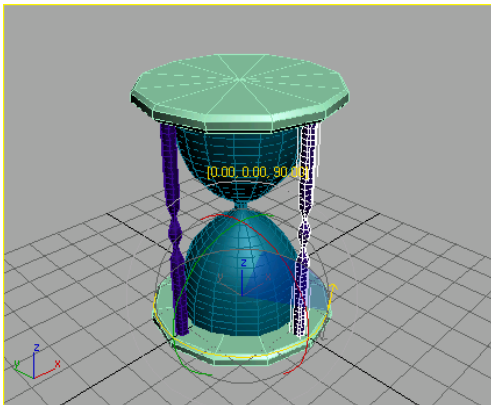


*Align the hose pivot with the chamfer cylinder.*

10. In the Adjust Pivot rollout, turn off Affect Pivot Only.



11. On the toolbar, turn on Select and Rotate. Hold down the SHIFT key and move your cursor over the Transform gizmo for the post (displayed where the new pivot is located). When the Z axis ring turns yellow, rotate the post. As you move the mouse, watch the coordinate display until it reads 90 degrees, then release the mouse button.

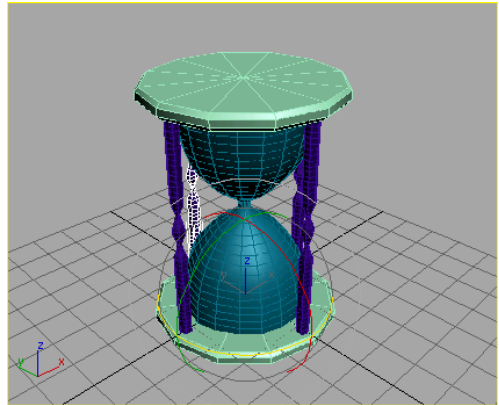


*Rotate the hose 90 degrees.*

Tip: To increase precision, you can turn on the Angle Snap by pressing the **A** keyboard shortcut.

12. In the Clone Options dialog, make sure Instance is turned on, then set the number of copies to 3. Click OK.

There are now four posts displayed in the viewport.



*Clone using SHIFT+Rotate.*

13. Save your work. On the menu bar choose File > Save As, and save the model as **MyHourglass3.max**.



Now that you've built a basic hourglass, you'll add some materials to give it some realism. After making the glass chamber transparent, you'll create the sand contained within the chamber.

## Adding Materials

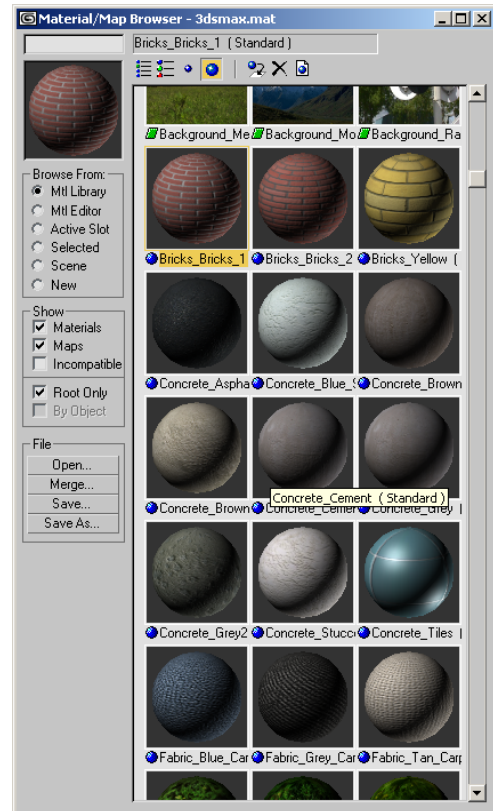
You can create your own materials or open materials that exist in another file. You'll do both in this next section.

Continue from the previous lesson or open *sands\_of\_time2.max* from the *|tutorials|hourglass* folder.

### Open existing materials from a library:

1.  On the toolbar, click the Material Editor button.  
You can also open the Material Editor by typing to keyboard shortcut, **M**.
2.  Click the Get Material button in the Material Editor.  
The Material/Map Browser appears.
3. In the Material/Map Browser, in the Browse From group, choose Mtl Library, then click File > Open at the bottom.
4. In the Open Material Library dialog, navigate to the *matlibs* folder and choose *3dsmax.mat*. Click Open.

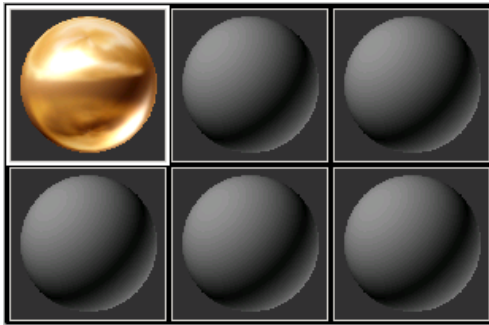
The Material/Map Browser fills with materials.



Large icons in the Material/Map Browser.

There are many interesting textured materials in this library. When you have time, look through them so that you can learn about these materials. For this exercise, you'll open two materials that you'll apply to the hourglass.

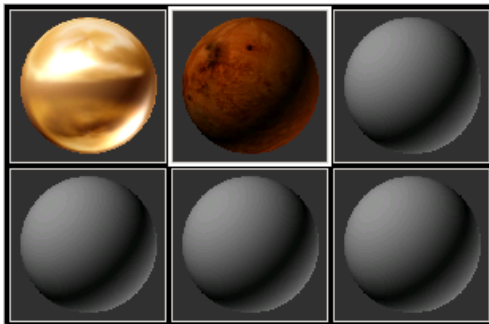
5. Scroll through the materials until you see *Metal\_Dark\_Gold*. Double-click that material so that you can see it in the Material Editor.



*Get Metal\_Dark\_Gold material from a file.*

Next you'll locate a Wood material.

6. In the Material Editor, click the top-middle sample sphere to activate it. Then click Get Material and scroll through the materials until you find *Wood\_Burloak*. Double-click that material to transfer it to the Material Editor.




*The Wood\_Burloak material is added to the Material Editor.*

7. Close the Material/Map Browser.

You'll now find out how easy it is to add these materials to the objects in the scene.

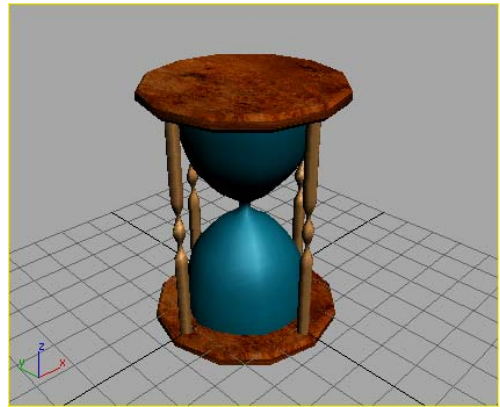
#### Add the materials:

1. In the viewport, select either the top or bottom cap of the hourglass.
2.  In the Material Editor, click the Assign Material To Selection button. The Wood

material appears on the cap in the viewport. Repeat the process for the other cap.

You can also drag materials from the Material Editor and drop them onto the objects in the viewport. The objects don't even have to be selected first; just drag right onto them.

3. In the Material Editor, click the sample slot that contains the *Metal\_Dark\_Gold* material, and drag the material to all of the posts.
4. Right-click the Perspective viewport label and turn off Edged Faces.



*The Wood\_Burloak and Metal\_Dark\_Gold materials applied to the hourglass.*

You've opened some pre-made materials for gold and wood. Now you'll make your own materials for glass and sand.

## Creating Glass and Sand Materials

In this lesson, you'll make a transparent material to simulate glass and a new solid material to represent sand. For the glass materials, you'll add transparency falloff and increase the glossiness, then make the material two-sided so you can see through to the inside of the glass.


1. Click the upper-right material sample slot in the Material Editor to activate it.

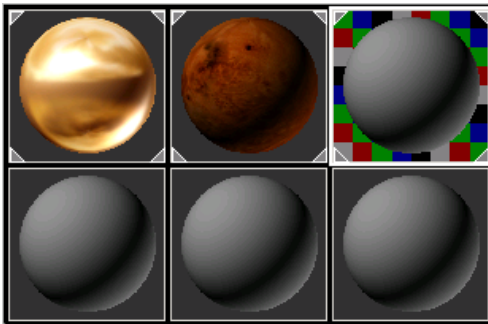
- In the Material name field, name the material **Glass**.

Giving your materials logical names helps you keep track of what you've made. Any materials that you make can be stored in custom material libraries so you can reuse them in the future.

- Drag the material onto the hourglass in the viewport.

The hourglass should turn gray; the same as the sample sphere.

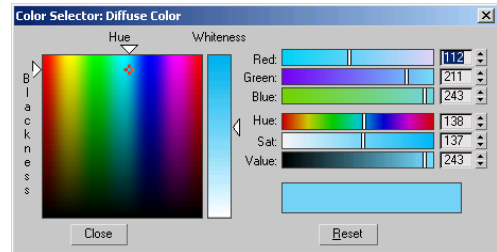
-  In the Material Editor, click the Background button (right side of sample spheres). A checkered background displays behind the purple sphere. This background is helpful in seeing transparencies in materials.



There are four options you need to adjust before the material will start to look like glass. You'll change the opacity, the color, the specular values, and set it to be two-sided.

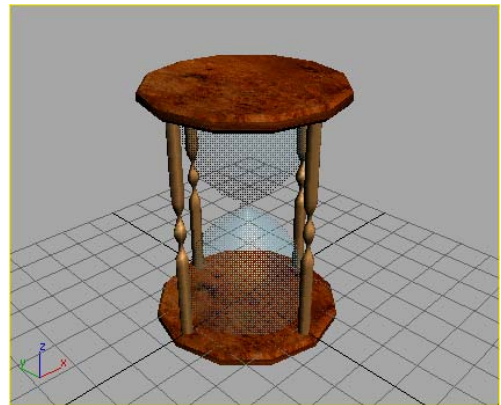
- In the Blinn Basic Parameters rollout, set the Opacity value to **22**.
- In the same rollout, click the Diffuse color swatch. In the Color Selector dialog, choose a light blue color. If you prefer, you can type these values into the Red/Green/Blue (RGB) fields at the right, then click Close:
  - Red: **112**
  - Green: **211**

- Blue: **243**



*Changes to the material are automatically reflected on the model.*

- In the Specular Highlights group, increase the Specular Level to **88**, and the Glossiness to **33**.



*Glass material.*

In the Options rollout, turn on 2-Sided.

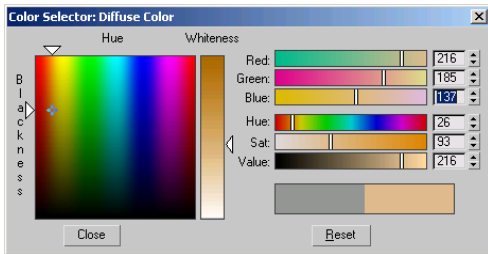
This option controls the visibility of the inside of the hourglass so that it displays.

**Note:** There is one additional setting for this glass, but it won't be visible until you render the file to a bitmap image.

- In the Material Editor, open the Extended Parameters rollout. Set the Falloff value to **In**, and Amount to **88**.

You'll now create the sand material, which is easy to do because it doesn't require as many settings as the glass material.

9. Click the sample slot in the lower-left corner to activate it. In the Material name field, type the name **Sand**.
10. Click the Diffuse color swatch. In the Color Selector, choose a light brown color or enter these RGB values:
  - Red: **216**
  - Green: **185**
  - Blue: **137**



The Red/Green/Blue settings for sand.

11. Save your scene as **MyHourglass4.max**.

Now that the Glass and Sand materials are created, you'll create the sand in the hourglass. Once you've created it, you'll apply the sand material.

## Animating the Sand Level with Slice Modifiers

The Slice modifier is a handy tool for creating the sand in the upper chamber of the hourglass. You'll use two Slice modifiers, and then animate the Slice gizmo to create the effect of the sand level sinking in the glass.

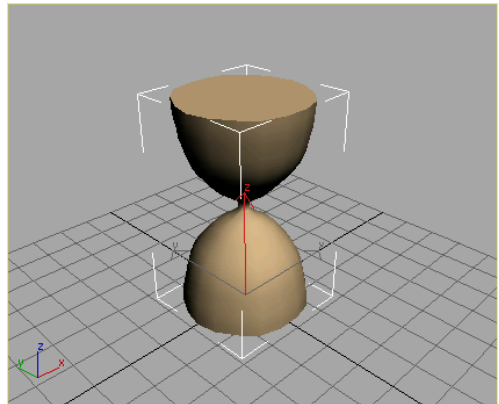
1. Select the tapered cylinder object in the viewport.
2. On the menu bar, choose Edit > Clone.  
The Clone Options dialog appears.
3. In the Clone Options dialog, click Copy, and then name the clone **Sand in upper globe**. Click OK.

4. Right-click the Perspective viewport and choose Hide Unselected. Everything should be hidden in the viewport except for the *Sand in upper globe* object.



5. In the Material Editor, click the Assign Material To Selection button.

The object in the viewport is assigned the sand material.



Sand material on object in viewport.

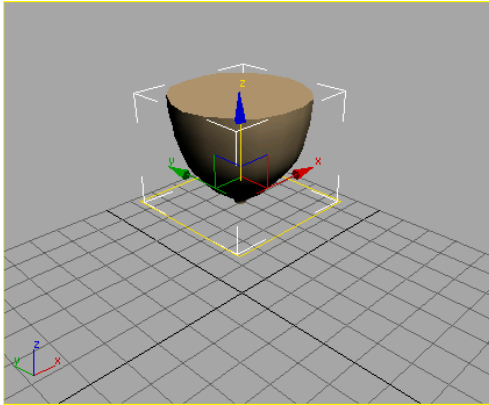
6. Go to the Modify panel. In the modifier stack, click to highlight the FFD(cyl) modifier, then on the menu bar, choose Modifiers > Parametric Deformers > Slice.

The Slice plane is displayed in the viewport.

7. In the stack display, expand the Slice modifier's hierarchy, and highlight Slice Plane.
8. In the Slice Parameters rollout, turn on Remove Bottom.



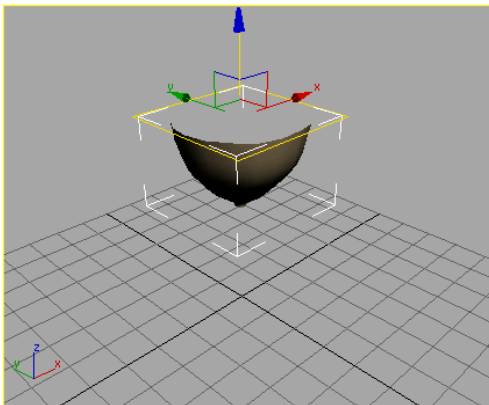
9. On the toolbar, click to turn on the Select and Move button.
10. In the viewport, select the Z arrow of the Transform gizmo and move the mouse upward so that the Slice plane causes the lower half to disappear entirely from view.



*Slice plane with remove bottom turned on.*

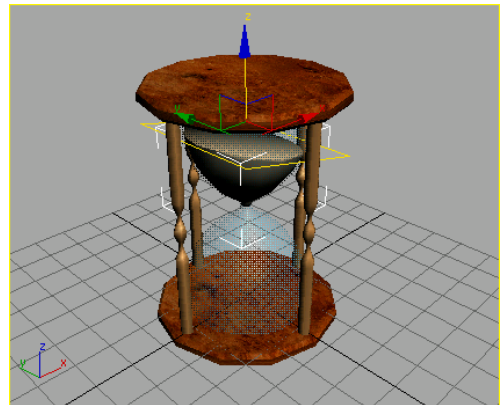
Tip: If Necessary, watch the other viewports to gauge how much slicing occurs.

11. In the modifier stack, click Slice again to deselect the Slice Plane. Now right-click the stack display, choose Copy, right-click again and choose Paste.  
A second Slice modifier appears in the Stack above the original.
12. Expand the Slice modifier's hierarchy, and highlight Slice Plane.
13. Move the Slice plane two-thirds up the globe, and then in the Slice Parameters rollout change Slice Type to Remove Top.





*Second Slice plane removes top.*

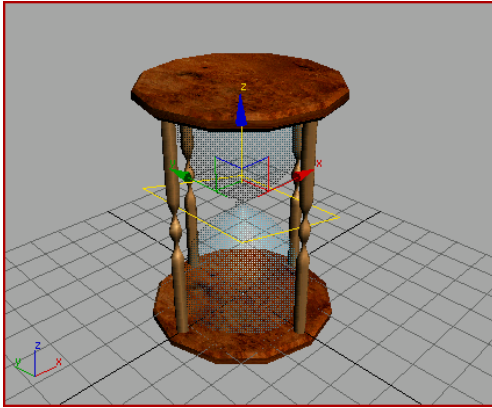
14. Select the Slice at the top of the modifier stack, and then on the menu bar, choose Modifiers > Mesh Editing > Cap Holes.
15. In the Parameters rollout, turn on Smooth With Old Faces.
16. Scroll down to the bottom of the modifier stack and select Cylinder, then reduce the Radius to 2.8.  
This will make the sand look like as if it's inside the glass.
17. Right-click in the viewport and choose Unhide All.
18. On the toolbar, click Select and Rotate. In the modifier stack, select the uppermost Slice Plane. Rotate the Y axis of the gizmo so that the level of the sand looks a little uneven.





*Sand made using Slice Plane and Cap Holes modifier.*

19.  Click to turn on the Auto Key button.
20. Move the time slider to frame 100. In the modifier stack, highlight the top Slice Plane.
21.  On the toolbar, click Select and Move button. Then move the Slice Plane downward along the Z axis of the Transform gizmo in the viewport until the sand completely disappears.





*The sand has disappeared.*

22.   Turn off the Auto Key button, then click the Play button.

The sand level in the upper globe slowly descends.

23. Save your work. Choose File > Save As and save your file as **MyHourglass5.max**.

Next, you'll create the illusion of the falling sand by using the Snow particle system.

## Animating the Falling Sand

Particle systems create effects that would be too laborious to make using geometry.

### Create the particle system:

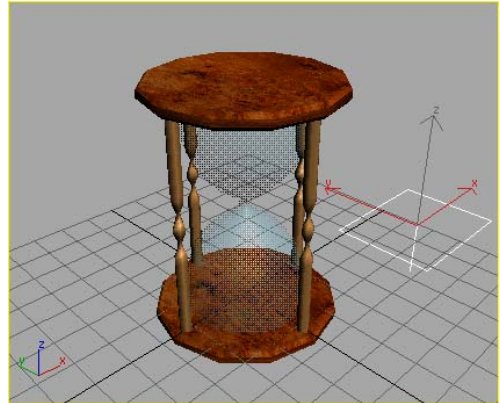
1. Continue from the previous lesson or open *sands\_of\_time3.max* found in the *tutorials\hourglass* directory.
2. Select the *sand in upper globe* object in the viewport. Make sure you see its name in the Name field, then right-click and choose Hide Selection.

This hides the sand.

3. On the menu bar, choose Create > Particles > Snow.

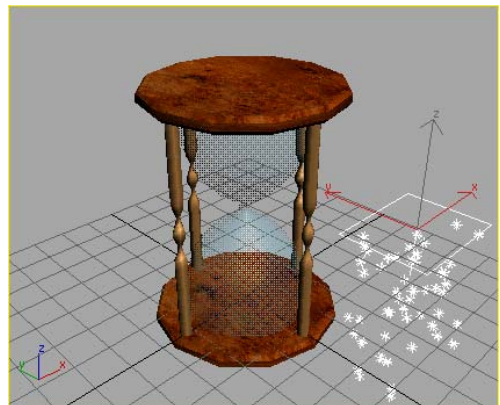
4. In a blank area of the perspective viewport, click and drag outward to create a Snow emitter.

An emitter specifies where in the scene particles are generated.




*Snow emitter.*

5. Play the animation and watch the snow particles in the viewport.



*Play the snow system animation.*

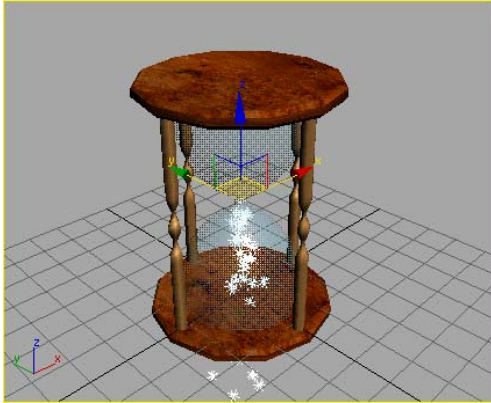
6.  On the toolbar, click Select and Move button. Then type in the Coordinate Display X: 0, Y: 0 Z: 30.

The snow emitter moves to the correct location at the neck separating the top and bottom chambers of the hourglass.



Tip: To quickly set the X and Y axis coordinates to zero, right-click the spinner arrows. Any current value is set to zero.

- On the Modify panel, in the Parameters rollout, in the Emitter group, change the width and length of the emitter to **1.5**.



*Snow particle system falling through the neck.*

### Create space warps:

The particle system interacts with space warp objects so that the particles can be controlled in various ways. You'll create two different space warps, Gravity and UDeflector. The Gravity space warp will force the particles to move downward, and the UDeflector space warp will keep the particles from passing through the bottom of the hourglass.

- On the menu bar, choose **Create > Space Warps > Forces > Gravity**.
- In an empty area of the viewport, click and drag outward to create a Gravity space warp.  
  
The placement of the space warps are not important, you can put them anywhere in the scene.
- On the menu bar, choose **Create > Space Warps > Deflectors > UDeflector**. In an empty area of the viewport, click and drag outward to create a UDeflector.

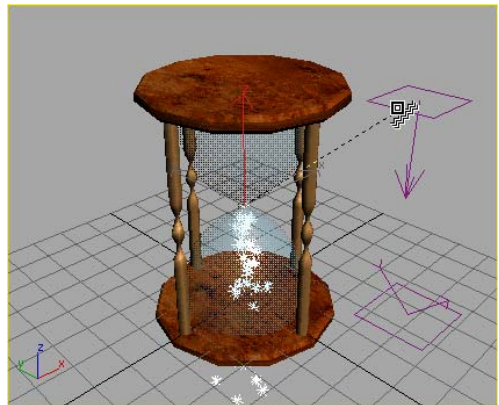
- In the Basic Parameters rollout, in the Object-Based Deflector group, click **Pick Object**, then in the viewport click the bottom plate (ChamferCyl02) of the hourglass.
- In the Particle Bounce group, set **Bounce** to **0**. This will allow the particles to "collect" on the UDeflector.



- Select the Snow Emitter in the viewport.




- On the toolbar, click the **Bind to Space Warp** button. Then click and drag from the Snow emitter to the Gravity space warp.



*Binding the Snow emitter to the Gravity Space Warp*

- Repeat the process for the UDeflector, binding the Snow emitter to the UDeflector.

### Adjust the appearance:

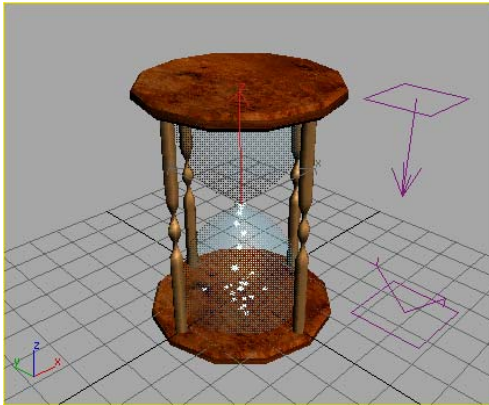
-  Now click the Play button to play the animation.  
  
You'll change the appearance of the snowflakes so that they look like falling sand.
- Stop the animation. Select the Snow emitter in the Modify stack, then in the Parameters rollout, enter these settings in the Particles group:
  - Viewport Count: **375**

- Render Count **888**
- Flake Size:**0.8**
- Speed:**0.5**
- Variation:**0.5**

**Warning:** In general, it is not a good idea to increase the Viewport Count very much. This can seriously slow down 3ds Max. If you do increase the Viewport Count, don't use the spinner to do so. If you inadvertently set the spinner to a very high amount, you could incur a long wait. Always enter the values using the keyboard or number keys.


Now you need to make an adjustment in the Timing group.

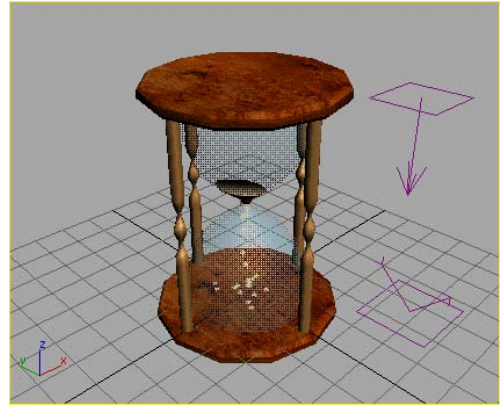
3. In the Timing group, turn off Constant. Set Life to **60** and Birth Rate to **1.0**.



*The snow is under control.*



#### Animate the falling sand:

1.  With the Snow selected, open the Material Editor (if it isn't already open), and select the Sand material, then click Assign Material To Selection.
2. Right-click the viewport and choose Unhide All and Play the animation.



*Sand made from particles and animated Slice modifier.*

To make the effect of the particles disappearing, you'll animate the Birth Rate of the particles.

3.  Click the Time Configuration button. In the Time Configuration dialog, in the Animation group, set the Length to **120**. Click OK.
4.  Click to turn on the Auto Key button, then with the Snow selected, move the time slider to frame 102.

In the Parameters rollout, change the Birth Rate to **0.0**. This will stop the particles emitting at frame 102, since the birth will stop.

The particles that were already emitted will continue to fall.

Now move backwards in time to where the sand in the upper chamber is getting smaller and the stream in the lower chamber needs to be stronger.

5. Move the time slider to Frame 86, and set the Birth rate to **6.0**.  
This will ensure a solid fall of sand at this frame.
6. Move backwards to Frame 78, and set the Birth rate to **5.9**.

This keeps the falling sand falling.

7. Move backwards to Frame 15, and set the Birth rate to **6.9**

This adds momentum to the falling sand.

8. Move backwards to Frame 0, and set the Birth rate to **5.0**.

This keyframe starts the fall of the sand while the sand level drops in the upper chamber.

9. Move the time slider forward in time to frame 106 and set the Birth rate to **1**.



This will allow you to set a key at frame 106. Once the key is set you'll change it's values using the time bar right-click menu.

10. On the time bar, select the key at frame 106, right-click and choose Snow01: Birth Rate from the list.

11. In the Snow01 Birth Rate dialog, change the Value to **-52** and set the In and Out tangents to Smooth.



This works to end the stream of falling sand.

12.   Turn off the Auto Key button and then play the animation.

The sand descends, the stream falls in concert with the sand in the upper chamber.



*Sand falling at frames 15, 86 and 120.*

If you had any trouble, you can open *sands\_of\_time4.max* to see the file with the correct settings. It's easy to miss a step or make a mistake and not get the correct results.

13. Save your work as **MyHourglass6.max**.


Next you'll use an animated hemisphere to create the sand building up in the bottom of the lower chamber.

## Creating the Sand Build-Up


The ability to animate object parameters gives great power and flexibility to 3ds Max. In this lesson, you will create a hemisphere with a pivot point at its base, then animate the hemisphere percentage to achieve the illusion that the particles are forming a mound with volume.

Continue from the previous lesson or open *sands\_of\_time4.max* from the *|tutorials|hourglass* directory.

1. Hide the Snow particle system. Select it in the viewport, then right-click and choose Hide Selection from the quad menu. Select the Hourglass object (Cylinder01 unless you've renamed it) and again choose Hide Selection.

2.  With the Perspective viewport active, click the Arc Rotate button to display the navigation

icon. Rotate the view so that the bottom of the hourglass is clearly visible.

3.  From the main menu, choose Create > Standard Primitives > Sphere.

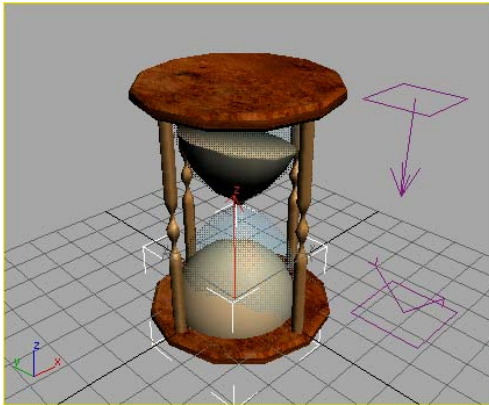
At the top of the Create panel > Object Type rollout, click to turn on the Auto Grid Toggle.

4. Drag out a Sphere object until the radius is approximately 17. A sphere should be created at the bottom of the hourglass plate.

Tip: Look at the Radius spinner in the Parameters rollout as you drag the sphere.

Right-click and select Unhide By Name and unhide the Hourglass object.

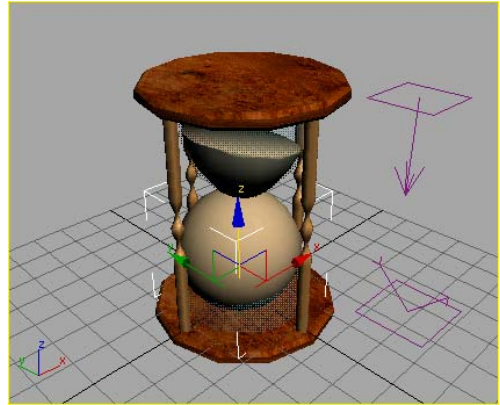
Assign the Sand material to the new sphere. (Open the Material Editor if necessary.)



*Sand mound made using a Sphere.*

5. On the Parameters rollout, turn on Base To Pivot.

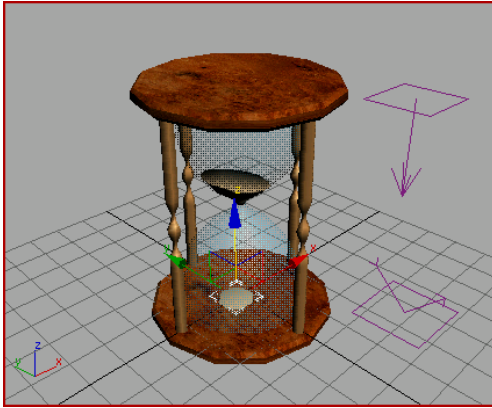
The sphere changes position in the viewport.



*The sphere now rests on the bottom plate.*

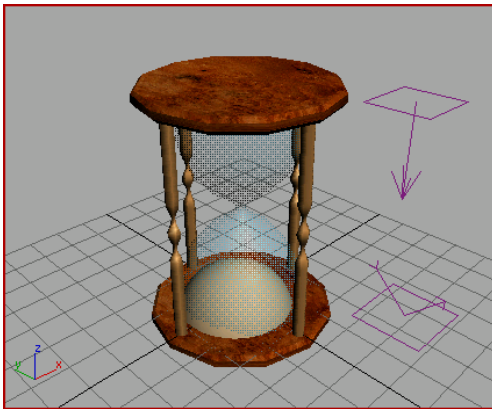
6. **Auto Key** Turn on the Auto Key button and then go to frame 0.
7. On the Parameters rollout, change the Hemisphere value using the spinner. Set the Hemisphere setting to .99.
8. Move the time slider to frame 25 and set the Hemisphere to .98. This will keep the hemisphere very small for the first 25 frames.
9. Move to frame 57 and set the Hemisphere to .9.
10. Move to frame 67 and set the Hemisphere to .8 and Play the animation.

Note: You may first need to change the rotation of the view before playing the animation if you previously rotated the hourglass when creating the sphere object.



*The hourglass at frame 57.*

11. Move to frame 96 and set the Hemisphere to .6 or so.



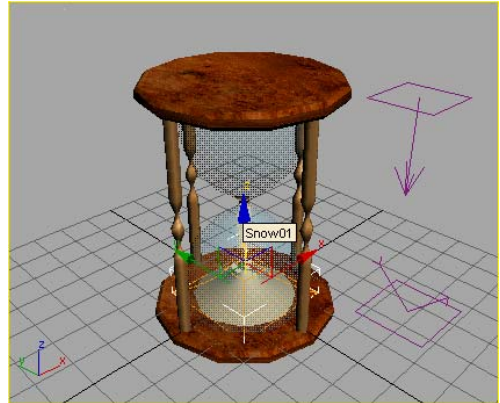
*The hourglass at frame 96.*

12. **Auto Key** Turn off Auto Key and play the animation. After stopping the animation, right-click the viewport and choose Unhide All from the quad menu

The sand level goes down in the upper globe as a stream of sand falls and collects into a mound in the bottom globe.

Tip: For a more realistic mound of sand, select the hemisphere and add a Taper Modifier. Set the taper Amount to **-.75** and the Curve to **-.5**, so the hemisphere turns into a rounded cone.

13. From the main menu, choose Tools > Align and pick the bottom plate. In the Align Selection dialog, turn on X Position and Y Position then click OK.



*The finished falling sand effect.*

14. Save your work. On the File menu, choose Save As, then name your scene **MyHourglass7.max**.  
If you want, load the file *sands\_of\_time\_finished.max* to see the finished model.

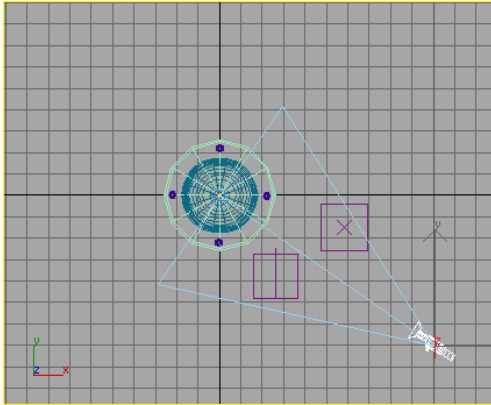
## Adding a Camera

So far you have defined everything in the Perspective viewport without considering lighting or cameras. As you prepare to produce output from your 3D scene, you will want to add cameras and lights to achieve a more realistic effect. Lights can cast shadows or add shiny highlights. Cameras can be animated so that they change your perspective and add emphasis and motion.

1. Continue from the last lesson, or load the *sands\_of\_time\_finished.max* file from the *tutorials\hourglass* directory.
2. Right-click to activate the Top view.
3. On the main menu, click Create > Cameras > Target Camera.

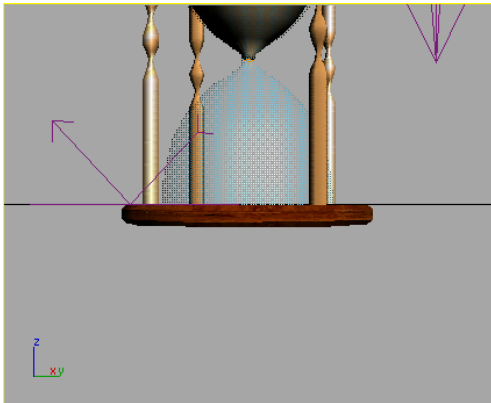


4. In the Top viewport, move your cursor to the lower-right quadrant of the viewport. Click and drag toward the center where the hourglass is situated. Release the mouse button when it is over the hourglass.




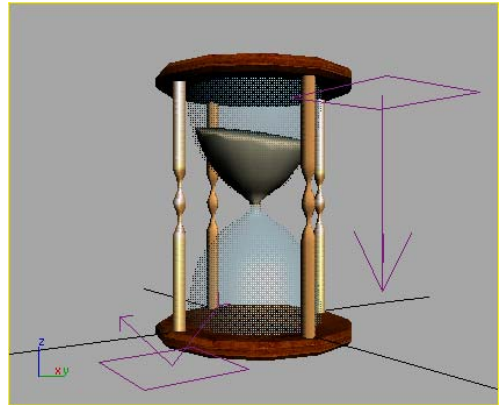
*Target camera from Top viewport*

5. Press **C** on the keyboard, to change the viewport to display the view from the Camera. If necessary, right-click the Camera01 viewport label and turn on Smooth + Highlights.




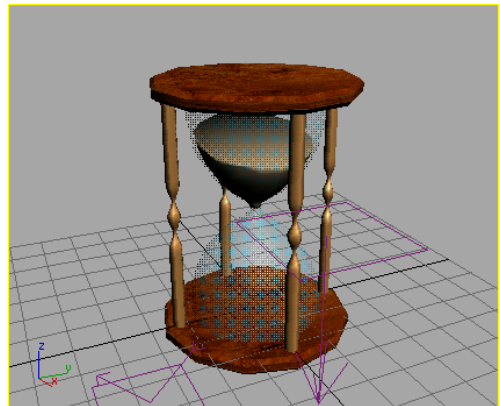
*Target camera is created on the ground plane.*

6.  From the view navigation tools, use the Truck Camera to move the camera so the hourglass is no longer cut off in the viewport.




*Truck and Dolly the camera to bring the hourglass into view.*

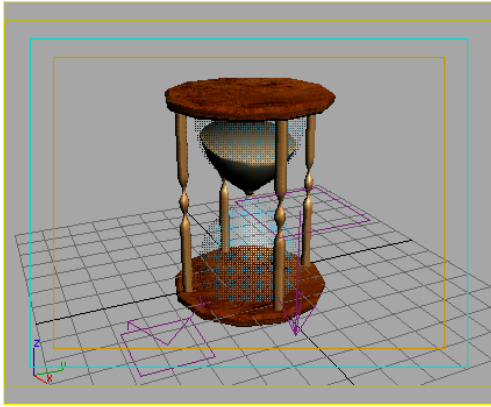
7.  Turn on Orbit Camera from the view navigation tools. Click and drag downward in the viewport to orbit the camera so you have a better view of the top of the sand.



*Orbiting the camera.*

8.  Turn on Dolly Camera. Click and drag in the viewport to zoom back so the hourglass is a bit smaller.
9. Right-click the Camera viewport label and choose Show Safe Frame. You use the Show Safe Frame tool to verify that objects you want to render will not get cut off. Show Safe Frame will

display the edges of your output resolution as yellow, cyan, and orange lines in the viewport.



*Show Safe Frame helps you frame your shot.*

10. To improve the authenticity of the hourglass, open the Modify panel and select either Chamfer Cylinders that make up the top or bottom caps. Increase the number of Sides to 33.

Because one cap is an instance of the other, changing the number of sides on one cap automatically affects the other.

11. Save your scene as **MyHourglass8.max**.

## Adding Default Lights to the Scene

You can create your own lights, or you can let 3ds Max do it for you. In this section you'll add a key light and a fill light using an automatic process.

Continue from the previous lesson.

### Add lights to the scene:


1. Right-click the Camera viewport label, and then choose Configure.
2. On the Rendering Method panel, in the Rendering Options group, turn on Default Lighting, and choose 2 Lights. Click OK.

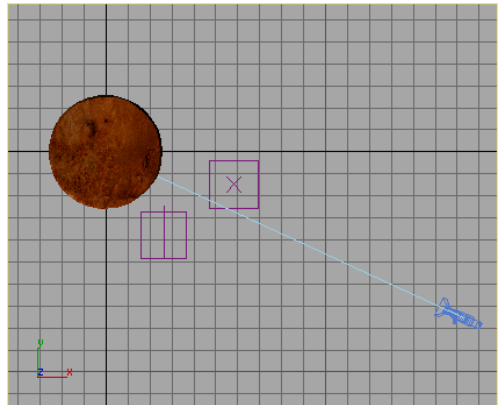
3. On the main menu, choose Views > Add Default Lights To Scene.
4. In the Add Default Lights To Scene dialog, set Distance Scaling to **0.2**, then click OK.

This hourglass is relatively small, so you use Distance Scaling to set the lights closer to the object.

### View the new lights:

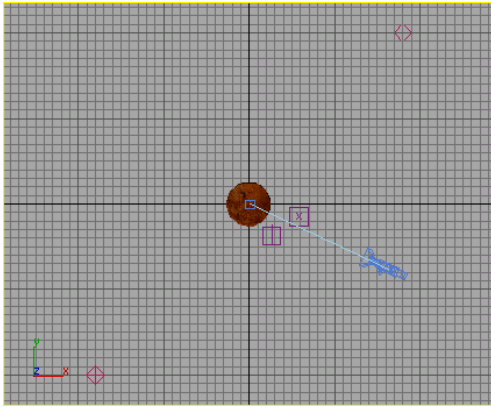
Follow these steps to see the new lights.

1. Press **T** on the keyboard to change the Camera viewport to a Top view. Also right-click the viewport label and turn off Show Safe Frame.
2.  From the view navigation tools, click Zoom Extents.



*The Top viewport without lights displayed.*



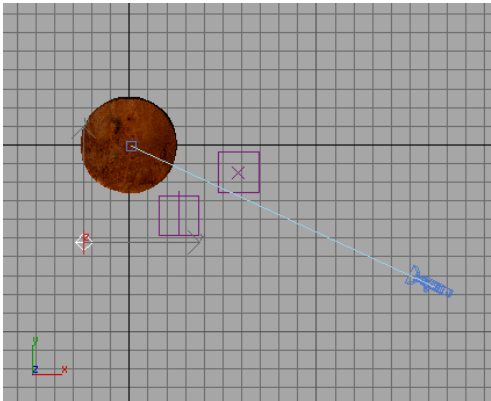


*Top viewport zoomed back to include added default lights.*

Now you'll add your own light to create a specular highlight on the glass.

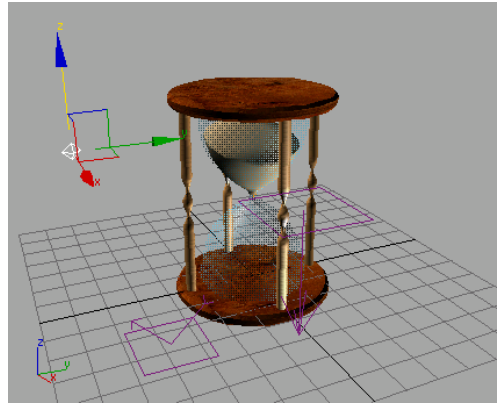
#### Add your own light to create a specular highlight:

1. On the main menu, click Create > Lights > Standard Lights > Omni. Zoom in the Top viewport and click in the lower-left quadrant (as shown in the illustration).



*Create an omni light close to the hourglass.*

2. Set the Top viewport back to the Camera view by pressing **C** then move the Omni light up so it is just above the height of the sand level. When you render the image this light will create a specular highlight on the glass.



*Move the omni light along the Z axis so it is level with the sand.*

3. Open the Modify panel for the light you just created. Locate the Multiplier field and change it to **1.33**. You can turn up the multiplier to give a larger specular highlight on the glass, or you can move the light closer to the glass.



*Rendered image shows omni-generated highlight.*

#### Save your work:

- Choose File > Save As, and name your file **MyHourglass\_with\_Lights.max**.

## Rendering Your Work

So far, everything you've done has been displayed in the viewport only: you haven't actually tried to

create any output. You essentially have two output types from which to choose:

- **Raster**—Raster formats, such as QuickTime MOV and Windows AVI, are flip books of still images, which means they can be rather large in size but very rich visually.
- **3D geometry**—3D output, such as VRML, MAX, DWG, 3DS, DXF or AI, allows you to choose your own viewpoint, as well as providing animation and behaviors through proximity triggers.

Since the hourglass has both transparency and particles, you'll choose the only output type which supports both, which is raster. You'll create a QuickTime movie that you can play on a Web site. First you'll render some still frames.

1. Activate the Camera viewport. If you do not have the Camera viewport visible, press **C** on the keyboard.
2. On the main menu, choose Rendering > Render.

In the Output Size group of the Common parameters rollout, click the 640x480 preset button.

3. Click Render.



*Rendered image shows off the highlights.*

4. To change the background, choose Rendering > Environment. In the Background group,

click the Background Color swatch. In the Color Selector, type these RGB values:

- Red: **120**
- Green: **194**
- Blue: **252**

This should produce a pale blue.

5. Close the Environment dialog, and press **F9** to render again automatically.



*Changing the background color.*

Next you'll render to an animation file.

6. In the Render Scene dialog, in the Common Parameters rollout in the Time Output group, change from Single to Active Time Segment. This renders the entire animation.
7. Reduce the size to 320x240. That's a better size animation for Web playback.
8. In the Render Output group, click the Files button and name the file you're about to create **myhourglass.avi** (for a Video for Windows animation) or **myhourglass.mov**, (for a QuickTime animation). Make a note of where you are saving this file.
  - If you are rendering to AVI, click OK in the Video Compression window, then click Save. To start the rendering, click Render.
  - If you are rendering to MOV, make adjustments as you like in the Compression

Settings dialog, then click OK. To start the rendering, click Render.

A Rendering dialog appears. As each frame is rendered, a bar shows the progress. You can see all types of information updating in the Rendering Progress group as your rendering advances.

9. When your rendering is finished, close the Rendering dialog. On the File menu, choose View Image File, navigate to where you saved the file, and open it. The appropriate player program will play your animation.

Tip: If you like, you can play *sands\_of\_time.avi* or *sands\_of\_time.mov* to see a finished rendering of the animation.



QuickTime MOV output

hourglass were created with various modeling tools.

## Summary

From this tutorial, you can see that modeling and animating particle effects doesn't always mean that all particles have to be created with a particle system. In the hourglass animation, you used a particle system only for the falling sand. The effects of sand at the top and bottom of the

# 15

## Advanced

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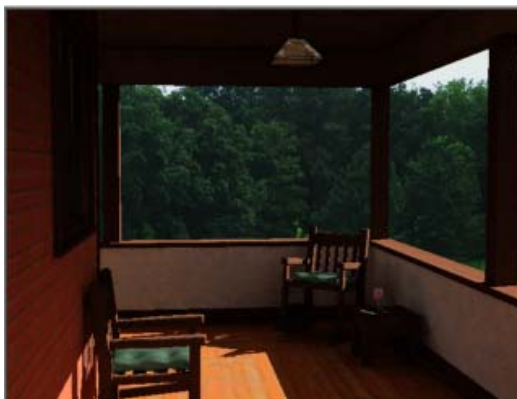
### Scene Management

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#### Scene Management

This tutorial touches on a number of the new features you'll find in 3ds Max. The scene you'll work on shows a covered porch or balcony that needs some detailing by means of the Sweep modifier and real-world materials. You'll become familiar with scene states and how they can help you store various conditions that can be recalled at a later time for visualization and rendering purposes. Radiosity adaptive subdivision will be used for preliminary rendering so you can create more accurate and realistic images. Finally, you'll get to experience the batch rendering tool and how it can help you increase efficiency when you're ready to generate renderings for clients.

You'll then learn how to save two versions of your scene using scene states. As a bonus step, the tutorial also shows how to use the batch rendering tool, which will render two scenes to file.



Skill Level: Beginner

Time to Complete: 2 hours

#### Features Covered in This Tutorial

After completing this tutorial, you should be able to:

- Use the Sweep modifier to create a baseboard from a spline
- Create materials that use real-world map scaling
- Generate a radiosity adaptive solution for more accurate lighting
- Set up and save two different scene states
- Use the batch render tool to render two scenes

## Tutorial Files

All the necessary files to do the tutorials can be found on the Tutorial, Samples, And Partners CD, in the `|tutorials|scene_management` folder, unless otherwise specified. Before doing the tutorials, copy the `|tutorials|` directory from the CD to your local installation.

## Lessons In This Tutorial

*Using the Sweep Modifier (page 3–62)*

*Creating Real-World Materials and Mapping (page 3–65)*

*Using Radiosity Adaptive Subdivision (page 3–68)*

*Saving Scene States (page 3–70)*

*Using Batch Render Tool (page 3–72)*

## Using the Sweep Modifier


In this lesson, you learn how to use the Sweep modifier to extrude a shape along a path. This can be very useful for creating baseboards, piping layouts and duct work. Although these examples sound like typical cases for the Loft tool, the Sweep modifier achieves the same results with an easier workflow, especially if you do not need all the functionality that the Loft tool has to offer.

### Set up the lesson:

- From the `|tutorials|scene_management` folder, open `balcony_sweep.max`.

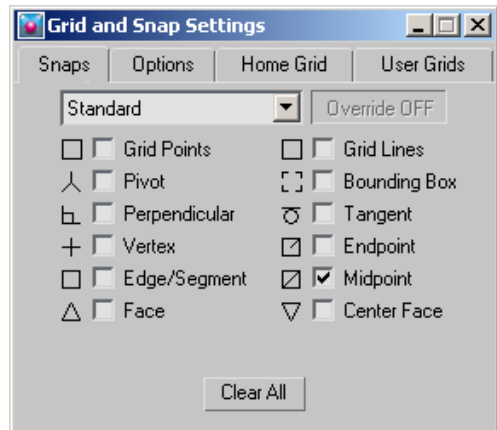
The scene is of a covered balcony. You will use the Sweep modifier to add a baseboard and a wooden ledge to the balcony wall.

### Creating the wooden ledge on the balcony wall:

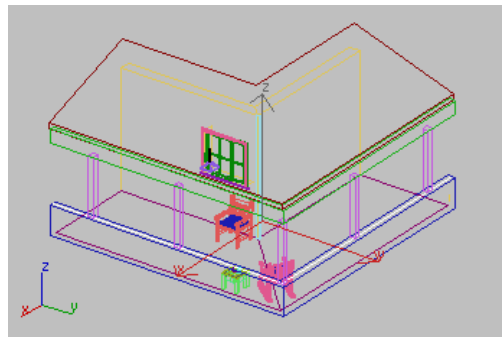
- Right-click in the User viewport to activate it.
-  Click the Maximize Viewport Toggle button to maximize the User viewport.



- On the main toolbar, click the Snaps Toggle button to activate it.
- Right-click the Snaps Toggle button to access the Grid and Snaps Settings dialog. Activate the Midpoint option and disable all others. Close the dialog when done.



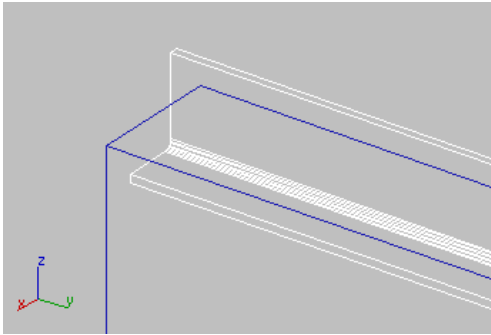
- From the Create panel, click the Shapes button, and then click on Line.
- Draw a line on top of the wall by snapping to the midpoints of the three segments that define the thickness of the wall, going from left to right.




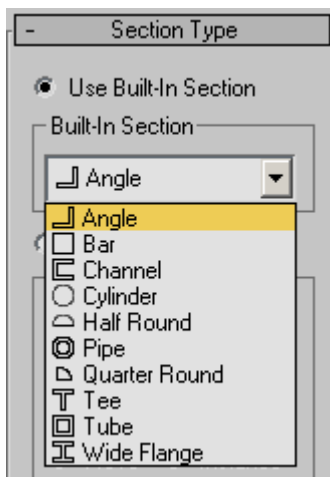
- With the line still selected, go to the Modify panel.

8. From the Modifier drop-down list, choose Sweep.

The spline is replaced by an object that has an L-shaped cross section.

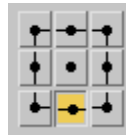


9.  Zoom on the new object in the Left viewport.
10. On the Modify panel, in the Section Type rollout, select each of the presets from the Built-in Section list.

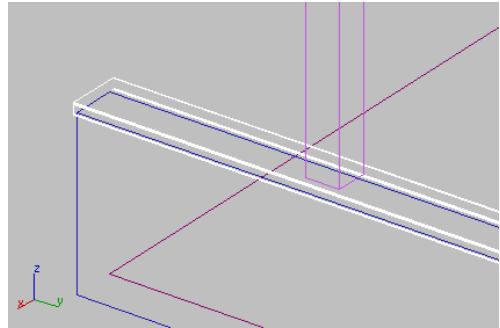


11. Choose the Bar preset. It is simply a rectangular cross-section that defaults to a square.
12. In the Sweep Parameters rollout, click the bottom center alignment point to properly align the rail on top of the wall. If you want,


experiment with the other alignment points to see their effect.



13. In the Parameters rollout, set Length to 2", Width to 10" and Corner Radius to 0.2".



14. Press **M** to open the Material Editor.

15.  Select the material named *Oak Moldings* and assign it to the bar cross-section.

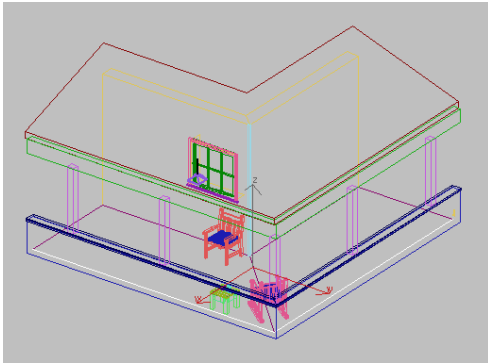
If a warning appears, click OK to replace the existing material.

### Creating the baseboard:

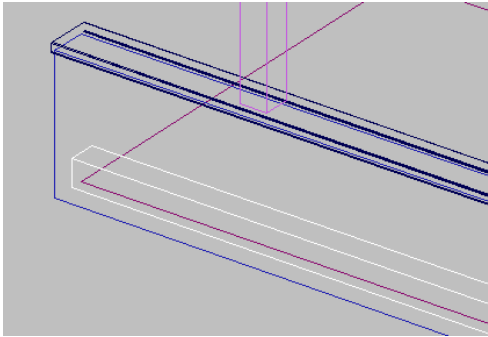
1. Make sure the User viewport is active and then press **ALT+W** to maximize the User viewport.



2. On the main toolbar, right-click the Snaps Toggle button. In the Grid and Snap Settings dialog, turn on Endpoint and turn off Midpoint. Close the dialog when done.
3. From the Create panel, click the Shapes button, and then click on Line.
4. Create a line at the base of the wall, snapping the three endpoints along the inside perimeter, going from left to right.

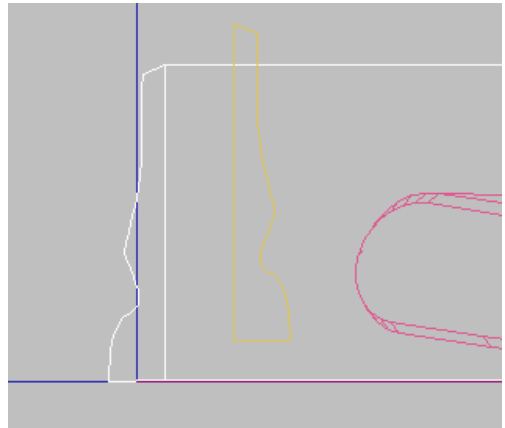


5. With the line still selected, go to the Modify panel.
6. From the Modifier drop-down list, choose Sweep. The spline is replaced by an object that has a square cross section as before. The Alignment point is also retained from the last Sweep object you created (mid-center).



7. Press **ALT+W** to toggle back to a four-viewport layout.
8. Zoom on the new object in the left view. On the Modify panel, in the Section Type rollout, choose the Use Custom Section option.  
The square cross-section disappears in the viewport.
9. In the Custom Section Types group, choose Pick.
10. In the Left viewport, select the object that is shaped like the profile of a baseboard.

A new sweep is performed but the baseboard is oriented the wrong way and its alignment is off.



11. In the Sweep Parameters rollout, enable the Mirror on XZ Plane option and set the Alignment point to the bottom right corner.
12. In the Material Editor apply the Oak Moldings material to the newly created object.



## Next

*Creating Real-World Materials and Mapping (page 3–65)*



## Creating Real-World Materials and Mapping

In this lesson, you learn how to use real-world-based materials and mapping. This is a feature that simplifies the application of 2D textures onto 3D geometry so that it always appears in the correct size. This is useful when you need to apply textures that you can measure, such as bricks or ceramic tiles. For textures that are more irregular, such as grass or stucco, these may require a traditional approach that needs a bit more adjustment at the UVW Map level.

### Set up the lesson:

- Continue working on your file from the previous lesson or from the File menu, choose Open and navigate to the `|tutorials|scene_management` folder. Highlight `balcony_RWmapping.max` and click Open. The scene shows the resulting file from the previous lesson.

### Setting 3ds Max to work in Real-World Texture Coordinates:

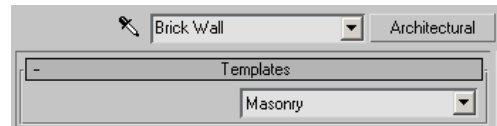
1. From the Customize menu, choose Preferences
2. On the General tab in the Texture Coordinates group, make sure the Use Real-World Texture Coordinates option is active.

Note: If you are a new user, you may find Real-World Texture Coordinates easier to work with. If you are already experienced with 3ds Max, you may elect to use the traditional approach. Either way, you can turn Real-World Texture Coordinates mode on or off in the Preferences dialog to suit your needs. For the purposes of this lesson though, make sure this option is active.

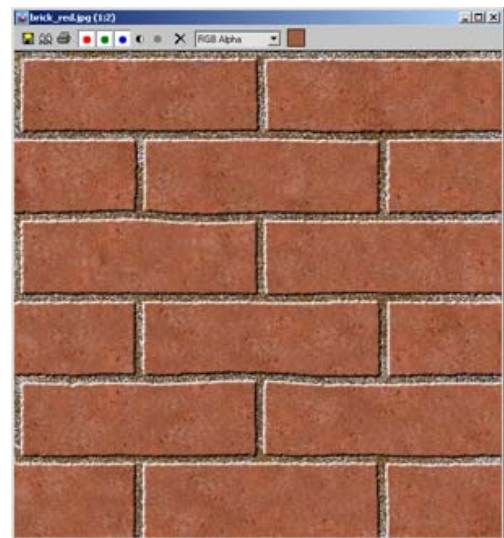
3. Click OK to exit the dialog.

### Creating a brick material for the wall:

1. Press **M** to open the Material Editor.
2. Choose an empty slot (represented by a gray sphere). All unused materials in this scene have been set to Architectural type.
3. Name the new material **Brick Wall**.
4. In the Templates rollout, choose the Masonry option from the drop-down menu.



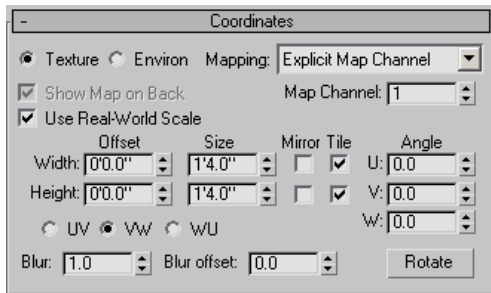
5. Click the None button for the Diffuse Map. From the Material/Map browser that appears, choose Bitmap, and then click OK.
6. In the Select Bitmap Image File dialog, browse to the `|tutorials|scene_management|VIZ|` folder and click once on `brick_red.jpg`.
7. Click the View button to see an enlarged view of the brick texture.





The texture is square and shows a layout measuring two bricks across by six rows of

brick down. Typically, a standard brick size is 8" in width, including the joint. This makes the texture's horizontal size 16" in the real-world because it holds two bricks horizontally. Because the texture is square, it measures 16" x 16" in Real-World coordinates.

8. Close the window showing the texture, and then click Open to use it as a Diffuse map.
9. In the Coordinates rollout, notice Use Real-World Scale is active. Set the Width and Height sizes both to **16"**. This automatically translates into 1'4.0".



Note: The Use Real-World Scale option is active because this option has been enabled by default in the Preferences dialog. You can still enable or disable it for individual maps.


10.  On the Material Editor's toolbar, turn on Show Map in Viewport.
11. Drag the newly created material onto the wall that has the window in the Camera viewport.  
At this point you still don't see the brick layout because you need to apply mapping coordinates to the wall.
12.  With the wall selected, go to the Modify panel.
13. From the Modifier drop-down list, choose UVW Map.
14. Set the mapping type to Box mode if it is not selected already.

The bricks appear on the wall in their proper size.

Notice how by default, some of the UVW Mapping parameters in the Parameters rollout are disabled, and how the Real-World Map Size option is active by default. You can disable this option at any time to revert to a more traditional mapping method.

Note: If you see distorted bitmaps in the viewport, right-click on the viewport label, and select Texture Correction. This is only for the software display driver. If you are using the OpenGL or Direct3D display mode, this option is always on.

#### Adding a bump map:

1.  In the Material Editor, click Go to Parent to go back one step in the material hierarchy.
2. Expand the Special Effects rollout.
3. Click the None button associated with the Bump control.
4. From the Material/Map browser, choose Bitmap, and then click OK
5. In the Select Bitmap Image File dialog, double-click *brick\_BUMP.jpg* file to select it.
6. In the Coordinates rollout, set the Width and Height sizes to **1'4.0"** (16") as you did earlier so that the bump map size matches that of the diffuse map you set up before.



#### Creating a wood material for the floor:

1. In the Material Editor, choose an empty slot.
2. Name the new material **Wood Floor**.
3. In the Templates rollout, choose Wood Unfinished.
4. Click the None button for the Diffuse Map .
5. From the Material/Map browser, choose Bitmap.

6. From the `|tutorials|scene_management|VIZ|`, click once on the `Wood_Boards.jpg` file, and then click View to display the bitmap.



Note: The texture is square and shows 7 planks running vertically. Typically, these planks each measure 4" wide, which means this texture measures 28" x 28" in Real-World coordinates.

7. Close the window showing the texture, and then click Open to open this file as a Diffuse map.
8. In the Coordinates rollout, make sure Use Real-World Scale is active. Set the Width and Height sizes both to **28"**. This automatically translates into 2'4.0".
9.  On the Material Editor's toolbar, turn on Show Map in Viewport, then select the floor group in the scene (Floor).
10.  Apply the newly created material to the selected object. The texture appears on the balcony floor with the right size and proportions, but in the wrong orientation.




Note: The floor has already been set up with two Real-World-based UVW Maps running at a 90 degree angle.

11. In the Coordinates rollout, set the W Angle to 90 degrees to fix the orientation of the planks.



#### Adding a bump map:

1.  In the Material Editor, click Go to Parent to go back one step in the material hierarchy.
2. Expand the Special Effects rollout.
3. Click the None button associated with the Bump control.
4. From the Material/Map browser, choose Bitmap, and then click OK

5. Double-click *wood\_Boards\_bump.jpg* file to select it.
6. In the Coordinates rollout, set the Width and Height sizes to **2'4.0"** (28") as you did earlier so that the bump map size matches that of the diffuse map you set up before.
7. Change the W Angle to **90** degrees to match the diffuse map.

## Next

*Using Radiosity Adaptive Subdivision (page 3–68)*

## Using Radiosity Adaptive Subdivision

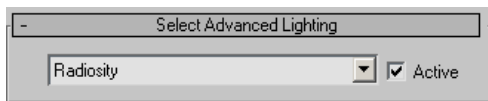
In this lesson, you learn how to use Adaptive Subdivision to calculate radiosity solutions. This option divides the geometry based on the light that falls on the faces and helps capture shadow boundaries and complex lighting changes more efficiently.

### Set up the lesson:

- Continue working on your file from the previous lesson or go to the File menu, choose Open and navigate to the *|tutorials|scene\_management* folder. Highlight *balcony\_radiosity.max* and click Open. The scene shows the resulting file from the previous lesson.

### Setting the radiosity engine:

1. From the Rendering menu, choose Advanced Lighting > Radiosity. Ensure Radiosity is selected in drop-down list in the Select Advanced Lighting rollout.



2. In the Radiosity Processing Parameters rollout, set the Initial quality value to **50%**.

This will make the calculation faster but less accurate.

3. In the Interactive Tools group, set both Indirect and Direct light filtering to **2**.

This will smooth any noise patterns in the shadow areas.

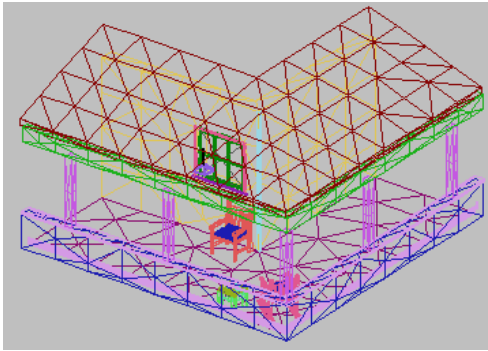
4. Expand the Radiosity Meshing Parameters rollout.

The scene is mostly made of simple geometry for the walls, floor, roof, etc. which needs to be subdivided because radiosity works by vertex-coloring the geometry. The more vertices in the scene, the better the solution.

5. In the Global Subdivision Settings group, turn on Enabled, and turn off Use Adaptive Subdivision. You will first experiment the effect of subdivision in global mode.
6. In the Camera viewport, right-click the Camera01 label and choose Edged Faces. This will make it easier to see the effect of subdivision in the viewport.



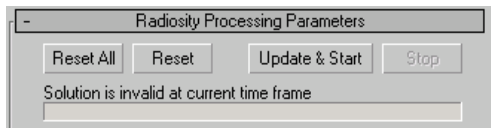
7. In the Radiosity Processing Parameters rollout, click Start to begin the radiosity calculation. Once the solution is calculated, you can see its effect in the viewports.



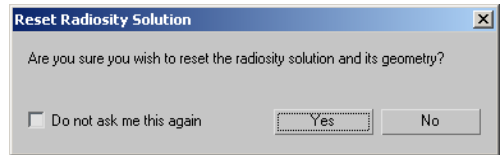
Note: Notice how the subdivisions are fairly equal in size. In this case, the default subdivision size of 3 feet is not enough to catch the subtle effects of hotspots and shadows created by the sun's rays. You could, of course, decrease the subdivision value globally, but it's better to use an Adaptive subdivision that would divide the geometry in a finer grid only where it is needed.

8. In the Radiosity Meshing Parameters rollout, turn on the Use Adaptive Subdivision option.
9. In the Mesh Settings group, set the Maximum Mesh Size to **2'0.0"** and the Minimum Mesh Size to **0'4.0"**.

In the Radiosity Processing Parameters of the Advanced Lighting dialog, notice the message that the solution is now invalid and needs to be recalculated.



10. Click Reset All. If a warning dialog appears, click Yes to dismiss it, and then click Start to begin the radiosity calculation again.



Once the solution is calculated, you can see that the divisions are more irregular, and relate mostly to the shifts in lighting, such as where the sun's rays hit the surfaces of the walls and floor.

11. With the Camera viewport active, press F4 to toggle off Edged Faces mode. Notice that even in the viewport, you can see the effects of Adaptive Subdivision on the floor as it shows the effects of the sun's hotspot.



12. Render the Camera viewport to see the results.





## Next

*Saving Scene States (page 3–70)*

## Saving Scene States

Once you have built a 3D environment with materials, lights and cameras, you can save various scene states so that you can later recall stored parameters. In this lesson, you adjust material and light values to effortlessly switch between a daytime and nighttime scene.

### Set up the lesson:

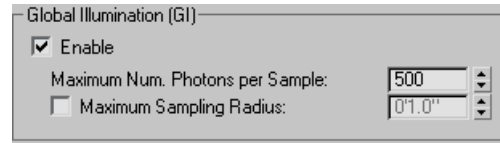
Continue working on your file from the previous lesson or go to the File menu, choose Open and navigate to the `tutorials\scene_management` folder. Highlight `balcony_scene-states.max` and click Open. The scene shows the resulting file from the previous lesson.

### Switching global illumination engines:

Before beginning this lesson, you will first disable Radiosity and use the mental ray renderer to simulate global illumination. It will speed up rendering in this case because it's not necessary to recalculate the solution every time you make a change.

1. From the Rendering menu, choose Advanced Lighting > Radiosity.
2. From the Select Advanced Lighting drop-down menu, choose <no lighting plug-in>. Click Yes to dismiss the warning that displays.
3. Open the Common tab. In the Assign Renderer rollout, click the button next to Production.
4. Choose the mental ray Renderer, and then click OK.
5. Open the Indirect Illumination panel.
6. In the Caustics and Global Illumination rollout, in the Global Illumination group, turn on the

Enable option. Leave all other parameters to their default settings.

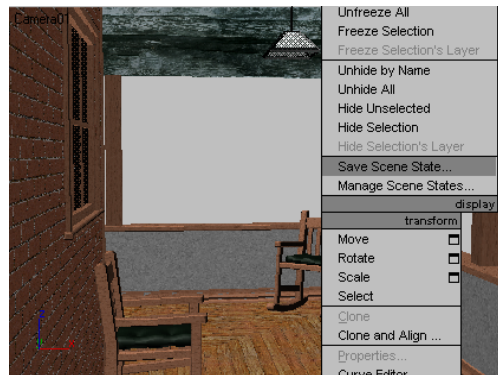


7. Render the Camera01 viewport to test the results.



### Saving scene states:

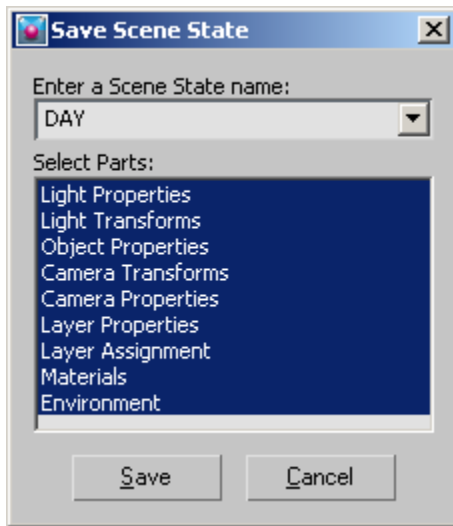
1. Right-click in the Camera viewport.
2. From the quad menu that displays, choose Save Scene State.



3. In the Save Scene State dialog, select all the scene parts so that cameras, environment,



layers, lights, materials and object properties will be saved with the scene state.

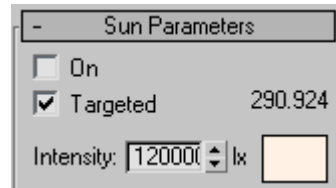


4. Name the scene state **DAY**.
5. Click Save to exit the dialog.

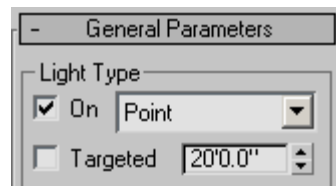
#### Changing scene parameters:



1. Go to the Display panel.
2. In the Hide by Category rollout, remove the check mark next to Lights.  
Three lights appear in the scene: one that simulates the sun (Sun01), one that simulates global ambient lighting (Sky01), and a simple bulb (FPoint01).
3. In the Top viewport, select the Sun01 object.  
Tip: It may be easier to select Sun01 by pressing **H** to open the Select Objects dialog.
4. On the Modify panel, in the Sun Parameters rollout, turn the light off.



5. Press **H** to open the Select Objects dialog.
6. Double-click the object named FPoint01 to select it.  
This represents the bulb that will light the scene at night.
7. On the Modify panel, in the General Parameters rollout, turn the FPoint01 light on.



Note: You do not need to change the state of the IES Sky object since skylight objects are not recognized by the Mental Ray Renderer.

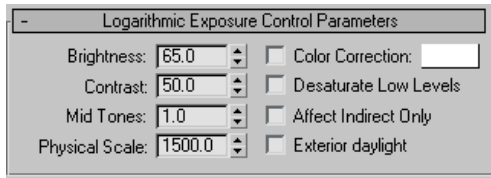
8. Render the Camera viewport.

The scene is very dark, and the background still displays daytime lighting.

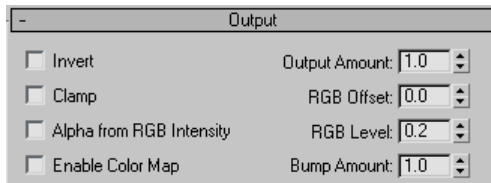


9. From the Rendering menu, choose Environment. In the Logarithmic Exposure

Control Parameters rollout, turn off the Exterior Daylight option.



10. Press **M** to open the Material Editor. Locate the material named *Background*, and select it.
11. At the bottom of the Material Editor, expand the Output rollout. Set the RGB Level value to **0.2**.



This will make the background image much darker to simulate a scene at night.

12. Render the Camera viewport again and notice the changes.



13. Right-click in the Camera viewport. From the quad menu, choose Save Scene State.
14. In the Save Scene State dialog, select all the scene parts.

15. Name the scene state **NIGHT**.

16. Click Save to exit the dialog.

#### Restore scene states to render:

1. Right-click in the Camera viewport, and choose Restore Scene State from the quad menu.

Notice the cascading menu lists the two scene states you previously saved.

2. Choose DAY to restore the daytime scene.

Notice in the Top viewport that the point light is displayed in black, which means it's inactive. Sunlight is displayed in yellow, which means it is enabled.

3. Render the Camera viewport to see that all scene parts such as light effects and environment backgrounds have been restored to their original states.

## Next

*Using Batch Render Tool (page 3–72)*

## Using Batch Render Tool

Batch Render is a tool that allows you to sequentially render any or all of the views in your project. It is especially useful in conjunction with the scene states tool shown in the last lesson to render different aspects of the scene with very little or no interaction on your part.

In this lesson, you use Batch Render to automate the rendering of both the day and night scenes created in the previous lesson.

#### Set up the lesson:

- Continue working on your file from the previous lesson or from the File menu, choose Open and navigate to the `|tutorials|scene_management` folder. Highlight `balcony_batch-render.max`, and click Open.

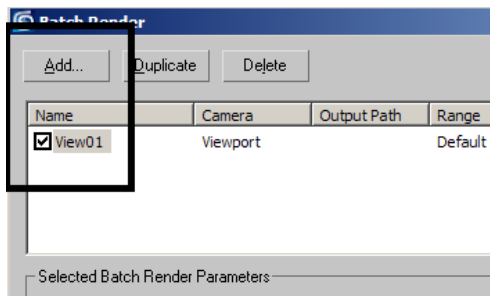
The scene shows the resulting file from the previous lesson.

### Accessing and setting up the Batch Render dialog:

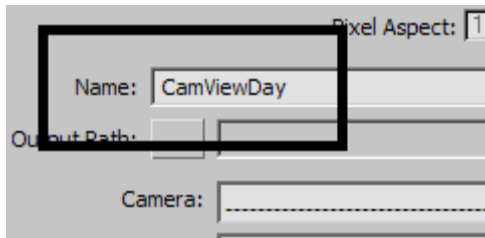
1. From the Rendering menu, choose Batch Render.

The Batch Render dialog displays.

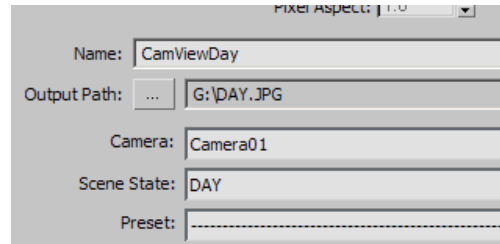
2. Click the Add button in the top left corner of the dialog. A new entry named *View01* is added to the list.



3. In the Name field, rename the view: *Cam ViewDay*.

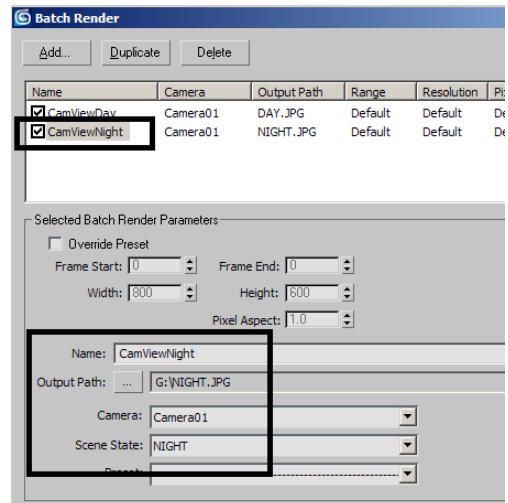


4. From the Camera drop-down list, choose *Camera01*. The view is now assigned to what this particular camera is pointed at.
5. Click the Output Path button and name the output file **DAY.JPG**, and then click Save.
6. Accept the JPEG Image Control defaults, and then click OK.
7. From the Scene State drop-down menu, choose **DAY**.



Note: This setup ensures the Camera01 viewport will be used for rendering, and that the DAY scene state with an output file named DAY.JPG is saved to disk.

8. Click the Add button at the top of the dialog to add another entry to the batch list. Rename the new entry: *Cam ViewNight*.
9. Assign Camera01 to this newly created view.
10. Make sure the new entry *Cam ViewNight* is displayed in the Name field, and create an output file for it named **NIGHT.JPG**.
11. Accept the JPEG Image Control defaults, and then click OK.
12. In the Scene State drop-down menu, choose the **NIGHT** scene state.



13. Click the Render button in the bottom right corner.

Both the day and night scenes are rendered and saved to disk.

## Summary

In these lessons, you worked on various aspects of scene creation and management. You learned how to add detail using simple 2D splines that you turned into 3D objects with the help of the Sweep Modifier. You have also learned how to adjust texture maps using Real-World values, and to adjust radiosity solutions by subdividing the geometry only where needed. Finally, you learned how to save scene states to record different scenarios like daytime and nighttime lighting, and to automate the rendering of those scene states using Batch Render.

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## Creating Explosions

In this tutorial, you'll hit an asteroid with a glowing laser blast, blowing the asteroid to bits and creating a fiery explosion.



Skill Level: Intermediate

Time to complete: 2+ hours

## Features covered in this tutorial

Doing this tutorial you will learn to:

- Use material effects channel ID's.
- Use animated opacity mapped plane objects to simulate an explosion.
- Use particle array fragmentation.
- Set visibility keys.
- Add motion blur.
- Use render effects glows and blurs.

## Tutorial Files


All the necessary files to do the tutorials can be found on the Tutorial Files CD, in the *|tutorials|space* folder, unless otherwise specified. Before doing the tutorials, copy the *|tutorials|* directory from the CD to your *|3dsmax8|* local installation.


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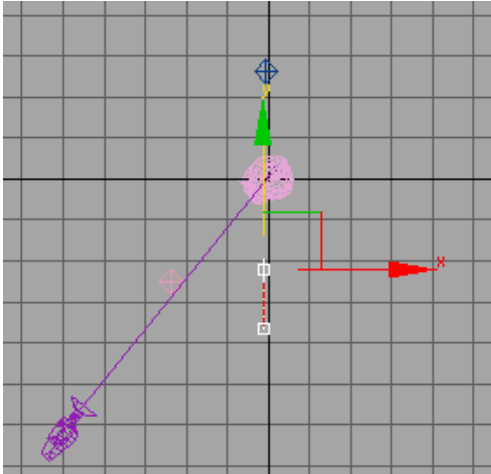
## Animating the Laser Blast

You'll find the files for this tutorial in the *|tutorials|space* directory.

### Animate the laser blast:

1. Open *exploding\_asteroid1.max*.  
This scene already has an asteroid as well as a thin box object named *laserblast*.
2. Press **H** on the keyboard to Select By Name. Highlight *laserblast* in the list and click Select.  
Now the *laserblast* object is selected. It's not very easy to see it in the viewport.
3.  Turn on Auto Key and move the time slider to frame 10.

4.  In the Top viewport, move the *laserblast* along the Y axis until it comes in contact with the asteroid.
5. Turn off Auto Key.  
A dotted line in the viewport shows the laser blast's trajectory.




Move the time slider to frame 0, then play the animation in the camera viewport.

The *laserblast* moves to the asteroid and stops.

## Creating a Material for the Laser Blast

Now you'll create a glowing material for your laser blast.

### Create a material for the blast:

1.  Open the Material Editor and move it so you can see the camera viewport.
2. Move to frame 8 so you can see the *laserblast* clearly in the camera viewport.

3. In the Material Editor, select an unused sample sphere and name its material **laserblast material**.

4.  Click Assign Material To Selection.

Tip: If the *laserblast* object is no longer selected, you can drag the material from the sample slot into the viewport and onto *laserblast*.

5. In the Blinn Basic Parameters rollout > Self-Illumination group, turn off the Color check box. Set Self-Illumination to **100**.

Self-illumination makes a material appear to glow. Self-illuminated materials have a flat, unshaded look.


6. Click the Diffuse color swatch.

The Color Selector dialog is displayed.

Adjust the color to R:255, G:114, B:0, and click Close.

The color of the material is a pumpkin orange.

### Set up an effects channel:

1.  On the Material Editor toolbar, click the Material Effects Channel flyout, and choose channel 1.





Later in this tutorial, you'll use the channel number to create a glow.

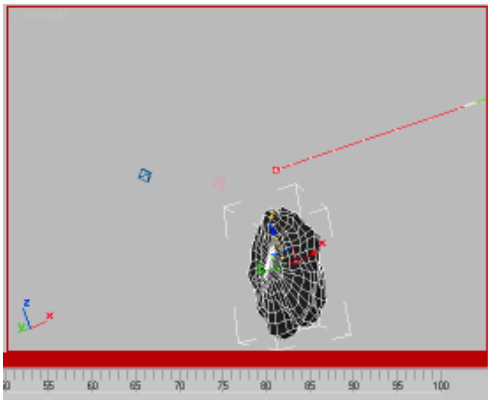
2. Close the Material Editor.

## Animating the Asteroid


Now you'll animate the asteroid so it tumbles before it's hit by the *laserblast*.

**Animate the asteroid:**

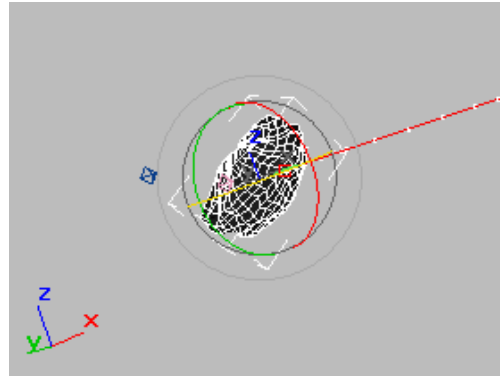
1.  Turn on Auto Key.
2. Activate the Camera viewport and move the time slider to frame 0.
3.  Select And Move the asteroid down in the Z axis approximately **—135** units, or until it is positioned just inside the camera's view.



Frame 0

4. Right-click and choose Rotate from the quad menu. Rotate the asteroid at frame 0 on both the Y and Z axes approximately **30** degrees.
5. Go to frame 10. Reposition the asteroid so it is in contact with the *laserblast*. Rotate the asteroid on both the Y and Z axes approximately **—30** degrees.
6.  Turn off Auto Key.
7. Play the animation.

The asteroid now tumbles until it's hit by the laser blast.



Frame 10

8. Save your work as **myrotating\_asteriod1.max**.

## Creating a Plane for the Explosion


Now that the asteroid and *laserblast* are animated, it's time to create the explosion that will blow it up.

There are several different ways you can create an explosion in 3ds Max. One technique is to use an animated map. This allows you to apply a movie of a real explosion to a simple planar object.

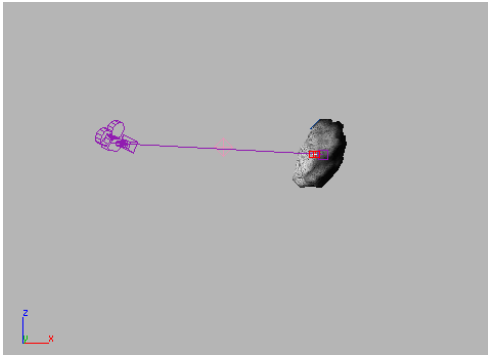
**Setup:**



- Continue working with the previous file or open *rotating\_asteroid.max*.

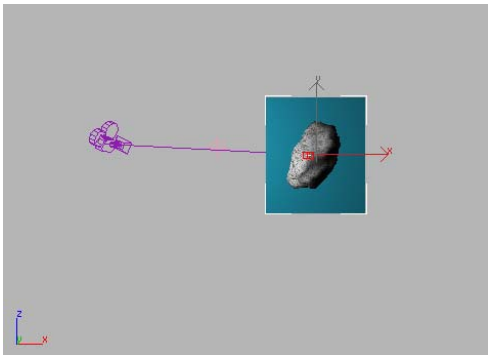
**Create a plane:**

1. Move the time slider to frame 10 if it's not already there.
2. Right-click to activate the Front viewport, and then press **ALT+W** on the keyboard to maximize the viewport.
3.  Use Zoom and Pan to navigate the viewport so the asteroid is in or near the center of the view.





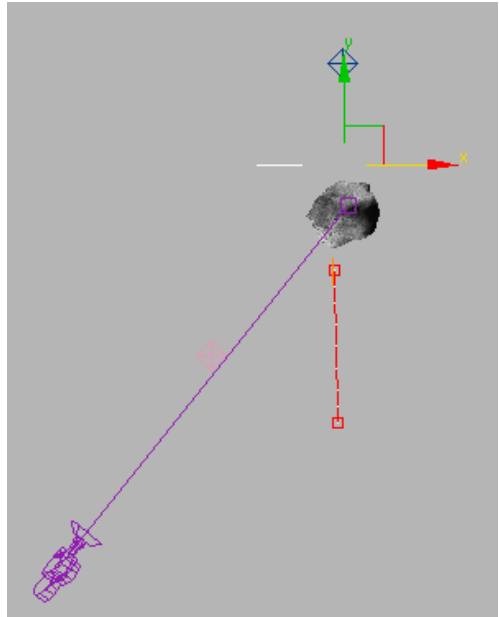
4.   Go to the Create panel > Geometry > Standard Primitives category. On the Object Type rollout, click Plane.
5. In the Front viewport, drag a plane over the asteroid.



6. In the Name And Color rollout, change the name to **Explosion Plane01**.
7. In the Parameters rollout, set the Length and Width of the plane to **300.0**. Set the Length and Width Segs (segments) to 1.  
The size and complexity of the Plane update in the viewport.
8. Right-click in the viewport, and press **ALT+W** to return to four viewports.



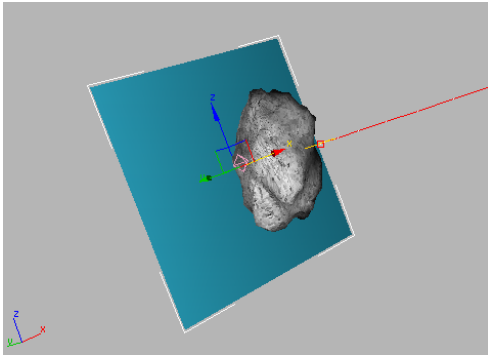
9. Right-click the Top viewport to activate it, and move the plane along its Y axis so it's behind the asteroid.



*Moving the plane in the top viewport*

Tip: You can turn off snaps by pressing the **S** key. This is handy for toggling the snaps settings when you are in the process of moving an object.

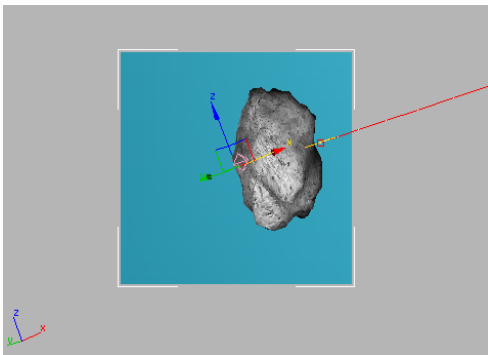
10. Right-click the Camera viewport to activate it without losing the selection of the plane.



Plane in camera viewport

11. In the Tools menu, choose Align To View.
12. In the Align To View dialog, make sure Align Z is chosen, and click OK.

The plane is now aligned to the Camera view.




Plane aligned to view

## Creating a Material for the Explosion

Next, you'll create a material for the explosion.

**Create a material for the explosion:**

1.  Open the Material Editor.
2. Select an unused sample sphere and name the material **Explosion**.

3.  Click Assign Material To Selection.

Tip: If the plane is no longer selected, you can drag the material from the sample slot to *Explosion Plane01*.

4. In the Blinn Basic Parameters rollout, click the blank button to the right of the Diffuse color swatch.

The Material/Map Browser dialog is displayed.

5. Click Bitmap in the dialog, and then click OK.


The Select Bitmap Image File dialog is displayed.

6. Use the Select Bitmap Image File dialog to find and choose *hercules.avi*.

The Preview window displays the first frame of the animation, which is solid black.

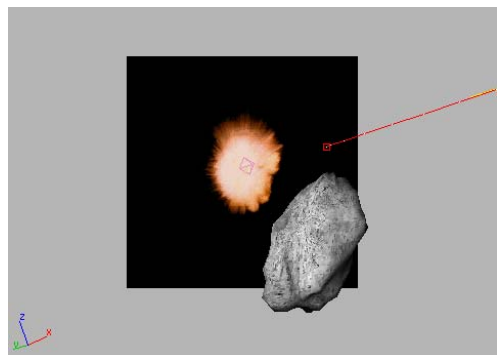
7. Click Open.

The animation is incorporated in the material as a Diffuse map.


8.  On the Material Editor toolbar, click to turn on Show Map In Viewport.

You can now see the frames of the animation on the plane object in the viewport.

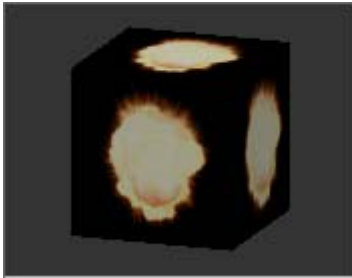
Tip: To see the animation in the viewport, drag the time slider forward. (The first frame of the animation, which displays at frame 0, is black.)



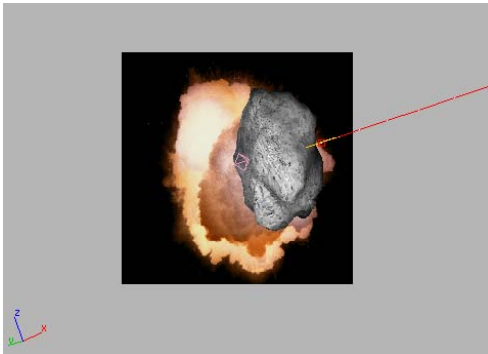
The material sample is currently a sphere. You can change that to a box to give you an undistorted view of the animated map.

9.  On the Material Editor vertical toolbar (to the right of the sample slots), choose the Box from the Sample Type flyout.

The Material sample is now a box, not a sphere.





10. Move the time slider and watch the explosion play on the plane in the viewport.



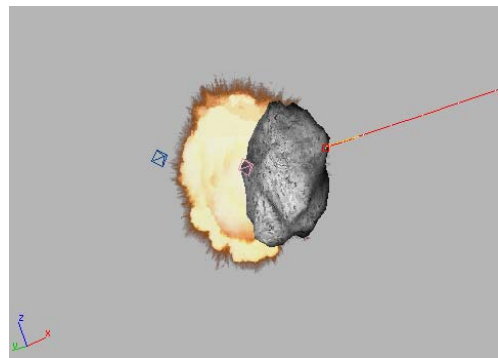
2. In the Material Editor, open the Maps rollout.
3. Click the Opacity map button (it is initially labeled “None”), and in the Material/Map Browser, choose Bitmap.
4. Use the Select Bitmap Image File dialog to choose *herculesm.avi*. Click Open.

The file *herculesm.avi* is a black-and-white mask of the animated explosion. Using the map’s alpha channel, the Opacity map makes the plane invisible and allows only the explosion to appear in the scene.

#### View the opacity map’s effect:

1.  On the Material Editor toolbar, click Go To Parent. Close the Maps rollout.
2.  On the Material Editor toolbar, click to turn on Show Map In Viewport.

The plane is now invisible in the viewport.




## Adding an Opacity Map

Now the explosion appears on the plane. The next step is to make the plane invisible so all you see in the scene is the explosion.

#### Add an opacity map:

1.  In the Material Editor toolbar, click Go To Parent.

Tip: If the transparency is not apparent in the viewport, right-click the viewport’s label, choose Configure, and then in the Viewport Configuration dialog > Rendering Method panel, change Transparency to Best.

3.  On the Material Editor vertical toolbar, click to turn on Background.

This turns on a checkered background that helps you visualize the opacity mapping.



#### Adjust the material settings:

- In the Blinn Basic Parameters rollout > Specular Highlights group, set both Specular Level and Glossiness to **0**.

This removes any shininess from the plane.

Tip: To set a numeric field to **0**, right-click the spinner next to the field.

#### Adjust the plane properties:

When using this mapping technique, you don't want the invisible plane to cast or receive shadows, so you'll turn those attributes off.

1. Select the plane in a viewport, then right-click and choose Properties from the quad menu.
2. In the Properties dialog that is displayed, in the Rendering Control group, turn off Receive Shadows and Cast Shadows. Click OK.

#### View the results:

- Play your animation.


The plane doesn't move with the asteroid.

That's okay, because you need the plane only at the point where the explosion occurs.

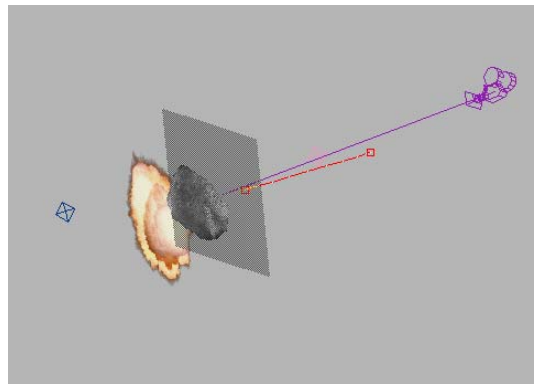
## Synchronizing the Animated Maps

Here you'll set the timing so the animated explosion doesn't start until impact at frame 10.

#### Set the timing:

1. Go to Material Editor > Maps rollout, and select the Diffuse map button, which is now identified as *hercules.avi*.
2. Scroll down and open the Time rollout.
3. Change the Start Frame setting to **10**.
4. In the End Condition group, choose Hold.
5.  In the Material Editor toolbar, click Go Forward To Sibling to navigate to the next map in the material. In this case, it's the Opacity map.
6. Repeat steps 2 through 4 for the *herculesm.avi* opacity map.
7. Close the Material Editor.
8. Save your scene as **myexplosion1.max**.

## Cloning the Explosion Plane



In this topic, you'll make a copy of the explosion plane, and set the copy in front of the asteroid. With two planes, the asteroid appears to be in the middle of the explosion, rather than in front of it.

#### Clone the explosion plane:

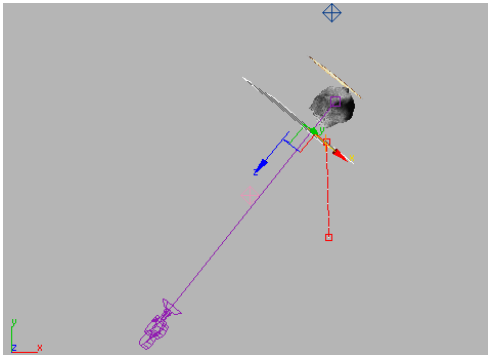
1. If it's not already selected, select *Explosion Plane01*. Press the SPACEBAR to lock your selection.

- On the toolbar, open the Reference Coordinates System list, and choose Local.



This will let you move the plane parallel to itself.

- In the Top viewport, right-click the plane and choose Move from the quad menu.
- Hold down SHIFT and drag a copy of *Explosion Plane01* in the Z axis. Position the plane so it is in front of the asteroid.



*Planes as seen in Top Viewport*

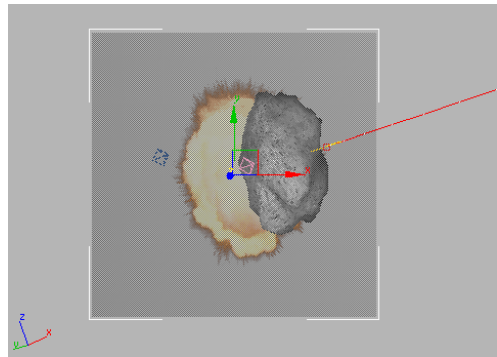
- A Clone options dialog is displayed. The program has automatically named the new plane *Explosion Plane02*. Leave the settings at their default, and click OK.

Note: The copy of the plane is now selected, and the Selection Lock Toggle automatically turns off.

### Set the new plane's properties, and make a named selection set:

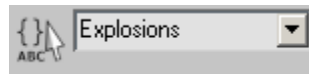
- Right-click the new plane and choose Properties. In the Display Properties group turn on See-Through. Click OK.

The cloned explosion plane now lets you see through it in the viewport. This doesn't affect the rendering.



*See-through plane in camera viewport*

- Select the two plane objects. In the Named Selection Sets window on the toolbar, type the name **Explosions** and press ENTER.



You can now reselect the two planes at any time by choosing this name from the Named Selection Sets drop-down list.

- Right-click the selected planes and choose Hide Selection from the quad menu.

The two planes are hidden from view.

- Save your scene as **myexplosion2.max**.



## Breaking the Asteroid into Flying Pieces with Particle Array

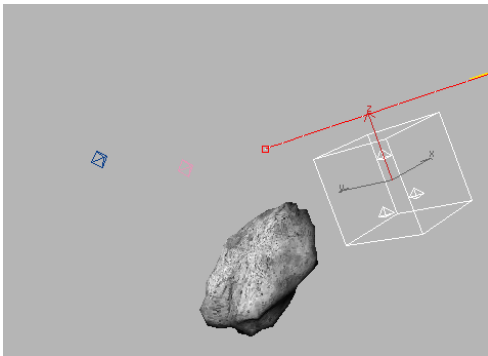
At this point, the asteroid, *laserblast*, and explosion are all animated. Next, you'll add particles to simulate the asteroid breaking up as it explodes.

### Setup:

- Continue working with the previous file or open *exploding\_asteroid\_with\_2planes.max*.

### Create a particle system in the scene:

1.   Go to Create panel > Geometry and choose Particle Systems from the drop-down list.
2. In the Object Type rollout, click PArray.
3. Click and drag to create a PArray particle gizmo in the Top viewport.



*Perspective viewport view of the PArray gizmo*

4. In the Basic Parameters rollout, click Pick Object, and then click the asteroid in a viewport.

The name of the asteroid, in this case *Sphere01*, is displayed below the Pick Object button to show that the particle system has been linked to the asteroid.

### Expand the command panel and adjust the PArray settings:

Next, you'll expand the command panel so you can see more of the particle system rollouts.

1. Move the cursor to the left edge of the command panel.

The cursor changes to a double arrow.

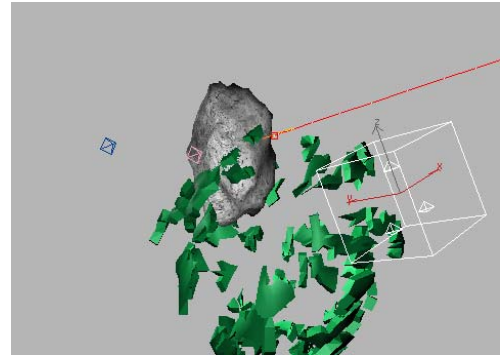
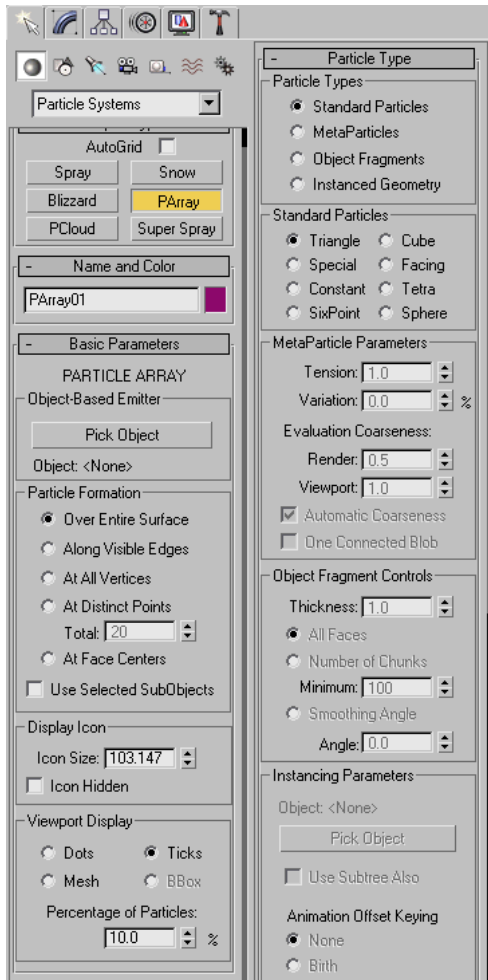
2. Click and drag the edge of the panel to the left.

A second column of the command panel appears.

3. Click the Particle Type rollout to open it.

The Particle Type rollout is now displayed in the second column.

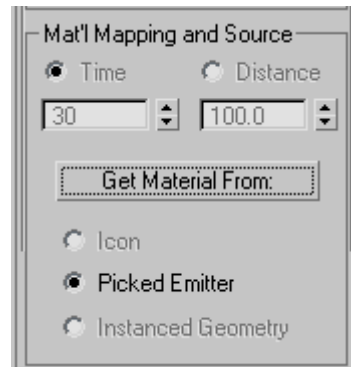




## Adding Materials to the Particles

### Add materials:

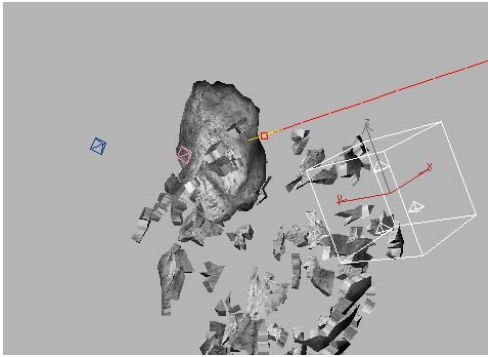
1. In the Particle Type rollout > Material Mapping And Source group, choose Picked Emitter.
2. Click the Get Material From button.



4. In the Particle Type rollout > Particle Types group, choose Object Fragments.
5. Scroll down to the Object Fragment Controls group.
6. Set Thickness to 11.0.
7. Choose Number Of Chunks and set Minimum to 75.
8. In the Basic Parameters rollout > Viewport Display group, choose Mesh.

Move the time slider to see asteroid chunks appear in the viewport.

The asteroid's materials appear on the particles in the viewport.



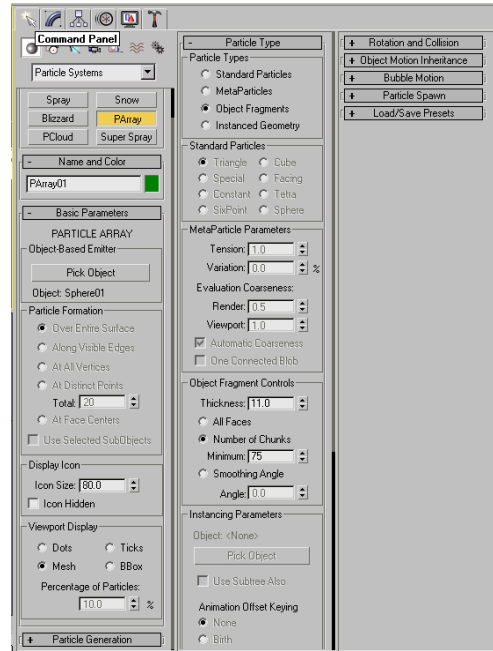
### Expand the control panel again:

1. Move the cursor over the far-left edge of the command panel.

The cursor once again changes to a double arrow.

2. Click and drag the cursor to the left to open a third column.

Now the Basic Parameters rollout appears in the first column, the Particles Type rollout in the second, and most additional rollouts in the new third column.



Tip: To close the additional columns, drag the left edge of the command panel to the right.

## Controlling Particle Animation

Next, you'll add some control to the animated particles.

### Control the animated particles:

1. Open the Rotation And Collision rollout. In the Spin Speed Controls group, set Spin Time to **50**.  
This will give some rotation to the chunks.
2. Open the Object Motion Inheritance rollout and set Influence to **0.0**.

This will keep the asteroid's movement and rotation from influencing the movement of the particles.

By default, the particle animation will begin on frame 0. Because the asteroid doesn't blow up

until frame 10, you'll have to adjust the timing of the particle animation.

3. Right-click an open rollout in the first column. Choose Particle Generation from the list.

The Particle Generation rollout is now displayed.

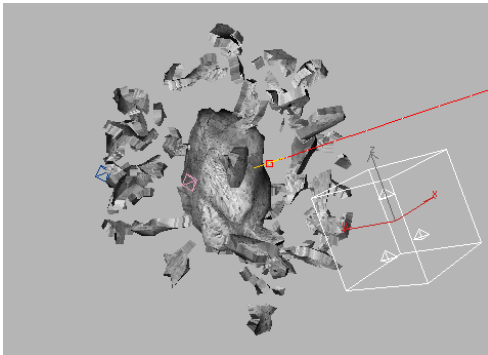
Tip: This right-click menu lets you navigate to a particular rollout quickly.

4. In the Particle Timing group, set Emit Start to **11** and Life to **90**.

The particles don't appear until frame 11, and they persist until the last frame of the animation.

5. Move the time slider or play the animation in the viewport to see the effect.

Now the asteroid starts to break into pieces after reaching the center of the viewport.



6. Drag the left edge of the command panel to the right to restore it to a single column.
7. Save your work as **myexplosion\_w\_particles.max**.

## Setting Visibility Keys to Make the Asteroid Disappear

The asteroid particle system explodes into pieces; however, the original asteroid object is still visible

in the scene. To make the explosion seem more realistic, the original object needs to disappear as it explodes.

### Setup:

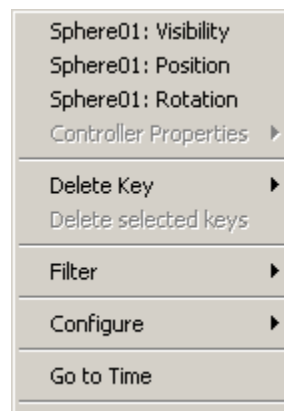
- Continue working with the previous file, or open *exploding\_asteroid\_with\_particles.max*.

### Create a visibility key:

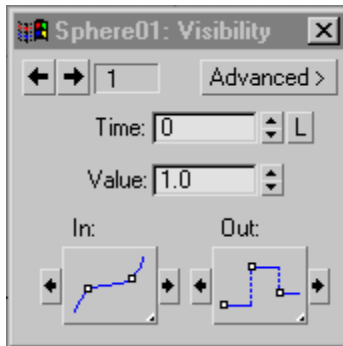
1. **Auto Key** Go to frame 11 and turn on Auto Key.
2. To select the asteroid, press **H** to open the Select Objects dialog, and select *Sphere01*. Click Select. Then right-click and choose Properties from the quad menu.
3. In the Object Properties dialog > Rendering Control group, right-click the Visibility spinner arrows to set this value to **0.0**.  
A red outline appears around the spinner arrows to indicate an animation key has been set.
4. Click OK to close the Object Properties dialog.
5. **Auto Key** Turn off Auto Key.

### Adjust the new visibility keys:

1. In the track bar, under the time slider, right-click the key at frame 0. Choose Sphere01: Visibility.



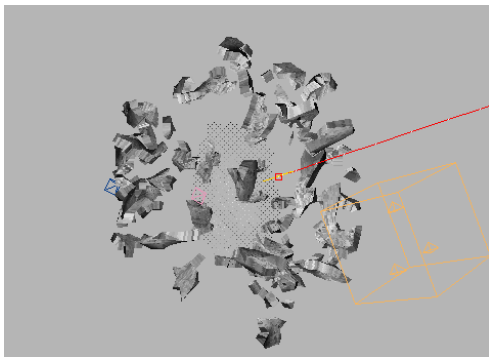
2. If necessary, set the Value to 1.0.
3. Change the Out interpolation to Stairstep.



This will make the object visible until the next key.


4. Drag the time slider and observe the animation in the viewport.

The asteroid disappears and the fragments fly outward.



5. Close the key dialog by clicking the X button in its title bar.

#### Render a frame to preview the explosion effect:

1. Right-click a viewport and choose Unhide All.  
The planes are now visible again.
2. Go to frame 21.
3.  On the toolbar, click Quick Render.

The single image shows you what the effect will look like so far. Verify that the asteroid is invisible, and that only the particle fragments and the explosion planes are rendering.



## Adding Motion Blur

To help create the illusion of fast movement in your explosion, you'll add motion blur to your animation.

#### Setup:

- Close the virtual frame buffer, if it is still open.


#### Add motion blur:

1. At frame 0 select the asteroid, then right-click it and choose Properties on the quad menu.
2. In the Motion Blur group, make sure that Enabled is on, and choose Object. Click OK.

Object motion blur will blur the asteroid, but not the entire scene.

3. Move the time slider to frame 7.



4.  Activate the Camera viewport and click Render Scene on the main toolbar.

The Render Scene dialog is displayed.

5. Click the Renderer tab. On the Default Scanline Renderer rollout, In the Object Motion Blur

group, make sure that Apply is on, and that Duration (Frames) is set to **0.5**.

This will create a motion blur that is not too blurry.

- At the bottom of the dialog, click Render to test the result.



*Motion blur on asteroid*

- Save your scene as **myexplosion3.max**.

## Putting a Light Inside the Asteroid

Creating fiery explosions with mapping techniques is effective, but it doesn't actually illuminate your scene. Adding a light inside the exploding asteroid illuminates its fragments and creates a more dramatic effect.

### Setup:

- Continue working with the previous file or open *exploding\_asteroid\_with\_motionblur.max*.

### Put a light inside the asteroid:

- Move the time slider to frame 10.

This puts the asteroid in the center of the frame.



- Go to Create panel > Lights > Object Type rollout, and click Omni.

- Activate the Top viewport, then click the center of the asteroid to create an Omni light.

Because the asteroid is positioned at the center of the scene, the light appears inside the asteroid.

- Change the name of the light you just created to **inside asteroid light**.

- Go to the Modify panel and click the white color swatch in the Intensity/Color/Attenuation rollout.

The Color Selector is displayed.

- Change the color to orange (R: **255**, G: **111**, B: **56**). Then close the Color Selector.

- Set the Multiplier to **4.0**.

Note: You don't need to animate the light. It will illuminate only the particles, and they appear when the explosion begins.



- On the toolbar, turn on Select And Link. Then press the **H** key to select the parent object. Choose *Sphere01* from the list, and then click Link.

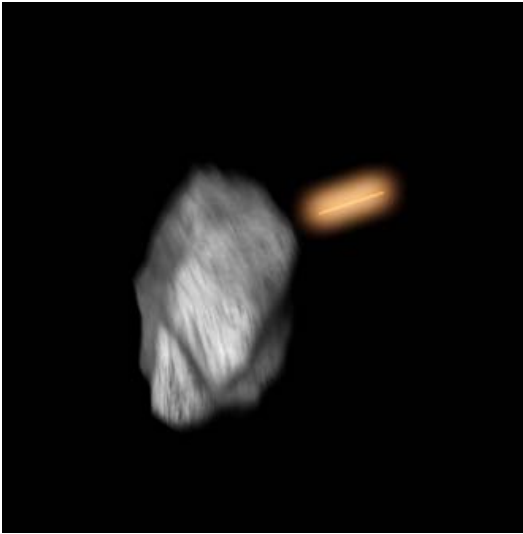
Now the light will move along with the animated asteroid.



- On the toolbar, click the Select button to turn off Select And Link.

- Save your work as **myexplosion\_w\_light.max**.

## Adding Render Effects to the Laser Blast



To give your scene some finishing touches, you'll add render effects to make the laser blast and the explosion glow.

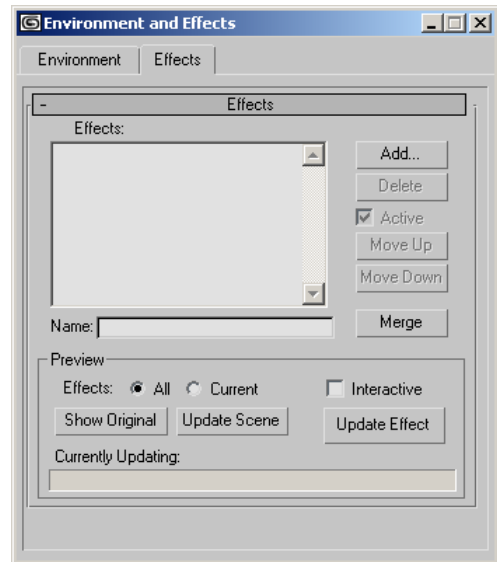
### Setup:

- Continue working with the previous file or open *exploding\_asteroid\_with\_lights.max*.

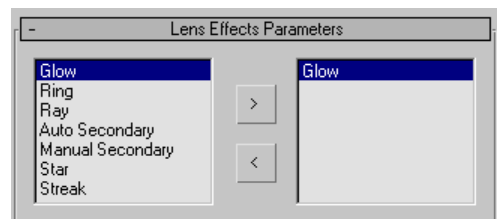
### Add a render effect:

1. Choose Rendering menu > Effects.

The Environment and Effects dialog is displayed, with the Effects tab active.



2. Click Add. In the Add Effect dialog, choose Lens Effects from the list, and click OK.
3. In the Lens Effects Parameters rollout, highlight Glow and then click the right-pointing arrow to move it into the list on the right.



### Adjust the glow settings:

1. Scroll down to the Glow Element rollout, and in the Name window, rename the glow effect **laser glow**.
2. Change Size to **0.1** and Intensity to **250**.
3. In the Radial Color group, click the white color swatch and change the color to orange (R: **235**, G: **120**, B: **60**).
4. Click the Options tab.



5. In the Apply Element To group, make sure Lights and Image Centers is off.
6. In the Image Sources group, turn on Effects ID. It should be set to 1 by default.
7. Scroll up to the Effects rollout > Preview group. Make sure the *Camera01* viewport is active, then click the Update Scene button.

The frame renders, and then the glow is applied to the laser blast.



8. Save your scene as **myexplosion4.max**.

## Adding a Second Glow to the Explosion

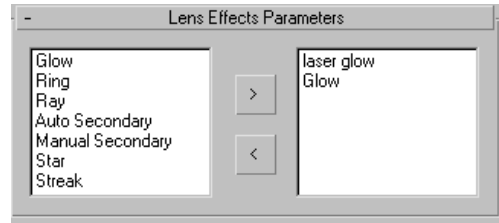
Next, you'll add a glowing effect to the light inside the asteroid to give the blast added realism.

### Setup:

- Continue working from the previous lesson, or open *exploding\_asteroid\_with\_laserglow.max*.

### Add a glow effect:

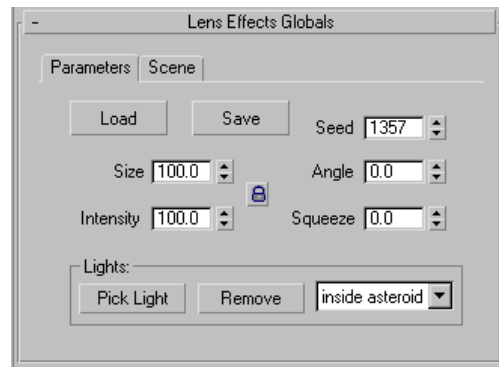
1. Choose Rendering > Effects, and highlight Lens Effects in the Effects list.
2. On the Lens Effects Parameters rollout, choose Glow once again in the list window on the left and click the right-pointing arrow.



3. Highlight the second Glow in the right-hand window and scroll down to the Glow Element rollout.
4. Name this glow effect **blast**.

### Adjust the glow settings:

1. In the Lens Effects Globals rollout, turn on Pick Light.
2. Press **H**, and use the dialog to select *inside asteroid light*.



The light's name is now displayed in the text field.

3. On the Glow Element rollout, open the Options panel.
4. In the Apply Element To group, turn on Lights. Turn off Image and Image Centers, if activated.
5. Go to the Parameters panel, and set Occlusion to **0.0**.

This allows you to see the glow through the explosion planes in the scene.

6. Turn off Glow Behind.
7. In the Radial Color group, change the swatch on the right to an orange color (R:242, G:150, B:0).
8. In the Glow Elements Parameters panel, set the Size to **30.0**.
9. Set the Intensity to **50**.

#### Preview the effect:

1. Go to frame 25 and activate the *Camera01* viewport.
2. Scroll up to the Effects area. Click Update Scene to see the results.



3. Close the virtual frame buffer and the Rendering Effects dialog.

## Animating the Explosion's Glow

The glow will be more realistic if it changes over time.

#### Animate the explosion's glow:



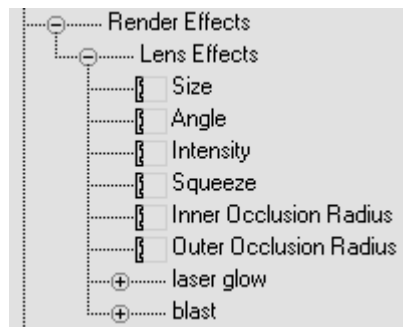
1. On the toolbar, click Curve Editor (Open).  
The Track View - Curve Editor is displayed.
2. Go to the Modes menu and choose Dope Sheet.

3. In the Controller window on the left, pan down until you can see the label Render Effects. This is near the top of the scene hierarchy.
4. Click the plus icon to the left of Render Effects to expand the render effects tracks.

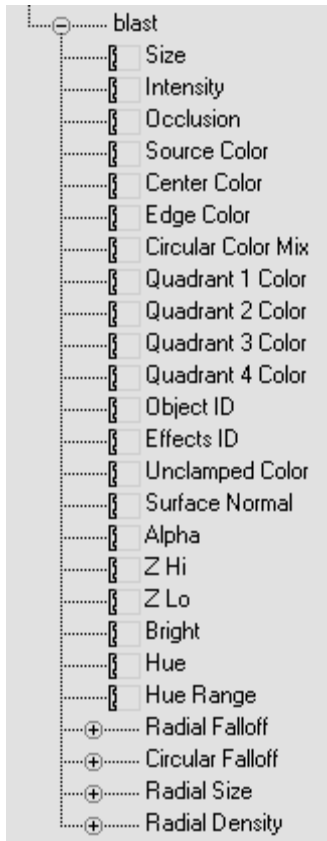
Tip: Clicking a plus icon in this window expands tracks. When the tracks have been expanded, the icon changes to a minus icon. If you want the tracks collapsed, click the minus icon. The tracks will no longer be visible.

5. Click to expand the Lens Effects tracks.

With the Lens Effects tracks open, you can see both glow effect tracks.



6. Scroll down and click to open the *blast* tracks.



All the glow attributes in the Rendering Effects dialog are listed here. You can set keys for any attribute to animate its effect.

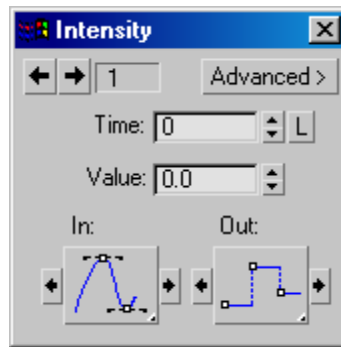
7. Click the Intensity track to select it, then right-click and select Assign Controller. Select Bezier Float, and then click OK.



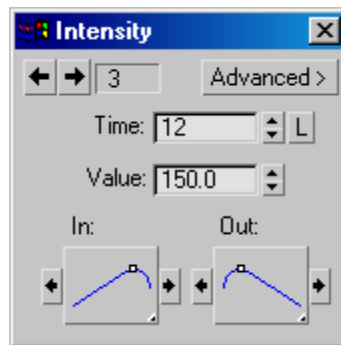
8. With the Intensity track selected, turn on Add Keys on the Track View toolbar.



9. In the Key window on the right, click the Intensity track to add a key at frame 0 and another key at frame 9.
10. Right-click the first key and set its value to 0. Move to the second key and set it to 0 as well.
11. Set the Out interpolation value of the first key to Stairstep. This will lock the glow between the first two keys.



12. Add another key at frame 12. Right-click the key and set its value to 75.0.
13. Add another key at frame 30. Right-click the key and set its value to 0.
14. Set the interpolation to Linear for the Out value keys at frame 9, the In and Out values for frame 12, and the In value for frame 30.



## Adding Streaks with Radial Blur

You can get a nice streaking effect using the Blur render effect. Adding a blur is just like adding a lens effect.

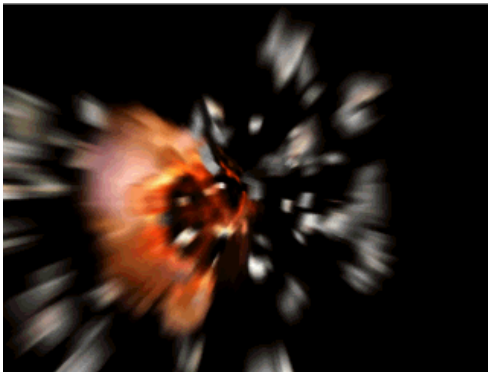
### Add a blur effect:

1. In the *Camera01* viewport, select the PArray gizmo, right-click it, and choose Properties from the quad menu.
2. In the G-Buffer group, use the spinner to set the Object Channel to **2**. Click OK.
3. Choose Rendering menu > Effects.
4. Click the Add button, choose Blur, and click OK.

### Set up the blur effect:


1. In the Blur Type panel, choose Radial.
2. On the Pixel Selections panel, turn off Whole Image, and turn on Object ID.
3. In the Object ID controls, use the spinner to change the ID to **2**, then click the Add button. The number 2 appears in the Object ID list.
4. Activate the *Camera01* viewport and drag the time slider to frame 33.
5. In the Effects rollout, click Update Scene to preview the result.

The radial blur is added to the image.



### Animate the blur effect:

Finally, you will keyframe the values and interpolation of the Blur Radial Pixel radius, so the particles fade out as they slow down toward the end of the animation.

1. Open the Dope Sheet Editor again and in the Controller window, navigate to the Blur entry. Expand its tracks, and click to highlight Blur Radial Pixel Radius.
2.  Turn on Add Keys on the Track View toolbar. In the Key window, click to add keys at frames 0 and 11.
3. Right-click a Blur Radial Pixel Radius key. Give both these keys a value of **0.0**, and use stairstep interpolation between them.
4. Click to create a key at frame 18. Give it a value of **7.0**. Leave the interpolation set to the default of Bezier.
5. Set another key at frame 100 with a value of **1.0**.
6. Save your scene as **myexplosion5.max**. You can open *exploding\_asteroid\_final.max* for comparison



### Render the animation:

1. On the Rendering menu, choose Render. Make sure the Common tab is displayed, click it if it isn't.

2. On the Common Parameters rollout, in the Time Output group, turn on Active Time Segment: 0 to 100.
3. In the Render Output group, click the Files button. Name the output file of the finished explosion **myexplosion2.avi**, and press ENTER.
4. In the Video Compression dialog, click OK.
5. Then click Render at the bottom of the Render Scene dialog.

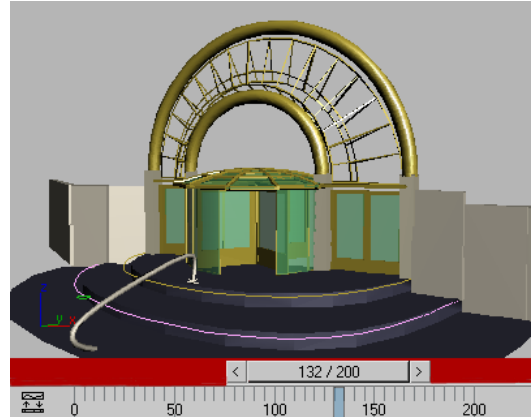
Or you can just play the provided movie *exploding\_asteroid\_final.avi*.

Tip: When doing high-quality work, render to a still image sequence of TGA files. Then you can use the Ram Player or other methods to turn these files into a movie sequence such as AVI or MOV.

## Summary

In this tutorial, you have created an exploding asteroid. You have learned to combine the use of many tools to create this effect. You have learned to use material effects ids with glows, and have created explosion planes with animated opacity mapping. You've created exploding fragments using PArray objects, and learned to set visibility keys. Finally you've used Render effects and motion blur to complete the shot.

navigation skills. You'll learn to instance objects and link them into an animated hierarchy. You'll also learn to merge files together.



Skill Level: Beginner

Time to complete: 25 minutes

## Features Covered in This Tutorial

After completing this tutorial, you should be able to:

- Have a working knowledge of the 3ds Max user interface.
- Create a revolving door by using primitive and AEC objects.
- Apply materials to objects and sub-objects.
- Animate the doors in the scene using rotation transforms and parametric animation.
- Merge objects from another file into your scene.

## Tutorial Files

All the necessary files to do the tutorials can be found on the Tutorial Files CD, in the *|tutorials|intro\_to\_design\_visualization|* folder, unless otherwise specified. Before beginning the tutorials, copy the *|tutorials|* directory from the CD to your *|3dsmax8|* local installation.

# Modeling a Revolving Door

In this tutorial, you learn how to model and animate in 3ds Max. You will construct an animated revolving door for a hotel lobby. In the course of doing so, you'll learn about creating and transforming primitive and parametric objects. You'll learn about using snaps and pivot points for alignment, as well as general user interface

## Setting Up Units and Snaps

Before you start to build your revolving door, you will set the display unit scale to feet and inches. You'll also make some changes to the snap options before you create the geometry.

### Set up the display unit scale:

**Note:** If you're using the product outside of the United States, you can choose to use metric display unit scale in the following steps. What's important is that the scale is a real-world measurement, rather than the default Generic Units setting in 3ds Max.

1. On the menu bar choose File > Reset to reset 3ds Max.

This tutorial does not require you to load any particular file to begin. As you work through it, if you get lost you can open a snapshot file, so you can complete the tutorial.

The files for this tutorial are on the Tutorial Files CD in the *tutorials\intro\_to\_design\_visualization* directory.

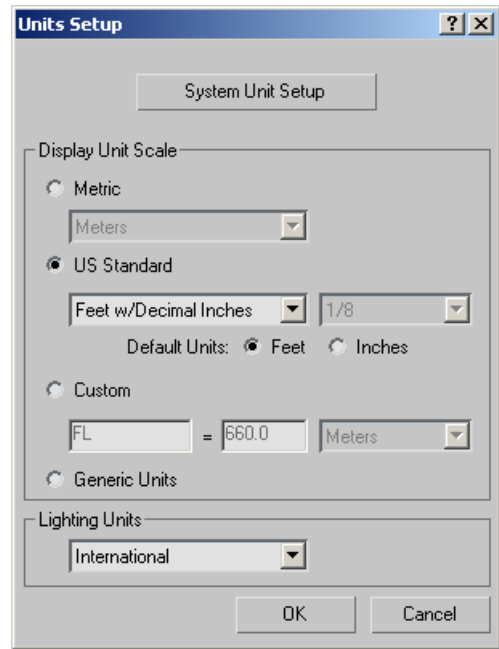
2. On the menu bar, choose Customize > Units Setup.

The Units Setup dialog appears.

3. In the Display Unit Scale group, choose US Standard.

Leave the scale set to the default Feet w/Decimal inches.

The Display Unit Scale is now set to Feet and Decimal Inches.



Leave the System Unit Setup as it is. This should be changed only to reset the system unit to the default setting (inches) after loading a file that uses a different system unit, or if you are working on files that are so huge or so tiny that values don't appear correctly in the numeric entry fields.

4. Click OK to accept the change.

Now, when you make something, its measurements are displayed in the command panels in familiar real-world terms.

Next, you will make some additions to the grid and snap settings.

### Set up snaps:

1. On the menu bar, choose Customize > Grid And Snap Settings.

The Grids And Snap Settings dialog appears.

2. On the Snaps panel, turn on Grid Points, Vertex, and Edge/Segment. Make sure all the other snaps are turned off.
3. Close the dialog by clicking the X button at the upper right of the dialog.  
Now, when Snap is on, you'll be able to snap to vertices, grid points and edges.  
You're ready to create a cylinder to serve as the central pole that rotates the revolving door.
4. Save your file as *my\_revolving\_door\_units.max*.

## Creating the Hub


Using the Cylinder object, you will create a central pole that will act as the hub for the revolving door. First you will create a new layer for the revolving door.

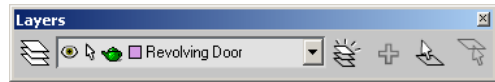
### Set up the lesson:

- Continue with the scene from the previous lesson, or open *revolving\_door\_hub.max* to begin.

### Create a layer:

You can use the layer management system for display and rendering purposes. Here you will create a new layer for the revolving door.


1. By default, the Layers toolbar is hidden when you start 3ds Max. If it is not currently open, right-click a blank space on the main toolbar and choose Layers from the pop-up menu.
2.  On the Layers Toolbar, click the Create New Layer button.  
This creates a new layer and opens the Create New Layer dialog.
3. Use the Create New Layer dialog to name the Layer **Revolving Door**, and then click OK.

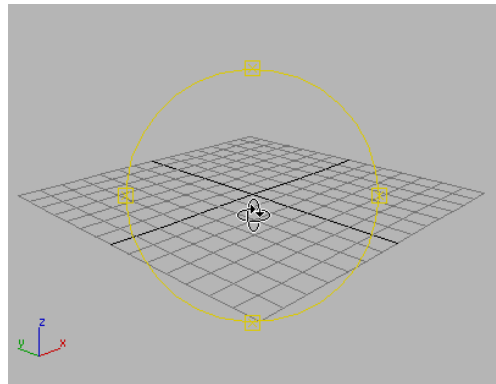



The Revolving door layer is now current and visible in the Layers toolbar. Whatever you create now will be on this layer.

### Create the hub:

Before creating the hub, you will adjust your viewport so you have a better view of the objects you will make.

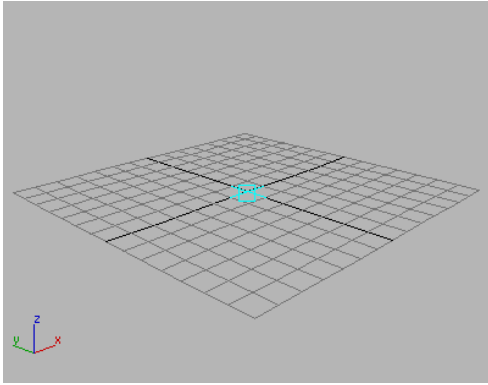
1.  In the viewport navigation controls at the lower right corner of the user interface, click the Arc Rotate button. In the Perspective viewport press and drag within the navigation orb to change the view of the home grid. When you are done, right-click in the viewport to turn off Arc Rotate.



2.  Click the 3D Snap Toggle on the toolbar.
3. On the Create panel > Standard Primitives > Object Type rollout, click Cylinder.  
The Cylinder button turns yellow, indicating it is active and ready for use.
4. Now move your cursor over the grid in the viewport.



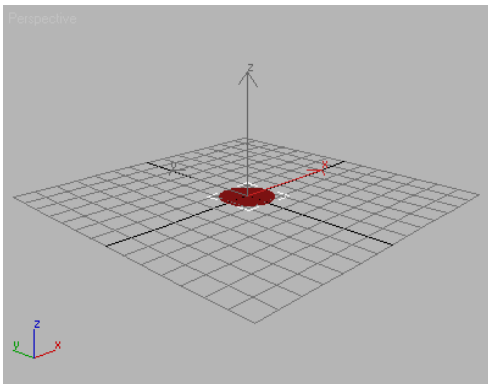
The cursor displays a blue snap icon and jumps to the grid points.



5. Position the cursor over the center of the grid and then press and drag.

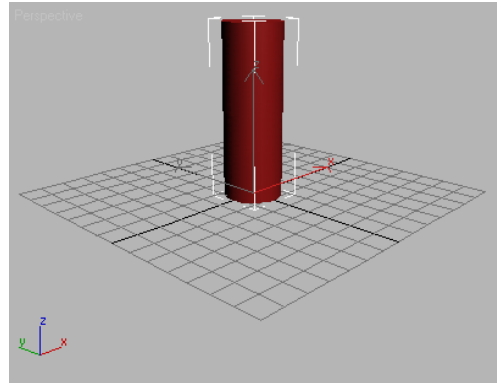
As you move the mouse away from the center, a flat shaded circle grows from your cursor. You are defining the radius of the cylinder as you move the mouse.

Notice that as you move away from the center of the grid the mouse will snap to grid points.



6. Turn off the snap by pressing the **S** on the keyboard while you are still moving the cursor.
- The snap has been turned off, while you are still in the middle of creating the cylinder. Now as you move your mouse, you are free from the snap control.

7. Lift the mouse button, and you have set the radius of the cylinder. The radius is displayed on the Parameters rollout.
8. Now move your cursor upward in the viewport.




9. The cylinder grows as you move the cursor upward. When you click again you have set the height.

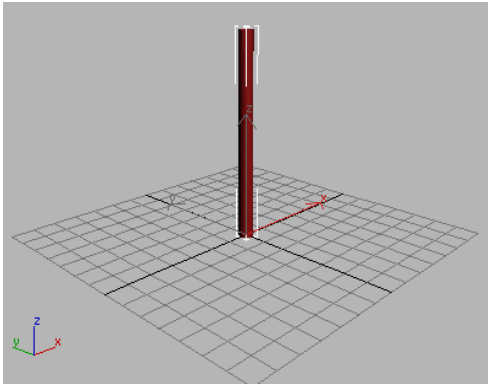
Make the cylinder any size you like. You're going to change the size in the next step.

#### Adjust the hub:

1. On the Parameters rollout change Radius to **0' 3.0"**.
2. Change the Height to **7'0.0"**.

3.  In the Navigation controls, click the Zoom Extents button.

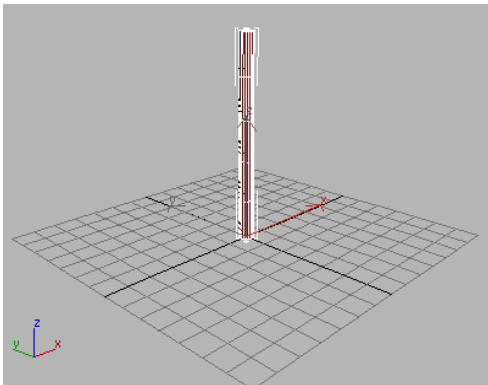
The viewport zooms out so you can see the cylinder.



*Zoom extents to see it all*

4. Right-click the Perspective viewport label and choose Edged Faces.

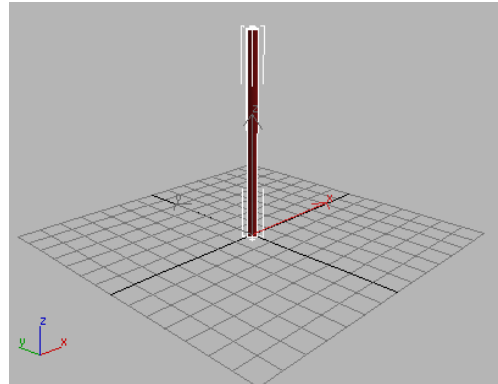
The Edged Faces option lets you see the edges that the software uses to create the surfaces of your model.



*Edged faces show the underlying geometry*

5. On the Parameters rollout, change Height Segments to 1.
6. Change Sides to 4.


The Cylinder changes into a tall box with four sides; this will make it easier to create the door. Later you'll change the pole back to a cylinder.

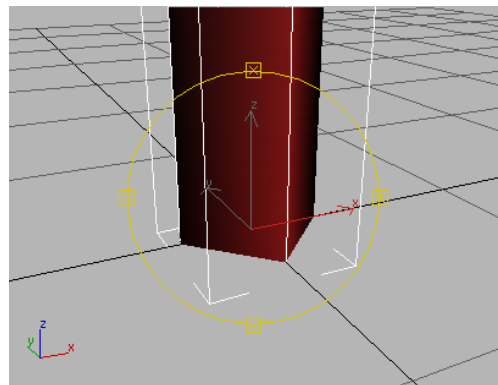


*Reduce the segments*


Next you'll rotate the cylinder so the four sides line up with the grid.

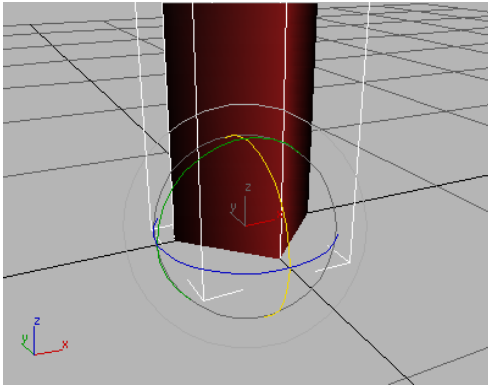
#### Rotate the hub:

1.  Click the Zoom button in the viewport navigation controls. Position the cursor over the bottom of the cylinder and then press **i** on the keyboard to center the viewport on the cursor position.
2. Zoom in so you can see the bottom of the cylinder up close. Use Arc Rotate to rotate the view if you like.



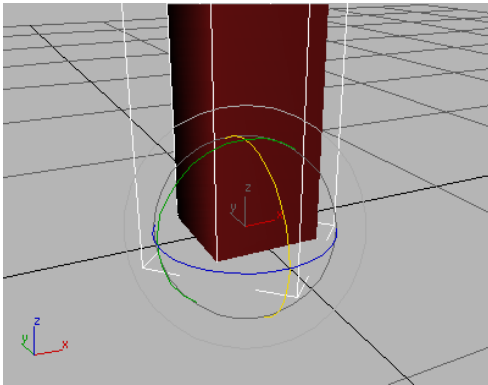
*Zoom in and rotate the view.*

3.  On the toolbar, click Rotate.
- The transform gizmo appears in the viewport.



4. In the coordinate display below the Perspective viewport, click in the Z entry field and enter **45**. Click OK to confirm the entry.

The cylinder rotates around the Z axis so the sides line up with the grid.



*Cylinder rotated*

This will be the pole that revolves to turn the revolving door. You'll snap to its sides when you create an initial Pivot door object. After the other doors are cloned, you can increase the number of sides so it will look like a cylinder again.


Next you will create a tube object to make the door enclosure.

5. Save your scene as *My\_revolving\_door\_hub.max*.


## Creating the Enclosure

You will use the primitive Tube object with the Slice option to create an enclosure for the revolving door.

### Set up the lesson:


1. Continue with your scene from the previous lesson, or open *revolving\_door\_enclosure.max* to continue.
2.  Right-click in the Perspective viewport to activate it, and then click the Maximum Viewport Toggle button at the lower right extreme of the 3ds Max interface to maximize the Perspective viewport.

### Create another layer:

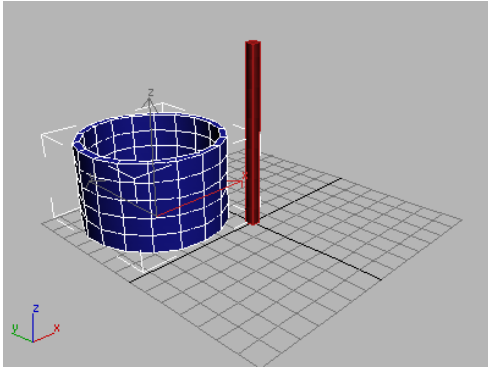
1.  On the Layers toolbar, click the Create New Layer button.  
This creates a new layer.
2. Name the Layer **Enclosure**.  
The Move Selection to New Layer setting should be off. If you leave this on, the hub will be moved from the previous layer to the new layer. Click OK.

The Enclosure layer is now visible in the Layer Properties field.

### Create the tube:

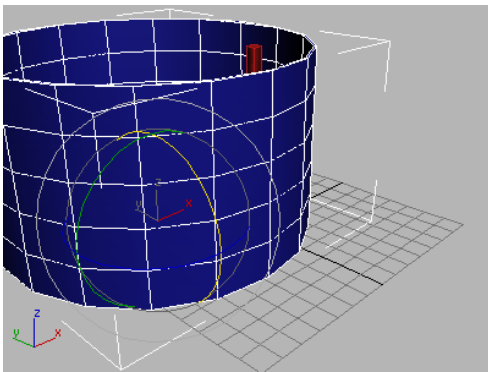
1.  On the navigation controls, click the Zoom Extents button to zoom back so you can see the area around the cylinder.
2. On the Create panel, on the Object Type rollout, click Tube.  
The Tube button turns yellow, indicating it is active and ready for use.
3. Drag out a tube anywhere in the viewport.

The size doesn't matter; you'll be changing it in a moment.



*Make a tube.*

4. In the Parameters rollout on the Create panel, change Radius 1 to **6'0.0"**.
5. Change Radius 2 to **5'11.0"**
6. Change Height to **7'0.0"**.



*Increase the radius and height of the tube*

7. If necessary, zoom out so you can see both the tube and the cylinder.

#### Align the tube:

Next, you'll center the tube over the cylinder.

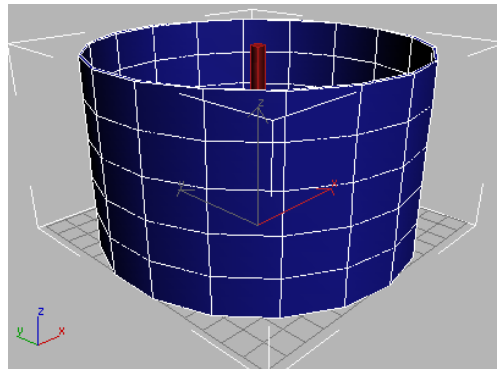


1. On the toolbar, click the Align button.

Since the tube is selected you will align it to the cylinder.

2. Click the cylinder in the viewport.
3. On the Align Selection (Cylinder01) dialog, turn on X Position, Y Position, and Z Position. Choose Pivot Point for both Current Object and Target Object. Click OK.

The tube is centered over the cylinder.

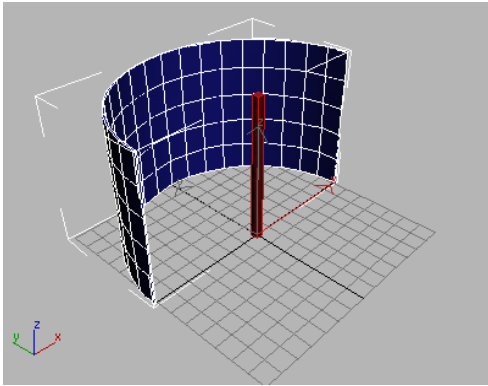


On the Create panel, in the Name And Color group, rename the Tube object **left enclosure panels**.

#### Slice the tube:

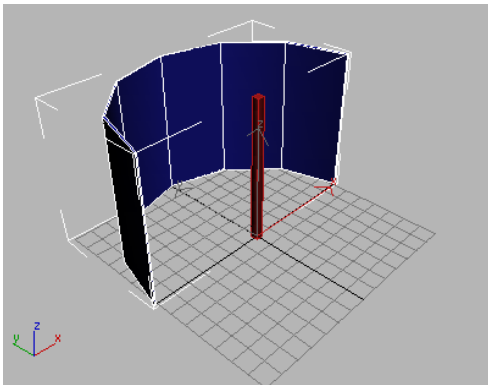


1. Click the Modify panel.
2. On the Parameters rollout, turn on Slice On.
3. Adjust the Slice From and Slice To values so you have a half of a tube visible in the viewport, resembling the illustration. The difference between the two values should be 180.



*Slice the tube*

4. Change Sides to **6**. The enclosure will be created out of flat panels, rather than curved glass.
5. Change Height Segments to **1**.



*Lower the geometry values*

Next you will clone the tube to create the other side of the enclosure.

#### Clone the tube:



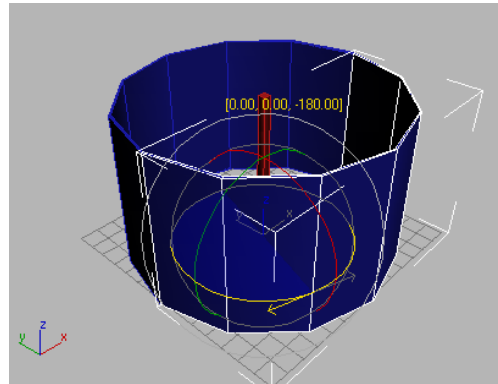
1. On the toolbar, click Rotate, if it isn't already active.
2. Press the **A** key on the keyboard to turn on Angle Snap.
3. Hold down the SHIFT key and rotate the left enclosure 180 degrees about the Z-axis.

A copy of the tube rotates into place on the other side of the enclosure.

4. When the copy of the tube is in the proper position, release the mouse button.

The Clone Options dialog is displayed.

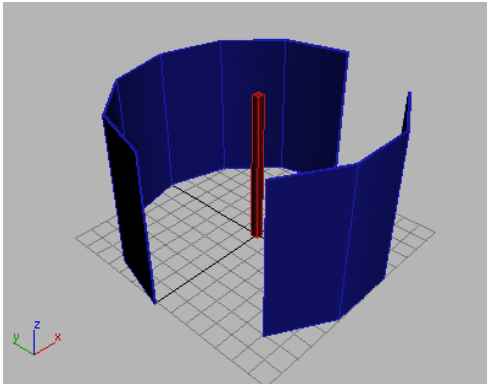
5. On the dialog, set the Object option to Copy and name the clone **right enclosure panels**. Click OK.



6. Adjust the Slice values so the tube resembles the illustration below. Try setting Slice From=**45** and Slice To=**-45.0**

Depending how you constructed the initial tube, you may have different values. The difference between the two should be a multiple of 90.

7. Change the Sides value to **3**.



*Left and right enclosures*

You'll do some more work on the enclosures in a while, but first you'll construct the revolving door.

8. Save your work as **my\_enclosure.max**.

## Creating the Revolving Door

To create the revolving door, you will rotate the right enclosure panel temporarily into a different position, then you will create a pivot door using snaps between the hub and the right enclosure panels. You can edit the material on the door, then instance the door to create a wheel of four doors.

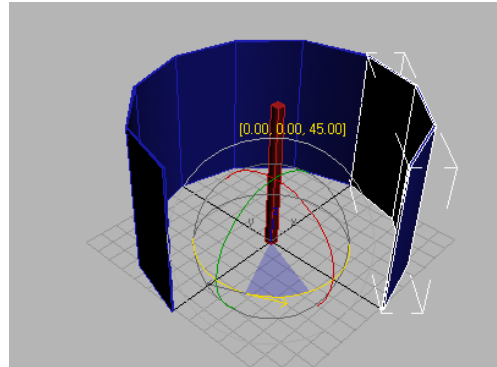
- Continue from before or open `|tutorials|intro_to_design_visualization|add_door.max`.

### Rotate the right enclosure:

1. Select the *right enclosure panels* object in the viewport.



2. On the toolbar, click the Rotate button. Rotate the *right enclosure panels* object 45 degrees until it touches the *left enclosure panels* object, as shown below.



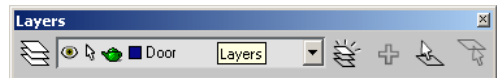
*Rotate the right enclosure.*

This rotation is temporary, for the purpose of modeling only.

### Create a new layer:

1. On the Layers toolbar, click Create New Layer.
2. Turn off Move Selection To New Layer and name the layer **Doors**.
3. Click OK.

The Doors layer is now visible in the Layer Properties field on the Layers toolbar.



### Create a door:

1. Right-click any of the Snap buttons on the Main toolbar, or from the menu bar choose Customize > Grid And Snap Settings.

The Grids And Snap Settings dialog appears.

2. On the Snaps panel, turn off Grid Points and turn on Midpoint. Make sure Vertex and Edge/Segment are still on, and then close the dialog.

Note: Even though you have selected new snap settings, you still need to turn on Snaps.

3. Press **S** on the keyboard to turn on snaps.



The 3D Snap button is highlighted on the Snaps area.

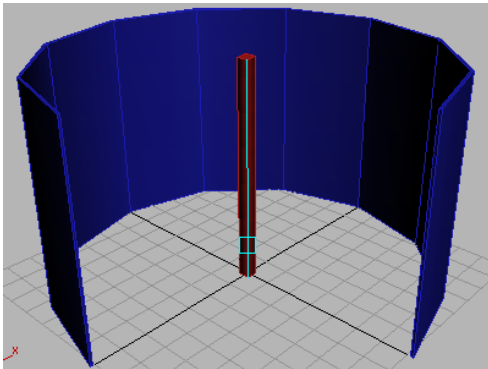


4. On the Create panel click the arrow on the drop-down list and choose Doors. On the Object Type rollout, click Pivot.

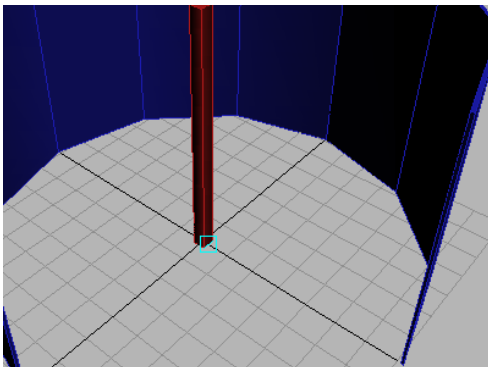
On the Create panel, the Pivot button turns yellow, and the pivot door Parameters rollouts appear.

5. In the Perspective viewport, move your cursor over the cylinder in the center.

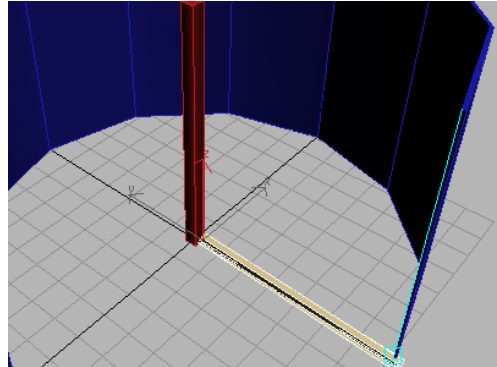
You can see the blue snap icon that follows the edges of the cylinder as you move.



6. Position your cursor so you are snapping to the bottom-right edge of the cylinder.

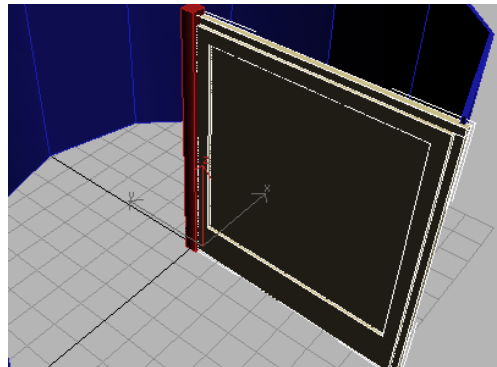


7. Drag to the right, away from the cylinder, *keeping the mouse button depressed*. Snap to the front of the right enclosure object. Release the mouse button to set the width of the door.



*Snap to the right enclosure.*

8. Press **S** to turn snaps off.
9. Without moving the mouse, click to set the depth of the door, and then move the mouse upward to adjust the height of the door. Click to set the height.



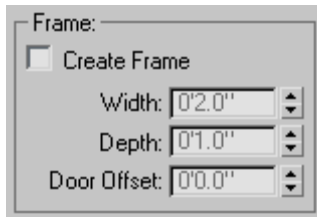
*Set the Height last.*

#### Adjust the door parameters:

Immediately after clicking to set the height, make the following parameter adjustments, watching the effects in the viewport. You can adjust these parameters at any time in the future using the Modify panel.

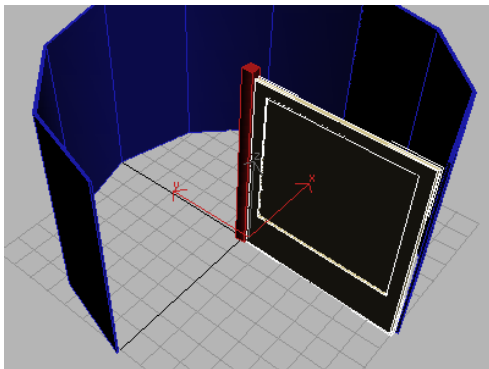


1. In the Frame group, turn off Create Frame.



The frame disappears from the door.

2. In the Leaf Parameters rollout, increase the Stiles/Top Rail value to about **0'5.0"**.
3. Set the Bottom Rail parameter to **1'6.0"**.
4. Adjust the width of the door so it fits inside the enclosure. If necessary, adjust the height and depth as well.

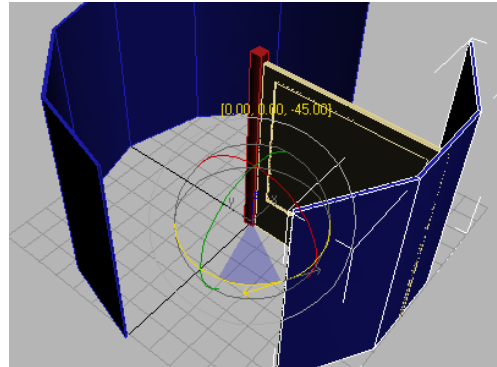


#### Rotate the enclosure:

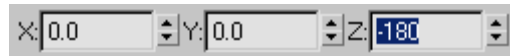
1. Select the right enclosure.



2. On the toolbar, click Rotate, and then move your mouse over the Transform gizmo tripod in the viewport. When the Z-axis is highlighted, move your mouse to rotate the sliced tube back into place.



Tip: If you prefer, you can enter the rotation in the coordinate display on the status bar.



3. If the pivot door is sticking through the enclosure after you rotate it, select the pivot door, and in the Modify panel, change its width so it fits within the space properly.

#### Add struts to the enclosure:

You'll use a Lattice modifier to add struts to the enclosure. The glass panels will be held up by stout uprights that you will create next.

1. On the Layers toolbar, choose the Enclosure layer from the drop-down list.



2. On the Layers toolbar, click Select Objects In Current Layer.

This selects both Enclosure objects and deselects any other objects.

3. On the menu bar, choose Edit > Clone.
4. Choose Object group > Copy, and click OK.

The software clones the two enclosure objects and selects the copies.

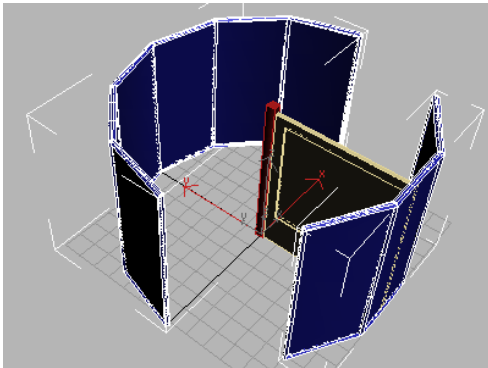
5. On the menu bar, choose Modifiers > Parametric Deformers > Lattice.

The software applies the Lattice modifier to the selected objects.

6. In the Geometry group of the Parameters rollout, choose Struts Only From Edges.

The right and left enclosure panels now are held up by struts.

7. Adjust the Struts parameters so that:
  - Radius=0'1.0"
  - Segments=3
  - Sides=4
8. In the Struts group of the Parameters rollout, turn on End Caps.



One of the objects with the Lattice modifier is named *left enclosure panel01*, the other is named *right enclosure panel01*. You'll rename both now.

9. Select the *right enclosure panel01* object, then type **Struts right** in the Name and Color field. Also rename the *left enclosure panel01* object **Struts left**.


Next, you will create, apply, and edit some materials for the revolving door.

10. Save your file as *my\_add\_door.max*.

## Applying Materials to the Revolving Door

You'll add some quick materials to help visualize your revolving door. You'll add a shiny black finish for the struts and a green glass material for the glazing in the door and the enclosures. You'll also edit the material that already exists on the revolving door, so it matches your own green glass.


### Open the material editor:

1. Continue from the previous exercise, or choose File > Open and load *tutorials\intro\_to\_design\_visualization\add\_door\_materials.max*.
2.  Open the Material Editor. You can press **M** on the keyboard, or click the Material Editor button on the toolbar.

The Material Editor appears in its own dialog.

### Apply a door material:

You can choose materials from a material library and apply them to the revolving door so the panel is transparent.

1.  On the Material Editor toolbar, below the sample spheres, click the Get Material button. The Material/Map Browser opens.
2. In the Browse From group, choose Mtl Library. "Mtl" is an abbreviation for "Material."
3. In the File group, click Open.
4. Open the *AecTemplates.mat* file
5. In the list of materials that appears double-click the material name *Door-Template*. The door material appears in the material editor.
6. Drag the material from the sample sphere to the door object in the viewport.

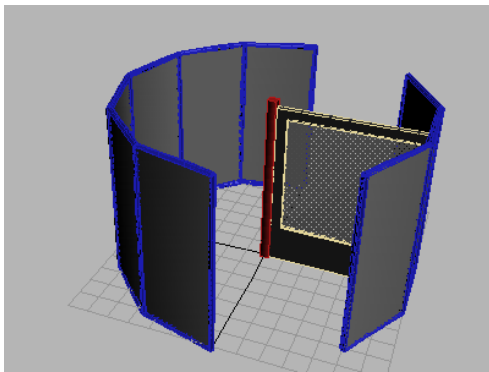
The door now displays with transparent glass.

Tip: If you loaded the provided scene file, you might get a message that asks you to Replace or Rename the material. Choose Replace and continue.

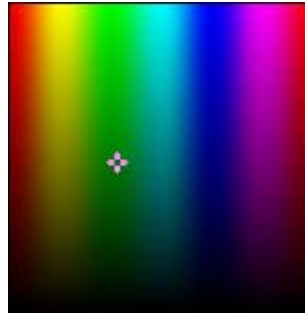
#### Create and apply a green glass material:

1. Click any unused sample sphere in the Material Editor to activate the material.
2. Drag the material onto the *left enclosure panels* object. Drag from the material sample sphere to the viewport, and read the tooltip to be sure you have the left enclosure object (*left enclosure panels*) as the target.

The glass panels of the left enclosure change their appearance in the viewport. Also, in the Material Editor, the sample sphere is now marked with corners showing that this material has been applied to an object in the scene.

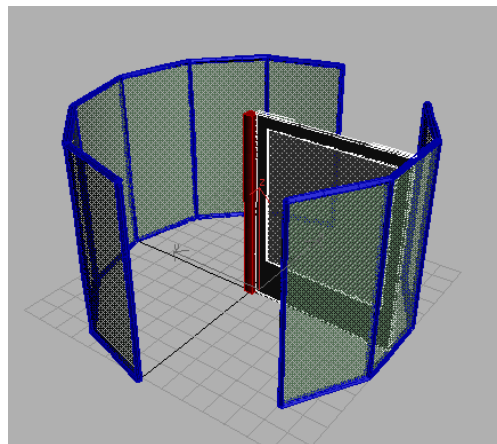


3. On the Blinn Basic Parameters rollout, change the color of this material by clicking the Diffuse color swatch. When the Color Selector opens, pick a green color.



Watch in the viewport; each time you click a different color, the material updates in the viewport. When you've decided on a color, click the Close button.

4. On the Blinn Basic Parameters rollout, change the Opacity value to **66**.
5. Rename the current material to **Green Glass**. Highlight the name and then enter the new name.
6. Drag the Green Glass material from the sample sphere in the material editor to the *right enclosure panels* object in the viewport.



The glass on the right enclosure matches the color and transparency of the left enclosure.

### Create a black metal finish:

1. In the Material Editor, activate a different sample sphere by clicking it.
2. Name the material **Black Metal Finish**.
3. On the Shader Basic Parameters rollout, click the drop-down arrow next to Blinn and choose Metal.


4. On the Metal Basic Parameters rollout, click the Ambient color swatch. In the Color Selector, choose a dark color close to black. You can use the Whiteness slider to darken the color.

Note: The Diffuse color changes to the same dark color, since the Diffuse and Ambient values are locked together by default.

5. Set Specular Level to **128** and Glossiness to **37**.

This will produce a black, shiny surface treatment.

6. Press **H** on the keyboard, then select the Struts objects by name. Hold down the CTRL key and highlight the names, and then click Select to select both objects and close the dialog.

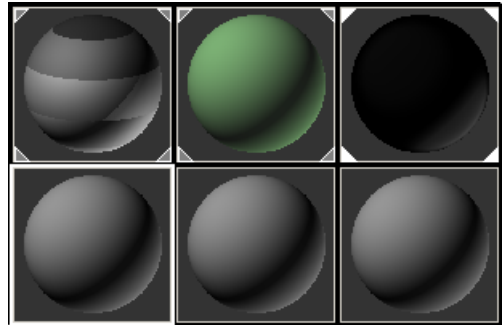
7.  Click the Assign Material To Selection button to apply the material to the selection.
8. Drag this material onto the central hub object (*Cylinder01*).


### Edit the material:

After you created the pivot door, you assigned a Multi/Sub-Object material from a material library to the door. When you have a single object, such as this door, with different, distinct components (such as glazing, frame, and so on), you can use this type of material to apply different materials to the parts.

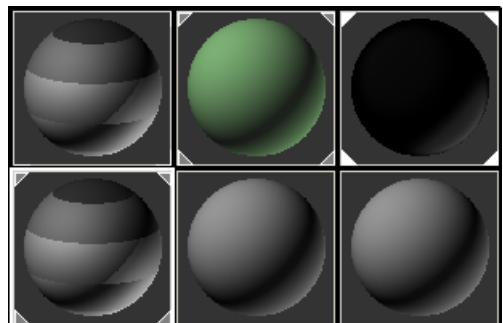
You will use the eyedropper to get the material from the door into the material editor. This will give you a second copy of the material to edit, leaving the original available for use.

1. Click another sample sphere, to make it active.



2.  In the Material Editor, click the eyedropper button to activate it, and then in the viewport click the pivot door.

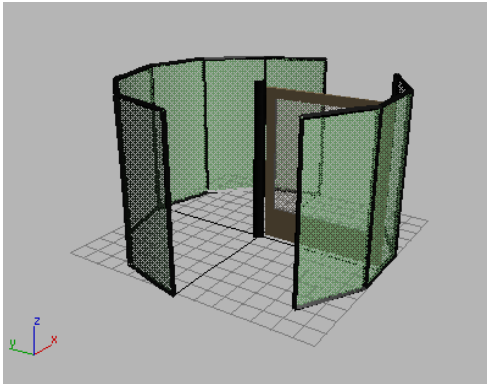
The sample sphere is replaced with a sphere that shows five stripes of different materials. This indicates that the selected material is a Multi/Sub-Object material.



On the Multi/Sub-Object Basic Parameters rollout you can click and access each individual material.

3. Drag the Green Glass sample sphere to the Inner Bevel (Standard) button. On the Instance (Copy) Material dialog choose Instance, if necessary, and click OK.

This is the material that is applied to the glazing. The glass on the revolving door turns green in the viewport.



4. Drag the Black Metal Finish material to the other material slots in the Multi/Sub-Object material. In each case choose Instance.

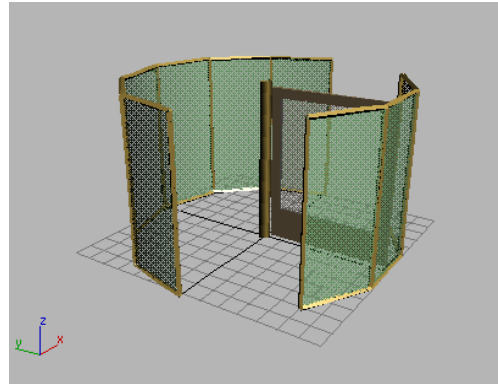
#### Change the material:

Now make changes to the material and watch them update on the objects in the viewport.

Change the Black Metal Finish to a shiny gold instead. Do the following:

1. Click the Black Metal Finish sample sphere.
2. Click the Diffuse color swatch, and then change the black material to a gold material. Use RGB values of approximately **176, 157, and 52**, respectively, to achieve a nice gold tone.
3. Rename the Black Metal Finish material to **Burnished Gold**.
4. Right-click the Perspective label in the viewport, and turn off Edged Faces.

Close the Material Editor when you're done.



5. Save your file as **my\_add\_door\_materials.max**.

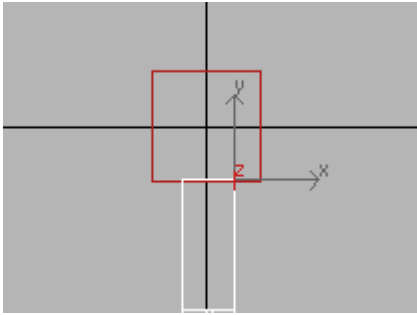
## Cloning the Door

There will be four doors revolving around the central hub. You have one door so far, and you will make three instances of the door to complete the wheel.

- Continue from before, or load *|tutorials\intro\_to\_design\_visualization\start\_door\_clone.max*.

#### Adjust the door position and rotation:

1. Activate the Top viewport or press **T** on the keyboard to change to a Top viewport.
2. Right-click the viewport label and make sure the viewport is set to Wireframe shading mode.
3. Zoom in and select the pivot door.
4. Move the pivot door, if necessary, so it is centered on the edge of the hub, as illustrated. Rotate the door, if necessary, so it is square to the hub. One way to accomplish the latter is to click the Select And Rotate button, and then set the Z coordinate under the viewport to **0.0**.



5. Press **P** on the keyboard to return to the Perspective viewport, or right-click anywhere within the Perspective viewport to activate it without changing the selection.


#### Create the cloned doors:

1. Right-click in the viewport and choose Rotate from the menu.

This right-click menu is called the quad menu. You can use it to access tools from the toolbar and command panel for quicker workflow. You can even customize it to keep your favorite tools right under your fingertips.

2. On the toolbar, click the drop-down arrow for the Reference Coordinate System (View is the default). Choose Pick, then click the *Cylinder01* object (the hub) in the viewport.

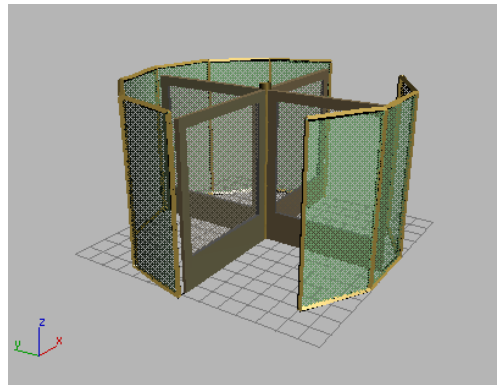


3.  On the toolbar, directly next to the Reference Coordinate system drop-down, choose Use Transform Coordinate Center. This allows you to rotate the pivot door around the cylinder's pivot point, rather than its own.
4. Press **A** on the keyboard to turn Angle Snap on, if it isn't already.

The Angle Snap button activates on the toolbar.

5. Hold down the SHIFT key and position your cursor over the blue circle (Z axis) in the Rotate gizmo until the circle turns yellow. Then click and drag slowly to rotate the door until Z= 90 degrees in the Coordinate display. Release the mouse button.
6. On the Clone Options dialog, set Number Of Copies to **3**, choose Instance (if necessary), and click OK.

Now there are four doors within the enclosure.

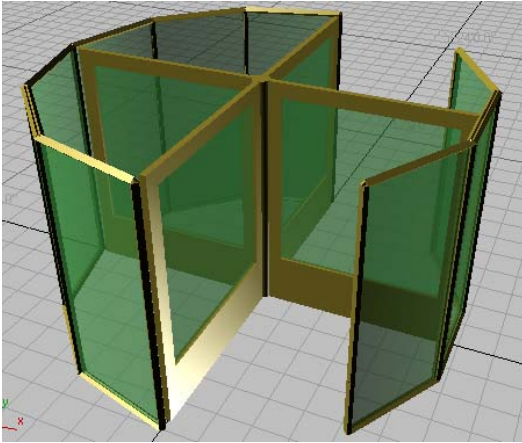


*Clone the door to create a wheel of doors*

7. Select the hub in the viewport, and then on the Modify panel, change its Sides value to **12**. The hub now resembles a cylinder rather than a box.
8. Save your work as **my\_fourdoor.max**.

## Animating the Revolving Door

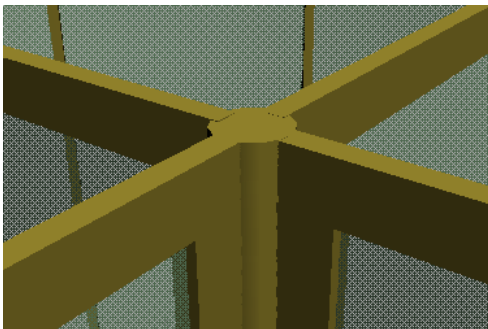
To make the revolving door spin, you will first link the four doors to the hub. Then using the Time slider, you will animate the rotation of the hub to spin the doors.




- Continue from before or load `|tutorials|intro_to_design_visualization|start_door_link.max`.



#### Link the doors to the hub:

1. Zoom in the viewport so you have a close-up view of the hub and the four doors.



2.  On the toolbar, click the Select And Link button.
3. In the viewport, drag from one of the pivot door objects to the hub. You will see a dotted line drawn between your cursor and the original door as you move.
4. Repeat the operation for each of the other three doors.

5. To verify that you correctly linked the four doors to the hub, do the following:

-  On the toolbar, click the Select button.
-  Click Select by Name, or press **H** on the keyboard.
- On the Select Objects dialog, turn on Display Subtree if necessary.


All four Pivot Door objects should be indented below the *Cylinder01* object in the list. If any aren't, re-link them to the hub.

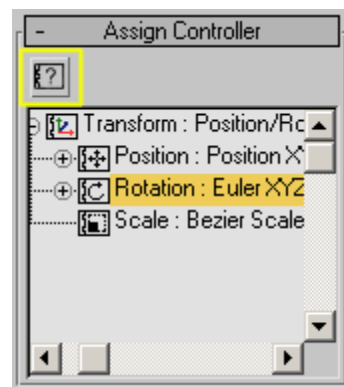
Now you are ready to animate the revolving door.

#### Replace the rotation controller

First you will replace the rotation controller on the hub. The default controller is good for character animation, but you'll replace it with a controller that is better for design visualization animation.

1. Select the hub in the viewport.

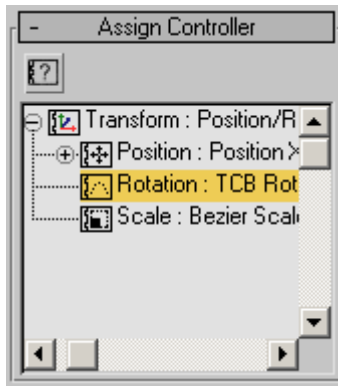
2.  Open the Motion panel, and expand the Assign Controller rollout if necessary.
3. In the Assign Controller window, highlight the Rotation: Euler XYZ item.



4.  Click the Assign Controller button.



4. In the Assign Controller dialog click TCB Rotation, and click OK.



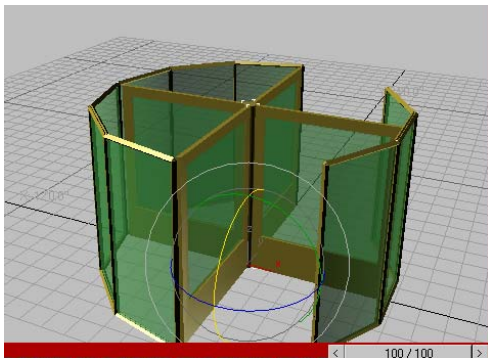
The rotation controller listed in the Assign Controller rollout changes to TCB Rotation.

5. Scroll down to the bottom of the Key Info rollout and turn on Rotation Windup. This will allow you to set rotation keys greater than 180 degrees.

**Important:** You must turn on Rotation Windup, or the animation won't work correctly.

#### Animate the hub:



1. **Auto Key** Turn on the Auto Key button.
2. Move the time slider to frame 100.
3. Click the hub in the viewport to select it.



4. Right-click and choose Rotate, then rotate the hub **360** degrees about the Z axis. Watch the coordinate display to get the correct rotation.

Tip: To make setting even rotations easier, turn on Angle Snap by pressing the **A** key on the keyboard.

The Time Slider now shows keyframes as small squares at the beginning and at the end of the time segment.

5.   On the VCR controls, rewind the animation by clicking the Go To Start button, and then click the Play button.


Watch your revolving door rotate in the viewport.

#### Save your work:

- On the menu bar, choose File > Save As and save your work as **myrevolvingdoor01.max**. You can use the plus button (+) to increment the file name.

#### Slow down the animation:

To slow down the rotation of the revolving door, do the following:

1.  Click the Time Configuration button.
2. In the Animation group, click Re-scale Time.
3. On the Re-scale Time dialog, change End Time to **200**, then click OK.
4. Click OK to close the Time Configuration dialog.

The Time Slider now displays 200 frames, with a key at frame 0 and frame 200.

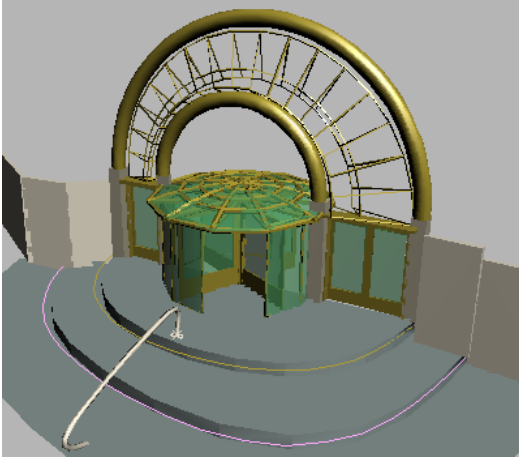
5. Click the Play button and watch the revolving door go around.

The animation plays slower than before.

6. Stop the playback in the viewport, and click the Auto Key button to turn it off.

7. Save your work as **myrevolvingdoor02.max**.

## Merging Files



The revolving door seems lonely, spinning by itself in the viewport. You can use the Merge File function to put this revolving door into context, by merging in another scene of an entranceway.

You'll also learn to animate the opening of parametric doors.


- On the File menu, choose Open and browse to `|tutorials|intro_to_design_visualization|revolving_door.max`. Click Open to load this file.

### Merge a scene:


1. On the File menu choose Merge and browse to `|tutorials|intro_to_design_visualization|entranceway.max`, and click Open.  
After you click the file name, the Merge File dialog displays a thumbnail of the scene.
2. In the Merge File dialog, click the All button to select all the objects in the scene, and then click OK.
3. If the Duplicate Name dialog appears, click Skip for any duplicate objects.

The revolving door is now in the middle of the entranceway.


Note: If you've been modeling in metric units you might need to scale the revolving door so it matches the new scene. You can use the [Rescale World Units utility](#) if you need to accomplish this.

4.  Click the Zoom button in the viewport navigation controls, then zoom back so you can see the double doors.

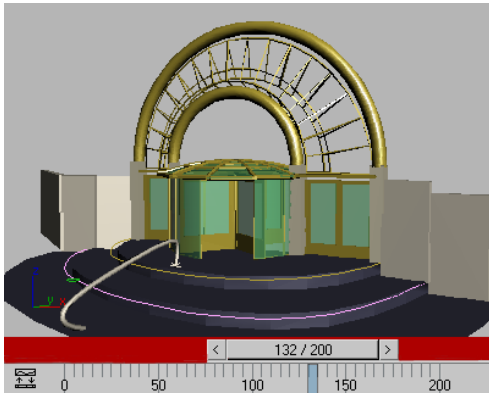
### Animate the double doors:

1.  Turn on the Auto Key button.
2. Move the Time Slider to frame 100.
3. Select the *Double doors* object in the viewport.
4. On the Modify panel, in the Parameters rollout, set Open to **75.0** degrees.

Note: The spinner is now outlined in red, indicating it is an animated parameter that has a key on the current frame.

5. Move the Time Slider to frame 200.
6. On the Modify panel, set Open back to **0.0** degrees.
7.  Play the animation using the Play button in the VCR controls.

The revolving doors go around and the double doors swing open.



### Fine-tune the animation:

You can use the track bar to make the double doors open and close faster.


1. Make sure the double doors are selected, and then on the track bar, drag the key at frame 100 to frame 25. Watch in the status bar for the frame number.
2. Similarly, move the key at frame 200 to frame 50, and then play the animation.

The doors open and close more quickly.

You can make the doors open and close repeatedly throughout the rest of the animation by using Track View.

3. On the Modify panel find the animated Open parameter, and right-click within the numeric field. From the menu that appears choose Show In Track View.

A Track View – Curve Editor window opens with the Double doors Open parameter highlighted.

4.  On the Track View toolbar click the Parameter Curve Out of Range Types button.
5. On the Parameter Curve Out of Range Types dialog, click Ping Pong.



Click OK to accept the change and dismiss the dialog, and click OK in the Selected track view dialog to dismiss it.


6. Play the animation again.

Now the doors open and shut throughout the animation.

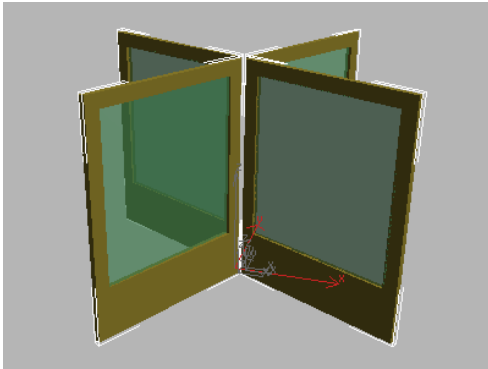
7. Turn off Auto Key before continuing.

The glass on the revolving doors is going to get covered with fingerprints from all the people pushing on the glass. You'll add a push bar to the doors. You can easily make a single push bar out of a torus and attach it to the door.

### Isolate the doors:

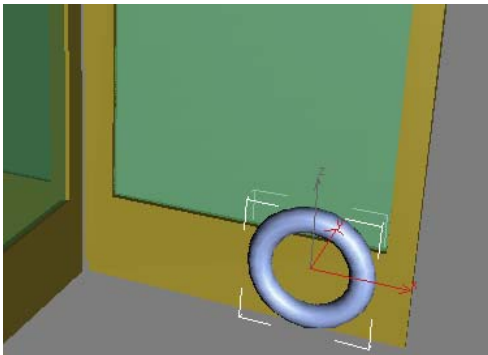
1.  On the Layers toolbar, click the Layer Manager button.
2. In the Layer dialog, click the gray box next to the Doors layer to make it the active layer.
3. In the Layer Manager click in the Hide column next to each layer except Doors. Close the Layer Manager.

The doors are isolated. Everything else in the scene goes away and only the doors are displayed.



### Create the push bar:

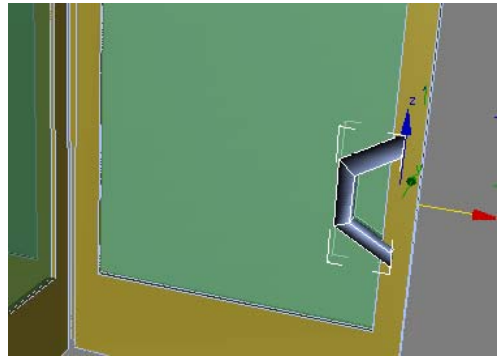
1. Zoom in on the doors, if necessary.
2. Make sure the Doors layer is active.
3. On the Create panel, in the Standard Primitives category, click Torus.
4. On the Object Type rollout, turn on AutoGrid.
5. Turn off Auto Key and go to frame 0, if necessary.
6. Move your cursor over the front of the door facing you and drag out a Torus.  
A Torus is created on the plane of the door.




7. Right-click in the viewport to exit Create mode.
8. Go to the Modify panel, and on the Parameters rollout:
  - Set Radius 1 to **0'8.0"** and Radius 2 to **0'1.5"**.

- Change the Rotation setting to **45.0**.  
Now the geometry will work for the push bar.
- Change Segments to **3**.
- Change Sides to **4**.
- Set Smooth to **None**.
- Turn on Slice On.
- Set Slice From to **180.0** and Slice To to **0.0**.

9. Right-click and choose Move from the quad menu, then move the push-bar object using the transform gizmo to the right center of the door, as shown below. Rotate it if necessary.



### Attach the push bar:

1. In the viewport, click the door to select it.  
The name PivotDoor01 appears at the top of the Modify panel.
2. From the Modifier List choose Edit Mesh.  
An Edit Mesh modifier is added to the Modify stack.
3. On the Edit Geometry rollout, click Attach, then click the push bar in the viewport.  
The push bar changes color in the viewport. Click the Attach button again to turn it off.
4.  Press the Play button on the VCR controls.

The revolving door spins around. There are four push bars, one on each door. Since the other three doors are instances of the first, adding geometry to one adds geometry to all.

5. Open the Layer Manager and unhide all layers.

The entire scene is visible now. You can find an example of the finished scene in *|tutorials|intro\_to\_design\_visualization|revolving\_door\_final.max* for comparison purposes.

## Summary

In this tutorial you learned to get around the 3ds Max user interface, and to do some simple modeling and animation. You learned to work with primitive objects and apply and edit materials. You created a door object, made clones of it, and linked the doors to a parent object in order to make an animation. Lastly, you learned to merge files together to create a more complex scene.

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## Camera Matching & Camera Map

Mixing video and computer generated graphics is accomplished here using the Camera Match utility.

The storyboard involves a pool game between two characters.

The animation of the cue ball is synchronized to the character's actions in the video.



The guy in the blue shirt is a magic guy who makes the cue ball move by using the pool stick as a remote control. The cue ball in the illustration is computer-generated. The video was shot with no actual cue ball.



*3D Pool Ball animation integrated with background video*

The magic guy can also create a wave in the table top. You'll accomplish this in the next tutorial, *Adding Effects with Camera Map* (page 3–125).



*Camera Mapping and Affect Region modifier*

To create these effects you'll use Camera Match to create a camera that closely emulates the actual camera used to take the video. Then anything you create will be in the proper perspective and will appear to be in the scene.

Camera Match relies on using accurate measurements of points in space that are visible in the video.

In this tutorial, you place 3D camera points onto box primitives, which match the shape and size of two overhead lamps in a pool hall. You then specify both a rendering background and a background for the viewport. Finally, you place 2D camera helper objects on the background and create a camera to match your background.

## Tutorial Files

The files for this tutorial are on the Tutorial Files CD in the `|tutorials|camera_match` folder.

Time to complete: 1 hour

This is an intermediate level tutorial.

## Preparing the Scene

Proper use of Camera Match requires some planning and preparation. In this tutorial, the planning work has been done for you. The following guidelines help you understand the planning involved, and what to do on your own Camera Match projects.

### Basic Steps

This topic introduces the first two steps. The rest of the tutorial concentrates on the details of the third step.

- Identify five or more reference points on the background video to use with Camera Match. The points cannot all be on a single plane. It's also wise to pick points spread throughout the scene, some near, some far, some high, some low. Sometimes a match isn't accurate because the points are too close together.
- Obtain accurate measurements of these points during the shoot. This is a critical step. Errors in measurement show up in the final match.
- Create CamPoint Helper objects and accurately position them in your 3ds Max scene to match the point measurements taken during the shoot.
- Camera Match uses these points to calculate the position and viewing angle of a software camera whose view is the same as the hardware camera that took the photograph.
- It is possible to work with stock footage, and other video without accurate measurements, if you can find other techniques to estimate the distance between the points. However, you might not get as accurate a match.

### Practical Advice for Best Results

The following recommendations will generally produce the best results.

- Work directly with the cinematographer. Let the cameraperson know that you are camera matching this scene, and that the points you'll be matching will be visible in the scene. If the point is deep in a shadow, it might not be distinguishable.
- Measure the points yourself. Have an assistant hold the other end of the tape measure. Make sure to get the camera height and the distance from the camera to the nearest and farthest points in the scene.
- Make a sketch with dimensions showing the relationships between the points you will match. Make copies of the sketches. Everyone loses the paper with the measurements.
- If possible try to pick points that will still be there the next day. You may want to come back and confirm the accuracy of the measurements. Try to avoid picking points that will be hidden by the actors.

## Choosing Good Reference Points

Selection of good reference points is the key to success with Camera Matching. Here are some guidelines:

- Choose points to match that are not all in one section of the scene. Select points that are widely separated.
- Choose points whose measurements are easy to obtain. These have a higher likelihood of being accurate.
- Choose points to maximize depth. More depth results in a more accurate match.
- A minimum of five points is needed for Camera Match to work correctly. In practice, you can't be sure all the points you choose will be accurate or appropriate, so it's a good idea to measure additional ones. If you have trouble with a match, you can substitute one of these points for a suspect one.

With a movie or photograph and a set of measured points, you can now input those points to begin Camera Match.

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## Placing 3D Camera Points

In this topic, the reference points that were measured on-site and identified in the background movie are converted to special helper objects called *CamPoints*. CamPoints represent the scene locations of the points you match in the background photograph.

The pool hall movie has been composed so that you can use the two lamps hanging over the pool tables behind the actors to do the camera match. The lamps over the pool table were measured while shooting the pool hall video. The pool table surface was used as the ground plane to measure from.

## Creating Stand-in Geometry

In general, it's helpful to model and position simple geometry to represent the outer dimensions of the objects you're matching. For example, the lamps above the pool table are 48.0" x 20.5" x 2.676". The opening scene contains two wireframe boxes of these dimensions, positioned to the measured height and spacing above the 3ds Max ground plane, which represents the pool table surface.

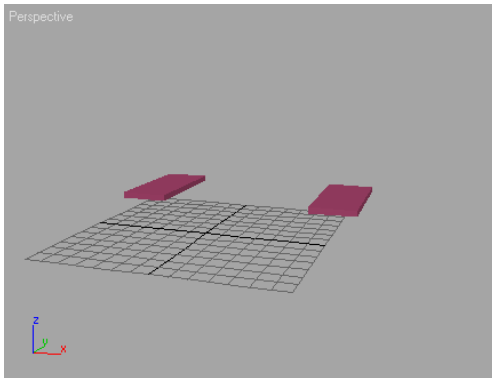
### Set up the lesson:

Tutorial files are on the Tutorials Files CD in the `|tutorials|camera_match` directory.

#### 1. Open *match1.max*.

Two boxes named *leftlamp* and *rightlamp* are already in place.







These two boxes represent the two overhead lights in the background video directly behind the pool player.

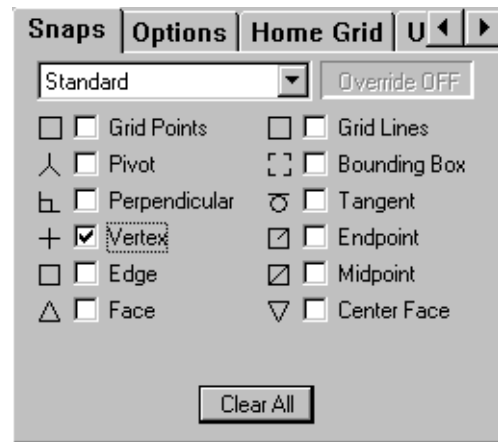


The boxes match the dimensions of the lights in the actual pool hall. You'll use the corners of the lights for the camera match point positions.

2.  In the Perspective viewport, select *leftlamp* and click Zoom Extents Selected.


The Perspective viewport zooms to a close-up of the left lamp.

3.  Right-click 3D Snap Toggle to display the Grid And Snap Settings dialog.



4. Turn off Grid Points and turn on Vertex, if they are not set this way already.



5.  Close the Grid And Snap Settings dialog, then click 3D Snap Toggle to turn on the snaps you've set.


Note: Choosing the setting for Grid and Snaps doesn't automatically turn on Snaps.

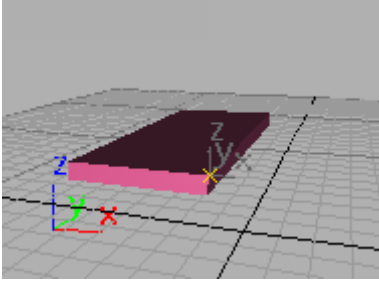


6.  Maximize the Perspective viewport by clicking Min/Max Toggle or pressing **ALT+W**.

#### Place CamPoints:




1.  On the Create panel click the Helpers tab. Click the drop-down arrow and choose Camera Match from the list.
2. On the Object Type rollout click CamPoint Object.  
The CamPoint button highlights in the Create panel.
3. On the *leftlamp* box, position the cursor over the top corner that is closest to the front of the viewport. When the cursor is close to a vertex, a blue cross shows the snap activity.
4. Click the corner to create a camera point.

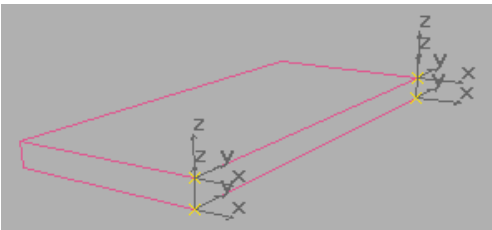


5. On the Name And Color rollout, change the name of the camera point you just created to **leftlamp center top**.

It's good practice to rename CamPoints as you create them.

You're calling this *leftlamp center top* because in the background video this point is in the center and at the top of the points you'll use.

6. Create the second point on the bottom corner of the lamp directly beneath the first point. Name it **leftlamp center bottom**.
7.  Use Arc Rotate to change the view slightly so you can easily place each point. Or hold down ALT+middle mouse button and drag to rotate the view.
8. Create two more points on the leftlamp, naming them as follows:
  - **leftlamp rear top**
  - **leftlamp rear bottom**

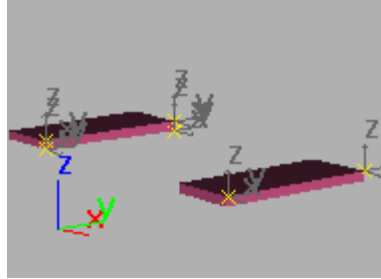


*Four CamPoint Helper objects snapped to vertices*

9. Add two CamPoints to the rightlamp, repeating the process described for the leftlamp. Note

that they are on the right side of the right lamp. Name them as follows:

- **rightlamp center top**
- **rightlamp rear top**



*Six Camera points in position*

#### Save your work:

- When all points are in place, save your file as **mymatch1.max**.

Next, you will add the video to the scene: first as a rendering background, then as a viewport background.

## Setting Up a Rendering Background

This topic sets up the background image used for *rendering*. In this case, the image is a bitmap taken from an AVI file. The rendering background will not be visible in the viewports. You set up a viewport background in a later topic.

#### Set up the lesson:

- To start at this point, continue from the previous sequence, or open your saved file *mymatch1.max*, or reset 3ds Max and open *match2.max*.

The scene displays the two boxes with their CamPoints.

**Set up a rendering background:**

1. On the menu bar choose Rendering > Environment.
2. On the Common Parameters rollout, click the Environment Map button marked None.  
The Material/Map Browser is displayed.
3. In the browser, pick Bitmap from the list and click OK.  
The Select Bitmap Image File dialog is displayed.
4. In the dialog, select *joystick.avi* from the *tutorials/camera\_match* folder, and click Open.

*Thumbnail of joystick.avi*

The Environment and Effects dialog now shows *joystick.avi* as the environment map. The Use Map box is automatically selected.

5. Close the Environment and Effects dialog.  
The background image is now set up as your *rendering* background. You won't see the image in the viewports.
6. Activate the Perspective viewport.
7. On the menu bar, choose Rendering > Render.  
Render the Perspective viewport at 320 x 240.  
The two lamps are displayed with the pool-hall image as the background.




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## Checking the Rendering Resolution

Camera Match requires correct synchronization between the rendering background resolution, the final rendering resolution, and the viewport background. Without this synchronization, Camera Match produces incorrect results.

**Tip:** To simplify synchronization, use the same resolution throughout.

In this topic, you simply check the resolution of the background image file. In your own projects, you would use this information to set the other resolutions before performing the camera match. The resolution of any image file can be checked in this way.

**Check the resolution of the image file:**

1. On the menu bar, choose File > View Image File.
2. On the View File dialog, do the following:
  - Select *joystick.avi*.
  - At the bottom of the dialog, the Statistics line shows the resolution of the file to be 320 x 240.
  - Click Cancel to dismiss the View File dialog.

## Displaying the Background in the Viewport

At this point, you're ready to display the background image in a viewport.

Note: Each viewport can display a different background, which can be independent of the background used by the renderer. This is most useful when modeling.

### Set up the lesson:

- To start at this point, continue from the previous step, or reset 3ds Max and open *match3.max*.

### Display a viewport background:

- Right-click anywhere on the Perspective viewport to activate it.
- On the menu bar, choose Views > Viewport Background to display the Viewport Background dialog.
- In this dialog, in the Background Source group, click Files.
- Choose *joystik.avi*. If necessary, navigate to the directory containing this file. Click Open.
- In the Aspect Ratio group, choose Match Bitmap so your bitmap is not distorted. (As an alternative, in the Background Source group, you could turn on Use Environment Background, but this limits the options for controlling display.)
- In the Viewport Background dialog, click OK.

In the Perspective viewport, you now see a frame from the background pool-hall movie.



Viewport display of Background Image

- Save the file as **mymatch2.max**.

## Using Different Files to Display the Same Background

Although you want to use the same image for both the viewport and rendering backgrounds, you don't have to use the same file.

The following procedure makes matching the perspective background easier. Using a paint program, you first mark up a copy of the file to emphasize CamPoints. You then make this file the viewport background. The procedure is optional here, but you might want to try it in your own project.

### Optional procedure to make Camera Match easier:

- Open *mymatch2.max*.
- Hide the geometry, and then render this frame as a TGA still image.
- Unhide the geometry.
- In the Windows Explorer, make a copy of the background image TGA file to use as the viewport background.
- Open this file in a paint program. Highlight the CamPoint locations and prominent edges in the image. This will make them easier to see when you do Camera Match.



*Paint arrows to show CamPoint object locations*

6. Save this altered image under another name.
7. In 3ds Max, activate the Perspective viewport.
8. Choose Views > Viewport Background to open the Viewport Background dialog.
9. In this dialog, click Files and select the file you just saved. Click OK.

Up to this point, you've placed CamPoints in real-world locations in your scene, and synchronized the display of the rendering and viewport backgrounds. In the lessons that follow, you use the Camera Match utility to assign 2D screen points and create the camera.

## Installing the Software Driver

In general, it's better to use the Software driver when learning to use Camera Match. Some video cards have a problem with Camera Match when using the OpenGL or Direct 3D drivers.

- If you've already installed the Software driver (the default choice when you first started 3ds Max), you can skip this procedure, or use it to double-check what driver you have installed.
- If you have an OpenGL video card, you should definitely follow this procedure. After Camera Match is complete, you can repeat the

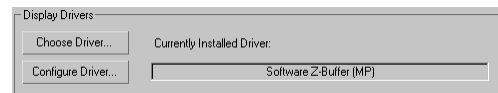
procedure to switch back to your OpenGL driver.

Not all OpenGL cards have this problem. You might opt to wait until you experience it in the next topic. If the red pluses don't appear, press ' to redraw the screen. If you still have no red pluses, it's time to change your driver.

### Install the Software driver:

1. On the Customize menu, choose Preferences to display the Preference Settings dialog.
2. Click the Viewports tab.

The currently installed driver is shown in the Display Drivers group.



3. Do one of the following:
  - If your driver is Software, as shown in the illustration, close the dialog and continue to the next topic.
  - If OpenGL or Direct3D is currently selected, click Choose Driver. On the dialog, select Software and then click OK.
4. Restart the program to initialize the new driver.

## Assigning 2D Camera Screen Points

You assign 2D camera screen points to identify how the 3D CamPoints are matched to the background image. You can assign camera screen points in either a User or Perspective viewport. These procedures use a Perspective viewport.

### Set up the lesson:

1. To start at this point, continue from the previous topic, or open your saved file *mymatch2.max*, or reset 3ds Max and open *match4.max*.

- If the background is not already displayed, right-click the Perspective viewport label and select Show Background. If you encounter an error message saying the program can't find the background, browse for it in the `|tutorials|camera_match` directory on the Tutorials Files CD.



- Click Min/Max Toggle, or press **ALT+W** to maximize the Perspective viewport.
- If home grid is on, press **G** to turn it off.

The grid is not needed here.

Next, you'll assign positions on the bitmap background in the viewport to represent the CamPoints.

#### Assign the first screen point:



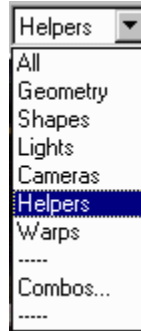
- Open the Utility panel. Choose Camera Match to display the CamPoint Info rollout.



- On the toolbar, in the Selection Filters list, choose Helpers.

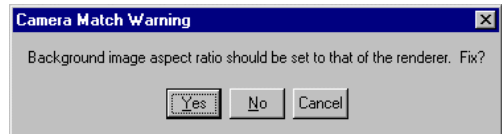
This prevents you from selecting any other kind of object in the scene.

Tip: This is very useful, but don't forget to turn it off when you're finished. Otherwise you won't be able to select anything but helpers.



- On the CamPoint Info rollout, select *leftlamp center top*.
- Click the Assign Position button to turn it on.
- On the background video itself, move the cursor over the top-center corner of the real leftlamp in the bitmap image (*not* the corner of the stand-in box geometry).
- Click the top-center corner of the left lamp.

The following warning message is displayed:



- Click Yes to close the dialog. A red plus sign is displayed on the bitmap.

**Warning:** If a red plus does not appear, you might be using an OpenGL driver. Press ' to redraw the viewport. If the red plus doesn't appear, follow the procedure for *Installing the Software Driver* (page 3-121), then repeat this procedure.

#### Reposition screen points:

Use this technique if you need to adjust the position of the red plus sign after you first assign a screen point.

- On the CamPoint Info dialog, click the X and Y spinner arrows (Input Screen Coordinates) to change the position of the red plus. The Input screen Coordinates Y position is inverted, increasing the Y value moves the point down.

Note: You can always reassign a screen point. Only the last position is saved.

#### Assign more screen points:

- From the CamPoint Info list, choose *leftlamp center bottom*. Assign its position.
- Toggle between the *leftlamp center top* and *leftlamp center bottom* and adjust the X values so they are the same.

This establishes a vertical relative to the scene.



The first two CamPoints

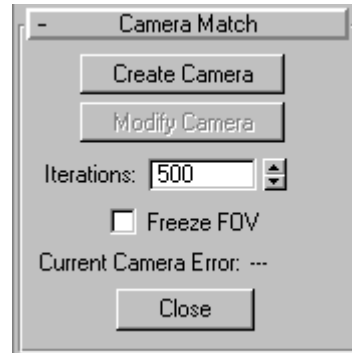
- Click *leftlamp rear top* in the CamPoint Info list. Assign its position.
- Repeat this process for *leftlamp rear bottom*.



The first four CamPoints

#### Create a camera to test Camera Match:

- On the Camera Match rollout, click Create Camera.



A message is displayed that says you don't have enough active points to make a meaningful estimate. You need to assign one more point.

- Choose *rightlamp center top* and assign its position.
- On the menu bar, choose Views > Save Active Perspective View so you can return to this view if necessary.
- Click Create Camera. This time, you can see that the camera has been created in the viewport.
- Right-click the Perspective viewport label, and choose Views > Camera01.

The viewport switches to the camera created by Camera Match.

#### Modify the camera position:

- Right-click the label of the Camera01 viewport and choose Wireframe.
- In the CamPoint Info list, select *rightlamp rear top* and assign its position.
- Click Modify Camera.  
The camera moves slightly, based on the addition of the new point.
- Click the Assign Position button again to turn it off.



- Using the X and Y spinners, try nudging the *rightlamp rear top* a bit. Then click Modify Camera again.

On the Camera Match rollout, notice the readout for Current Camera Error. You want this number as small as you can get it, but there are diminishing returns in trying to establish zero error. If the match looks good, it's probably as close as you'll need.

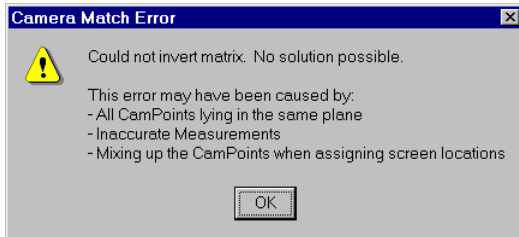
#### Save your work:

- When Camera Match is complete, save your scene as **mymatch3.max**.

## Troubleshooting Camera Match

Camera Match depends on how accurately you measured the geometry, and how accurately you assigned the CamPoints to the bitmap background.

You might get the following error message:



#### Check for problems:

If you get an error message, there are a number of possible causes. The following are some general approaches for troubleshooting. When you think you've corrected the problem, click Create Camera to test the solution.

- Try disabling one or more points, maintaining a minimum of five points.
  - You do this on the CamPoint Info dialog by selecting a point in the list and then turning off Use This Point.

- Check the coordinates of each CamPoint.



- Turn on Select and Move and right-click the button to display the Transform Type-In dialog.



- Use Select By Name to select each point.
- Check the coordinates and revise as needed.

- Check for coplanar CamPoints.

- Hide the viewport background and rotate the viewport. If the points all line up at some point during the rotation, they are coplanar. You might have inadvertently snapped the points to a grid. Use the previous method to reposition them.

## Next

*Matching Camera to View (page 3–124)*

## Matching Camera to View

If the camera fails to match perfectly, here are a few possible reasons:

- Measurements of the physical 3D points are not accurate enough, particularly elevations.
- Distortions in the lens, or from the digital scanning and processing of the photo.
- The points are too close together and are not spread sufficiently throughout the scene. This is sometimes the case when your camera match is slightly off.
- User error. You have incorrectly assigned a position to a point. This is usually the case when your camera match is way off.

Regardless of the source of the problem, you can manually adjust a match that is less than perfect. You use Perspective navigation tools to adjust the scene visually, then use a command to move the camera to match that perspective.

**Adjust the match:**

1. Right-click the Camera01 viewport to activate it.
2. Press **P** on the keyboard to change the viewport to Perspective.



3. Activate Arc Rotate and roll the Perspective viewport by clicking outside the yellow circle in the viewport.



4. Use Pan and Arc Rotate tools repeatedly until the stand-in geometry lines up more closely.

In this example, a slight rotation of the Perspective viewport to the right might improve the match.



5. Select Camera01. Because cameras are often hard to locate, use Select By Name on the toolbar for ease and precision.

6. Right-click the Perspective viewport label to display the flyout menu. On the menu bar, choose Views > Create Camera From View.

Camera01 moves to match the view in the Perspective viewport.

Note: The Create Camera From View command will create a new camera if no camera is selected. If a camera is already selected, that camera will be matched to the view.

7. Press **C** to switch the viewport to the camera. Camera Match is now complete.

**Save your work:**

- Save your scene as **mymatch4.max**.

**Summary**

This tutorial has demonstrated:

- Placing 3D CamPoint helpers to match a scene's geometry.

- Using a background for rendering and for a viewport.
- Placing 2D camera screen points that correspond to the CamPoint helpers.
- Using Camera Match and the camera screen points to generate a camera position that matches the background.

Using the Camera Map modifier and other techniques, this tutorial adds some special effects to a camera-matched scene. You will animate a cue ball and synchronize it with the movement of actors in the pool hall video. You'll create a matte object so the cue ball can move behind the bitmap of the player's hand, and you'll use the Camera Map modifier to create a wave in the table.

**Features Covered in This Tutorial**

- Adding time tags to aid in synchronizing animation.
- Creating a matte object and material.
- Animating a 3D object to match video footage.

**Tutorial Files**

The files for this tutorial are in the *|tutorials|camera\_map* folder.

Time to complete: 45 minutes

## Adding Time Tags

In the next three lessons, you will set up the synchronization, then create and animate a cue ball. Finally, you'll create a matte object to make the ball appear behind the player's hand.

In this lesson, you'll add time tags to three locations in the *joystik.avi* video. The tags coincide with the motion of the dark-haired pool player in the video, who will use magic to interfere with his opponent's shot. When you animate the surface of the table and the cue ball, you use these tags to place keyframes.

### Set up the lesson:

Files for this tutorial are located on the Tutorial Files CD in the *tutorials\camera\_map* folder.

1. To start from this point, do one of the following:
  - Start or reset 3ds Max and open *match6.max*.
  - Open *mymatch4.max*, if you saved this file at the end of the tutorial *Using Camera Match (page 3–114)*.
2. On the menu bar, choose Customize > Preferences, and click the Viewports tab.
3. In the Viewport Parameters group, turn on Update Background While Playing, then click OK.

Now the movie will update in the viewport background when you play the animation or drag the time slider.

### Display a viewport background:

1. Activate the Camera viewport.
2. Choose Views > Viewport Background to display the Viewport Background dialog.
3. Make sure the background file is *joystik.avi*, and not *joystik.tga*.
4. Turn on Animate Background and click OK.

5.  Click the Play Animation button.

The video plays in the viewport. Depending on the speed of your computer, the timing might be off, not playing in real time. If so you can play the movie using Windows Media Player.

### View the video in real time:

You need to see the actual timing of the video to determine where to add time tags.

1. On the menu bar, choose File > View Image File.

2. Choose *joystik.avi*, and then click Open.

The Media Player window is displayed.

Note: You may have a variety of Media Players, depending on the version of your operating system. Some steps might not apply to your player program.

3. Click the Play button and watch the video play in real time.

Notice that the timing of the cue stick movement. First it is slow, then fast.

4. Close the Media Player.

5. Click the Play Animation button in 3ds Max.

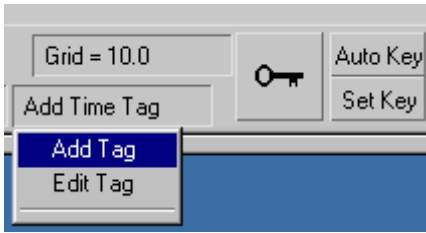
You can see the movie updating in the viewport background.

6. Use the greater than and less than keys ( < and > ) to shuffle through the movie a frame at a time. Determine at which frame the stick movement shifts direction.

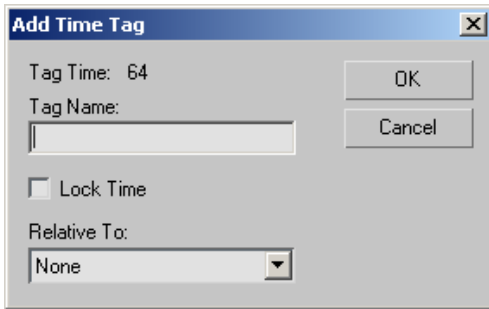
The stick movement stops at frame 64.

### Add time tags:

1. In 3ds Max, move the time slider to frame 64.
2. On the status line, right-click in the Add Time Tag field to the left of the Set Keys button.
3. Choose Add Tag from the menu to display the Add Time Tag dialog.



The Add Time Tag dialog appears.




*Add Time Tag dialog*

4. In the Add Time Tag dialog, add the Tag Name **extreme right**, and click OK.
5. Maximize the Media Player and scrub its time slider to determine where the dark-haired player's cue stick stops near the middle of the video. Minimize the Media Player when you're done.  
The actor holds the cue stick almost stationary for a moment between frames 39 and 43.
6. Move the time slider to frame 39 and add a time tag named **start hold**.
7. Add a time tag at frame 43 named **end hold**.
8. Drag the time slider to see these named tags appear in the Add Time Tag field.  
You can jump to any of these named frames now by right-clicking Add Time Tag and choosing the name from the list.

### Match the number of frames:

In this procedure, you first determine the exact last frame of the video.



1. Use the > key on the keyboard to shuffle through the movie one frame at a time.  
Note that the length of the video is 84 frames. The current 3ds Max file is set to play 100 frames, so the movie disappears from the viewport background after frame 84.. You need to make the file match the background movie.
2.  In the Animation Controls area, click Time Configuration.
3. In the Time Configuration dialog, change End Time from 100 to **84**. Click OK.
4. In 3ds Max, move the time slider to the end.  
The slider reads 84/84. The animation is now the correct length.

## Animating a Cue Ball

In this step, you create and animate a cue ball to follow the movement of the pool player shooting with the cue stick.

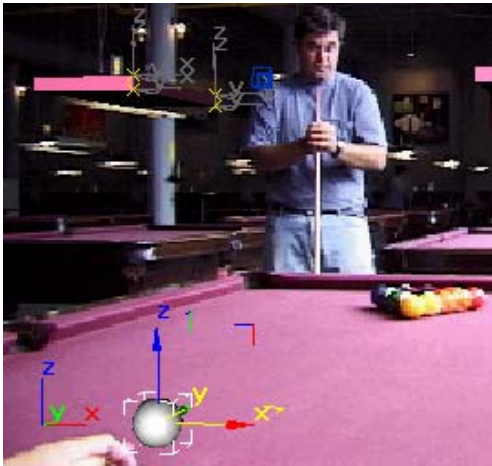
Continue using the file created in the previous lesson.

### Position the cue ball:

1. Go to frame 0, and activate the Camera viewport.  
 Make sure the Snaps Toggle is turned off.
2. Create a sphere in front of the hand. Give the sphere a Radius of **1.8** units.
3. In the Name And Color rollout, click the color swatch.
4. Change the color of the cue ball to white.
5.  Turn on the Auto Key button.

6. At frame 0, position the cue ball in front of the hand. Use the Transform gizmo to move the ball. Don't move the ball in the Z axis.

Note: If you're continuing from the previous tutorial in the same session and have trouble selecting the cue ball, try the following. On the toolbar, change the Selection Filter from Helpers to All.



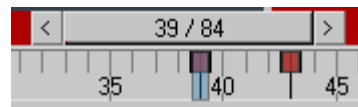
7. Right-click the Time Tag slot and select *39 start hold*.
8. Reposition the cue ball in front of the hand so you can add a keyframe at 39. Use the Transform gizmo and move the ball in the X axis.



9. Right-click the time slider. In the Create Key dialog, do the following:

- Set Source Time to **39** (default)
- Set Destination Time to **43**
- Turn off Rotation and Scale, and click OK.

You have just created position keys at frames 0, 39, and 43. You see squares representing these keys in the line below the time slider.




Keys in track bar

#### Add more position keys:

1. Go to Frame 64 by right-clicking the Time Tag slot and selecting the tag named *64 extreme right*. Reposition the cue ball to the right of the hand.
2. Go to Frame 84 and reposition the cue ball to the left of the hand.
3. You need to add a key between 0 and 39 to more closely control the ball movement. Add a key at frame 13 by moving the ball.

Tip: Instead of dragging the Time Slider each time you want to move to a different frame, enter the frame number in the Keyframe window.

4.  Click Play Animation to play the animation in the Camera viewport.

Depending on how you repositioned the ball, you may see the ball passing in front of the arm of the pool player who is trying to shoot the ball. You now need to create a matte object to maintain the illusion that the shooter's arm is in front of the ball.

The interpolation may cause your ball to move in unexpected ways. In the case of this animation, this could be a serendipitous situation. If it looks bad however, right-click the cue ball position keys and change the interpolation to linear.

5. Turn off the Auto Key button.
6. Save your file as **mymatch5.max**.

## Creating a Matte Object

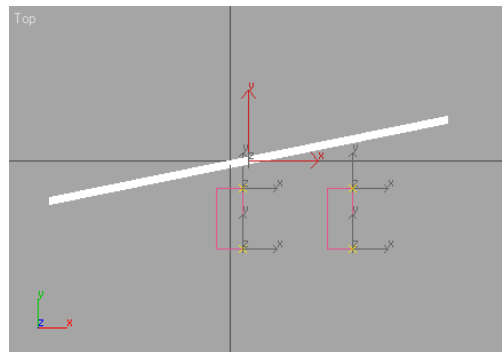
The arm needs to pass in front of the cue ball to make the cue ball look like it's actually part of the scene. To accomplish this, you draw and extrude a matte object the same size as the arm in the video. First, however, you need to position a grid aligned with the Camera viewport, to act as a drawing surface.

### Set up the lesson:

1. Continue from the previous sequence, or reset 3ds Max and open *match6b.max*. If you open the provided file, reassign the viewport background, if necessary.
2. Files for this tutorial are located in the *|tutorials|camera\_map* folder.

### Set up a grid:

1. Go to Create panel > Helpers > Object Type rollout and click the Grid button.
2. In the Front viewport, drag from upper-right to lower-left to create a grid.
3. Activate Grid01 by using Views menu > Grids > Activate Grid Object.
4. To align the grid to the Camera viewport, first right-click the Camera Viewport to activate it without losing the grid selection.
5. On the menu bar, Choose Views > Grids > Align Grid To View.  
The grid aligns to the camera view.
6. In the Top viewport, zoom out so you can see the grid and the cue ball.
7. Move the grid along the Y axis so it is between the camera icon and the cue ball.



### Create a matte object for the arm:

In this procedure, you use the Line tool to create a spline around the arm, and then an Extrude modifier to make the shape a 3D object.

1. Advance to the last frame of the animation (frame 84). The arm comes fully into view.
2. Right-click the Camera viewport to activate it, if necessary.
3. Press **ALT W** key to maximize the Camera viewport.

4. On the Display panel choose Hide By Hit.
5. Click the ball in the viewport to hide the ball.
6. Go to Create panel > Shapes > Object Type rollout and click the Line button.
7. In the Creation Method rollout, do the following:
  - Make sure Initial Type is set to Corner.
  - Set Drag Type to Corner.
8. Starting in the upper left corner of the arm, where the arm enters the frame, click to place points around the outline of the arm, watch, and cue stick.
  - Take your time and draw in small increments.
  - Trace along the bottom of the frame and around the left-hand corner.
  - When you get close to the original point, double-click to close the shape.



*Drawing a matte object using a grid aligned to the Camera viewport*

9. On the Modify panel, open the Modifier List and click Extrude to convert the 2D shape to 3D geometry.

This is the arm matte. It's not necessary to change the Amount setting.

10. Save your files as **mymatch6.max**, then continue on to the next procedure.

## Creating and Applying a Matte/Shadow Material

In this lesson, you apply a matte/shadow material to the matte object you just created. You then

animate the matte object to follow the arm in the video.

When rendered, the matte/shadow material is transparent, but blocks objects behind it. At the end of this procedure, you see the arm move with the cue ball behind it.

### Set up the lesson:

- Continue from the previous lesson, *Creating a Matte Object* (page 3-129).


### Create and apply the material:



1. Open the Material Editor, and select the third sample sphere.
2. Click the Type button, which reads Standard by default.  
The Material/Map browser is displayed.
3. In the Browse From group, select New.
4. Double-click Matte/Shadow in the list to apply this material type to the sample slot.

The Type button now reads Matte/Shadow.



5. Rename the material **matte arm**.
6.  Make sure the arm matte is selected, then click Assign Material To Selection to apply the material to the arm matte. When you're done, close the Material Editor.
7. Right-click in the active viewport and, in the quad menu > Display quadrant, choose Unhide All to unhide the cue ball.

### Render the arm to check the matte object:

1. Go to frame 80 and move the cue ball behind the arm matte.





2. On the toolbar, click Render Scene, or from the Rendering menu choose Render.
3. In the Render Scene dialog, do the following:
  - Under Time Output, choose Single.
  - Under Output Size, choose 320 x 240.
  - Turn off Save File if it's on.
  - Click Render to render the image.

The arm now appears to be in front of the cue ball.



*The sphere is behind the matte object*

### Keyframe the matte object:

In this procedure, you'll keyframe the matte object so it moves as the arm moves when you play the video.

1. Go to the first frame of the animation and turn on the Auto Key button.
2. Right-click the Camera02 viewport label and select Wireframe.
3. On the toolbar, under Reference Coordinate system, choose Grid.

Now any movement of the matte object will take place aligned to the grid.

4. Move the wireframe outline of the matte arm object to match the background. Position the wireframe outline so that the knuckles are covered up. The rest of it probably won't matter.

If the transform gizmo is off screen, lock the selection and choose restrict to X or Y in the main toolbar to move the arm. Remember you only really care about the frames in which the ball passes behind the knuckles of the hand.

5. Go to the last frame of the animation (84). Move the arm wireframe to the correct location.
6. Slowly move backward through the frames by clicking the left arrow of the time slider. Every time the hand and arm move out of sync, reposition the geometry to align with the video of the arm.
7. Using the > key on the keyboard, advance the time slider frame by frame. When you see the hand reposition itself, move the matte object so it covers the hand.

This is tedious, and is reminiscent of how all animation used to be created. If you create a key on every frame, your interpolation won't matter.

8. When you're done, press **ALT W** to minimize the Camera viewport.

9. Turn off the Auto Key button.

10. Click Play Animation.

The animation plays in the Camera viewport. The matte object moves with the hand and pool cue.

If the arm changes shape, you could also animate the vertices on the matte object. You might notice that the cue stick is visible sticking out of the hand at frame 0, but then disappears from sight by around frame 54. If you're a perfectionist, you'll want to have extra vertices for the cue stick and animate those vertices to change the shape of the matte object.

**Save your work:**

- Save your scene as **mymatch7.max**.

It's always a good practice to save the scene file after completing a labor-intensive procedure, such as setting keys frame by frame. In any long session, save frequently (CTRL+S) or use Auto Backup.

You can render to an AVI file if you like, or continue learning and render later. Or you can play *matte3e.avi* to see the results.

In *matte3e.avi* the cue ball is casting a shadow on the pool table. In the next lesson, you'll create a box that will be capable of receiving the shadows.

The shadow is created using a spotlight that follows the cue ball's movement. The spotlight has a negative multiplier to create a dark spot, and the ball is excluded from the spotlight.

You won't go through the exercise of setting up the spotlight. For information on how to work with lights, see *Introduction to Lighting (page 1–409)*.

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## Creating the Pool Table Surface

In the next two lessons, you'll use Camera Map to create mapping coordinates aligned to the camera's view. This will enable you to paste video onto objects regardless of their orientations. You'll create a box to serve as the pool table surface, then map the video to the surface of the box. Finally, using an Affect Region Modifier to smoothly pull the geometry of the box, you'll animate the surface so it rises up and follows the motions of the pool player at the far end of the table.

In this lesson, you'll create a box to serve as the pool table surface, and then map the video to the surface of the box.

**Set up the lesson:**

- Continue from the previous lesson, or reset 3ds Max and open *match8.max*.

Files for this tutorial are in the *|tutorials|camera\_map* folder.

**Create a box for the surface:**

If you're continuing from the previous lesson, begin with step 1. Otherwise, begin with step 2.

1. Choose Views menu > Grids > Activate Home Grid.

Now if you create something, it will use the home grid, which happens to coincide with the surface of the pool table.

Note: You might also want to turn off home grid display (Views menu > Grids > Show Home Grid) in the *Camera02* viewport, as this makes the display more cluttered and obscures the viewport background.




2. Go to Display panel > Hide By Category rollout. Click Helpers to hide all helper objects, including the grid.
3. Go to Create panel > Geometry > Standard Primitives > Object Type rollout and click the Box button.
4. In the Camera viewport, starting at the far left-corner pocket, drag diagonally in the direction of the right corner pocket to create a box. Cover about  $\frac{3}{4}$  of the table with the box.
5. On the Parameters rollout, give the box a negative height of approximately -1.
6. Use Select And Rotate to rotate the box slightly around the Z axis, so the perspective is correct.



7. Rotate the box until the right side of the box matches the angle of the bumpers.
8. Select Sphere01 and go to Modify panel > Parameters rollout. Turn on Base To Pivot.
9. Select the box.
10. Right-click the box and choose Move.
11. Use the Transform gizmo to move the surface along the XY axes until you have a best fit. The fit does not have to be perfect.
12. On the Modify panel, rename the box **pool table surface**.

#### Color the pool table surface:

1. Open the Material Editor and select any available material sample slot
2. Replace the default material name (e.g., 7 - Default) with **pool table surface color**.
3. In the scene, make sure that the box of the pool table surface is selected.
4.  In the Material Editor, click the Assign Material To Selection button.
5. Press **F3** to turn on Smooth + Highlights shading mode.
6. Right-click the viewport label and choose Configure.
7. In Rendering Options, turn on Default Lighting and 2 Lights.

Using 2 default lights will give you a well lit view to work with.



*The Box appears to be in the perspective of the scene*

#### Save your work:

- Save your scene as **mymatch8.max**.

## Animating with Camera Map

In this procedure, you create and then animate a bulge in the pool table surface. The objective is to make the bulge look as though it's controlled by the pool player at the far end of the table. You do this by applying an Object-Space Camera Map modifier, and then an Affect Region modifier.

Before you begin, you should understand the two kinds of Camera Map modifiers.

### Understanding Camera Map modifiers

Camera mapping lets you create mapping coordinates aligned to a camera's view, so you can paste video onto objects regardless of their orientation. There are two versions of the Camera Map modifier. One is an object-space modifier (OSM), the other is a world-space modifier (WSM).

The WSM modifier continually updates the mapping coordinates according to the movement of the camera.

The OSM modifier is "sticky," because it doesn't update with camera movement. It lets you distort geometry from frame to frame. You'll use this

version for animating the bulge in the surface of the table.

When animation is involved, you should *not* use a matte/shadow material. Because it pastes the background onto every frame, a matte/shadow material doesn't let you distort or animate the surface, making any effects you create invisible. Instead of using a matte/shadow material, you'll use a diffuse map.


### Set up the lesson:

Files for this tutorial are located in the `|tutorials|camera_map` folder.

- Choose File > Reset and open *match9.max*. Reassign the viewport background as you did earlier in the tutorial.

The pool table surface is displayed with the default mapping coordinates.

### Apply a material to the pool table surface:

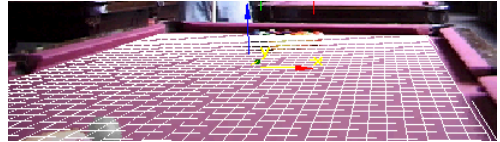
1. Open the Material Editor by pressing **M**.
2. In the second slot of the first row, select *pooltable material*.  
  
This material uses *matte3e.avi* as a diffuse map. This file has the animation of the pool ball already rendered. This way you can concentrate on animating the bulge.
3. Drag the material to the pool table surface in the viewport. A tooltip will tell you when you're on the right object.
4.  If the pool table doesn't show up in the viewport, go to the Material Editor and click the Show Map In Viewport button.

This version of the pool table appears out of alignment on the surface. We can fix the display of the *matte3e.avi* texture on the pool table surface with the Object Space Camera Map modifier.

5. Close the Material Editor.

### Apply a Camera Map modifier:

1. Press **H** to display the Select Objects dialog. Highlight *pool table surface* in the list, then click Select.
2. Go to the Modify panel.
3. Change the Length and Width Segs (segments) of the pool table surface to **33**.



Tip: To view the increased segmentation of the pool table surface, press **F3** to toggle the viewport to wireframe mode.

4. On the Modify panel, open the Modifier List.
5. Under Object-Space Modifiers, choose Camera Map.

**Warning:** Do not choose Camera Map (WSM). That modifier is a world-space modifier, which is not used in this tutorial.

6. On the Camera Mapping rollout, click the Pick Camera button. Press **H** again to pick Camera02.

The viewport display corrects itself.



*Camera Map modifier perfectly aligns the mapping coordinate*

### Apply an Affect Region modifier:

The pool table surface should still be selected.

1. On the modifier stack display, make sure the Camera Map modifier is selected in the stack list.

If you ignore this, you'll be placing the Affect Region modifier before the Camera Map and the effect won't work.

2. On the Modify panel, open the Modifier List.
3. Under Object-Space Modifiers, select Affect Region.

A large bulge appears in the center of the pool table.



#### Preview the result:

The result of this workflow is a short video clip. Look at a finished version first so you can see the intended effect.

- Choose Files > View Image Files and play the animation *cammap.avi*.

#### Animate the mound:

The following procedure uses frames identified earlier in the background video.

1. In the Affect Region Parameters, change the Falloff to **10** instead of the default value of 20.
2. In the modifier stack display, click the + button to display the Points sub-object level (the only sub-object selection level in the Affect Region modifier). Click the Points level to highlight it.
3. Zoom in to the Front viewport.

In the Front viewport, notice that there are two points, one at the top and one at the bottom of the mound.

4. **Auto Key** Move the time slider to frame 13 and turn on the Auto Key button.
5. In the Front viewport, select both points and move them slightly to the right. Move the top point down to more closely match the animation you just viewed.

This adds an animation key to both points at frame 13.

6. Go to frame 39 and move both points a short distance to the right.
7. Go to frame 43 and move the top point to the left to create some secondary movement. Move the bottom point slightly to add a key.



8. Go to frame 64 and move both points to the extreme left.
9. Go to frame 84. Select the top point and move it down to the surface of the table.

The bulge flattens into the table.

10. Go to frame 0 and flatten the mound there, too.

Tip: There's a reason for going frame 0 last. If you began at frame 0 and moved the top point to 0, the two points would be coincident, making them hard to work with on later frames.

11. **Auto Key** Turn off the Auto Key button.

12. If you get unexpected results, adjust the interpolation on the position keyframes to linear.

That's it. All that remains is to save your work and render.

#### Save your work:

- Save your file as **mymatch9.max** and render to an AVI file. Compare it with *cammap.avi*.

## Summary

In this tutorial, you have learned to create camera effects. You have learned to use camera matching to synchronize real-world footage with your virtual shot. You have used matte shadow materials to cast shadows onto the background footage, and have used the Camera Map modifier to create the illusion of an animated bulge in the pool table.



The Camera Tracker utility lets you animate the movement of a scene camera to match the movement of the real camera that was used to shoot a background movie or video. Once the 3ds Max camera is correctly matched, you can render animated, matched footage of your computer-modeled scene combined in perspective with the background video.

This tutorial shows you in detail how to use the Camera Tracker to track some background video and animate a camera so it matches the footage.

## Tutorial Files

The files for this tutorial are on the Tutorial Files CD in the `|tutorials|camera_tracker` folder.

**Warning:** This particular tutorial requires that you work from the hard drive, not directly from the CD. Make a folder with the same name on your hard drive, and then copy the files there from the CD.

Time to complete: 1 hour

## How Camera Tracking Works

Camera Tracker works by tracking a selected set of features in the movie. The features can be markers that you place in your movie during filming or any point of contrast with a distinct position, such as the corner of a window or the top of a pole. The feature needs to stay visible within the range of frames to be tracked, and should not drastically change color or shape.

A critical, preparatory step is making accurate, real-world measurements of the positions of these features from some zero point in the filmed scene. You use these measurements to create CamPoints (camera point helpers) in the your 3ds Max scene. You place these CamPoints at the 3D positions of the tracking features and assign tracker gizmos to them. Camera Tracker uses the combined information to track the camera from frame to frame.

## Workflow for Camera Tracker

Here are the general steps followed in this tutorial. You can use them as a checklist for your own work with Camera Tracker.

1. Make accurate measurements of tracking features in the filmed scene. These measurements are supplied for this tutorial. See *Preparing the Scene* (page 3–115) in the *Using Camera Match* (page 3–114) tutorial for



practical advice on taking these measurements for your own projects.

The camera-matching algorithm requires at least six features to be visible at any one time, and of those, at least two must be out of the plane of the others. The features should be spread throughout the scene as much as possible. If all the features are too close together, the match accuracy will be diminished.

2. Load the movie as a viewport background and a rendering background.
3. Position CamPoint helper objects in the 3ds Max scene. These correspond to the real-world positions of features to be tracked in the movie.
4. Load the movie to be tracked with Camera Tracker. Set up feature tracking by placing motion tracker gizmos on each of the features to be tracked. Set feature visibility frame ranges.
5. Perform movie-feature tracking with Camera Tracker. This generates a set of data for the position of each feature in the image over all the frames tracked.
6. Review the tracking to make sure Camera Tracker has correctly tracked all the features. Camera Tracker provides several tools for reviewing, tracking, and fixing any problems that occur. For example, if a feature changes shape substantially over the tracking frames, Camera Tracker may not be able to follow it completely. You can make manual corrections to the tracking at any frame, and then have Camera Tracker complete the tracking.
7. Perform a *match move* with the Camera Tracker when you get a good set of tracking data. You set this up by selecting the camera to be animated, then choosing the parameters of the camera to be estimated, the range of movie frames to match, and the range of

animation frames where you want to place camera animation keyframes.

8. Review the match move by generating a preview animation, or by inspecting the camera's Track View curves.

In some cases, depending on the accuracy of your field measurements, the movie resolution, the accuracy of the feature tracking, and other factors, the generated camera animation may be "noisy." You can use tools on the Camera Move Smoothing rollout to filter selected camera parameters to achieve smoother match moves.

---

## Loading the Background Movie

To begin this lesson, you create an Image File List file, *table.ifl*, in order to use a sequence of still images as a movie. Then you will use the IFL file as both a rendering environment and viewport background. You'll skip the steps of shooting the footage and taking the measurements, instead you'll use images and measurements provided for you.

Camera Tracker works with any movie file format that 3ds Max supports. You'll use an IFL file here. IFL files are ASCII text files that contain a list of sequential still image files.

You can generate an IFL file automatically using the Sequence button of the file selector. Or you can use the IFL Manager utility, to create an IFL file. For this example, you'll create an IFL file using 242 JPEG files originally recorded on a hand-held camcorder, captured at 640x427 resolution.

### Set up the lesson:

1. Start a new session of 3ds Max. If you are running the program, choose File > Reset.
2. Choose File > View Image File and navigate to *|tutorials|camera\_tracker|rinodesk.avi* on your hard drive.



### 3. Play *rinodesk.avi*.

This is an animation of a rhino tossing his head, using camera-matched footage. This is where you will end up when you've finished this tutorial.

#### Use the RAM Player to generate an IFL:

You can use the RAM Player to generate an IFL file and play the background video at full resolution.

#### 1. Choose Rendering > RAM Player.

#### 2. Click Open Channel A on the RAM Player toolbar.

#### 3. In the Open File, Channel A dialog, choose *tabl0000.jpg*.

This file selector dialog lets you generate an IFL file if you use the Sequence button.

#### 4. Turn on Sequence, to the right of the View button, then click Open.

The Image File List Control dialog is displayed. Here, you can define the target path and name for the IFL file.

**Warning:** Because this IFL file is about to be created, don't select a CD ROM drive

#### 5. Name the IFL file **table.ifl**. Turn on Include Image Path and click OK.

After generating the IFL file, the RAM Player Configuration dialog is displayed. Here you can limit the amount of memory the RAM Player will use.

#### 6. In the Memory Usage group, check the Maximum memory setting (you can increase this if you know you have lots of memory), then click OK.

The RAM Player loads the sequence of still images into memory.

#### 7. Watch the Available Memory value. Click Stop Loading if you don't have enough memory.

#### 8. Click Play on the RAM Player toolbar to play the sequence of still images from memory. The background sequence should play smoothly.

#### 9. Clear the sequence from memory by clicking Close Channel A.

#### 10. Close the RAM Player.

Next, you will define the IFL file as a rendering background.

#### Render the background:

#### 1. On the menu bar, choose Rendering > Environment.

#### 2. Under Environment Map, click the gray button marked None.

The Material/Map Browser is displayed.

#### 3. Choose Bitmap, and then click OK.

The Select Bitmap Image File appears.

#### 4. Change the Files of type field to IFL Image File List.

#### 5. Navigate to the directory where you created *table.ifl*, choose it, and then click Open.

The Environment Map now displays Map #1 (*table.ifl*). Use Map has been automatically turned on.

#### 6. Close the Environment and Effects dialog and activate the Perspective viewport.

#### 7. Choose Rendering > Render.

#### 8. In the Render Scene dialog, in the Output Size group, adjust the Height to **427**.

This is the resolution of the background video sequence. You can leave the default Width set to 640.

#### 9. Render a single frame to ensure the background video is being rendered correctly.



10. Close the rendered image window.

#### Add the background to a viewport:

Now you load the movie into the background of the Perspective viewport, so you can see it as you work. It's not strictly necessary to do this, but it can help later when you check the generated match move.

1. Close any dialogs that are open. The Perspective viewport should still be active.
2. From the Views menu, choose Viewport Background.
3. On the Viewport Background dialog, do the following, beginning from the top of the dialog:
  - Turn on Use Environment Background. (Most options become unavailable.)
  - Turn on Display Background.
  - Make sure that Viewport shows Perspective.
  - Click OK.

The first frame of the movie is displayed in the background of the Perspective viewport, along with the home grid.

The home grid is distracting and can be turned off.

4. In the Perspective viewport, press **G** to turn off Show Grid.

There is one more problem to correct. The IFL file is 243 frames long, but the animation length is only 100 frames right now.

5.  Click Time Configuration.

The Time Configuration dialog appears.

6. Set the Animation End time to **242** and close the dialog.

Since the first frame is 0 and the last frame is 242, that creates 243 frames of animation.

7. Scrub the time slider and watch the viewport background update.
8. Return to frame 0.

### About the movie

The first frame of the movie shows a tabletop with two markers standing on end. There are also four small red stickers on the surface of the wood. The tops and bottoms of these markers and the red stickers will serve as tracking features. You'll use the four small red marks, plus the ends of the markers to serve as locations for CamPoints.

The camera-matching algorithm requires at least six features to be visible at any one time, and of those, at least two must be out of the plane of the others. If a point moves out of frame, it can no longer be tracked until it returns into view, and then an additional tracker gizmo will need to be created with a new range assignment. In this example, the points remain visible throughout the tracking, so you won't have to set the ranges.

---

## Creating Camera Match Points

In this lesson, the goal is to place the camera points helper objects (called CamPoints) in the 3ds Max scene at positions corresponding to the movie positions of the four red stickers on the tabletop and the tops and bottoms of the markers standing

on end. We supply measurements for you to work with.

**Make the CamPoints:**

Each CamPoint can be created, positioned, and named one at a time. However, an alternate method, used here, is to make all the CamPoints first (a total of eight, all at 0,0,0), then select each one, rename it, and reposition it.

- 1. On the Create>Helper object panel choose CameraMatch from the drop-down list
- 2. On the Object Type rollout, click CamPoint  
The CamPoint button highlights in the Create panel.
- 3. Click the Keyboard Entry rollout to open it.  
The default entry is 0,0,0.
- 4. Click the Create button at the bottom of the rollout.

A point object appears in the middle of the viewports. On the Name And Color rollout, you see its name listed as *CamPoint01*.


- 5. Click the Create button seven more times to complete the series from CamPoint01 through CamPoint08.

All the CamPoints are on top of each other. This is what you want. Next, you'll reposition the points.

**Rename and reposition the CamPoints:**

Here you use the keyboard shortcut **H** to select each CamPoint object. You then rename it and use Select and Move with the Type-in Transform dialog to reposition it.

- 1. Choose Customize > Units Setup.
- 2. Turn on US Standard, and select Feet w/ Fractional Inches from the list, then close the dialog.  
This file was created in the United States, and the measurements are in feet and inches.

- 
- 3. On the toolbar, click Select And Move. When it highlights, right-click Select And Move to display the Transform Type-In dialog. .

There are two columns of XYZ values. For CamPoints, you only want to enter values on the *left* side, under Absolute:World.

The Transform Type-In dialog is invaluable for entering exact locations. Many modelers use it continuously in their work. You can also type in transform values in the coordinate display fields below the viewports.

- 4. Click outside of the Transform Type-In dialog, and then press **H** to display the Select Objects dialog. In the list, double-click CamPoint01 to select it.
- 5. On the Name And Color rollout, change the name of CamPoint01 to **1 Left Front**.

In the following table, *1 Left Front* is supposed to be the zero point (0,0,0). This position is the default in the Transform Type-In dialog, so this first point is already, located where it should be.

Here is a table with the XYZ positions of the CamPoints. The CamPoints are set one each at the bottoms of the six markers, and two CamPoints are set at the tops.

Point	Number	X	Y	Z
1 Left Front	1	0"	0"	0
2 Left Middle	2	0	0'6"	0
3 Left Back	3	0	1'4"	0
4 Left Up	4	2/8"	1'4"	0'5 3/8"
5 Right Front	5	1'1 6/8"	-1/8"	0
6 Right Middle	6	1'1 4/8"	0'6"	0

Point	Number	X	Y	Z
7 Right Back	7	1'1 2/8"	1'4"	0
8 Right Up	8	1'1 4/8"	1'4 2/8"	0'4 6/8"

- Click outside of the Transform Type-In dialog.
- Press **H**. Select *CamPoint02*.
- Rename this point **2 Left Middle**.
- On the Transform Type-In dialog, under Absolute:World, enter the X, Y, and Z values for this point (listed in the table as **0, 0'6", 0**). Press TAB to move between fields. Use a hyphen for a minus sign. When you've entered the values, click outside the dialog.

The point moves to the location you've entered and becomes deselected. This is how you can create and position all the CamPoints in the scene.

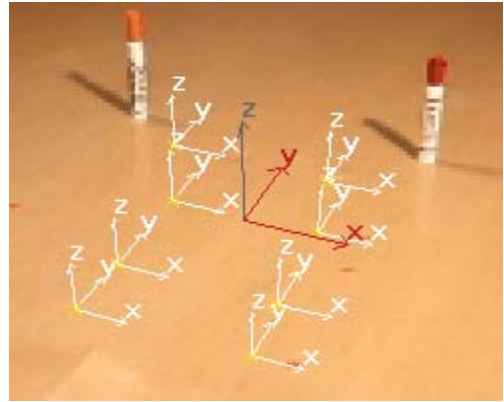
Since this is tedious and time consuming task, you'll delete these points and merge in the correct CamPoints from a prepared MAX file.

#### Merge in the correct CamPoints:

- Select the points you've created and delete them.
- Choose File > Merge. Open *merge\_points.max*.
- On the Merge dialog, click All to select the eight points.
- Click OK.

The new set of points appears in the viewports, all selected.

- Arc rotate the Perspective viewport, so you can see the points. Zoom in so the points are distinct.



*CamPoints in the viewport*

If you review the position of the points you will discover the *Left Front* point is in fact  $-1/8, -1/8, 0$  slightly off from  $0,0,0$ . Don't worry, this is how it should be. Careful measurements of the scene revealed this error, so the correction was required.

#### Save your work:

- Choose File > Save As. Save your work to this point as **mycamtrack1.max**.

## Loading the Movie into Camera Tracker

In this step, you load the background movie into the Camera Tracker utility. You then create and set up a motion tracker for each of the features in the movie. This establishes the connection between the feature in the background movie and the associated CamPoint you placed in 3D space to correspond to that marker's position in the real world.

#### Load the movie:



- On the Utilities panel, click More. Choose Camera Tracker from the list (choose More), and then click OK.

2. On the Movie rollout, click the Movie File button labeled None.
3. In the Browse Images for Input dialog, select *table.ifl*, and then click Open.

The first frame of the movie appears in a separate movie window.

Note: The movie window displays the IFL file at a resolution of 640 x 427. In your own projects, you're likely to use Camera Tracker at video resolution (720 x 486 for NTSC, larger for PAL). In this tutorial, you use a slightly lower resolution for faster performance.

#### Fade the screen:

Tip: You'll definitely want to keep the screen faded when you're working with trackers.

- On the Movie rollout, turn on Fade Display.  
The background is lightened but still visible. This will make the tracker gizmos easy to see when you add them.

#### Set up a motion tracker:

1. On the Motion Trackers rollout, click the New Tracker button.  
A new tracker gizmo appears at the center of the movie window and in the Tracker list.
2. In the movie window, drag the Tracker gizmo over the left-front red sticker.



3. On the Motion Trackers rollout, in the Tracker Setup group, click the button below Scene Object.

This activates object selection mode.

4. Press **H** and choose the CamPoint named *1 Left Front*. Choose Pick.

In the Motion Trackers list, the tracker gizmo, now named 1 Left Front, is associated with the CamPoint of the same name.

#### Work in the movie window:

- When working in the movie window in the next procedure, select the gizmo, then use the following keyboard shortcuts to produce zooms centered on the selected tracker gizmo.
  - Press **I** repeatedly to zoom in.
  - Press **O** repeatedly to zoom out.
  - Press **R** to reset the zoom level to 100%.

#### Adjust the position of the motion trackers:

The accuracy of a match move (the alignment of a 3ds Max camera with the background scene at each frame) is determined, in part, by the accuracy of feature tracking. Camera Tracker provides controls for subpixel motion tracking, allowing you to position tracker gizmos very accurately against the feature markers in the background movie. This can improve a match move substantially.

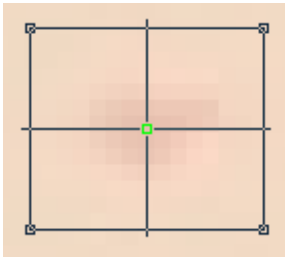
When subpixel tracking is enabled, a tracker gizmo can be positioned *within* a single pixel. You need to zoom in sufficiently so that you can see the slight changes in position corresponding to the subpixel tracking level you set.

1. On the Motion Trackers rollout, set Subpixel Tracking to **1/4**.
2. In the movie window, the tracker gizmo you just created should be roughly centered over the front left red sticker. Zoom in repeatedly by pressing **I**.
3. Reposition the gizmo so it is centered over the feature.

The center of the gizmo snaps to the increment of subpixel tracking. With a setting of 1/4 of a pixel, these are very small motions.

A tracker gizmo is made up of two boxes and a cross hair. The inner box is called the *feature bounds box*. This defines the feature to be tracked frame-to-frame by Camera Tracker.

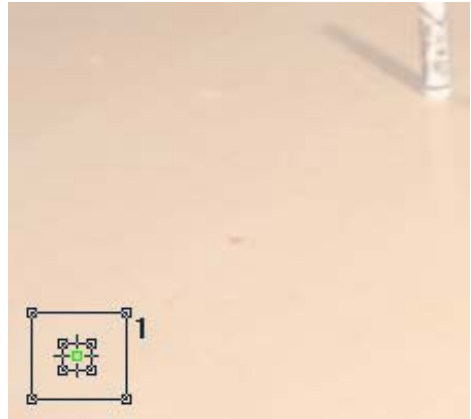
4. Drag the corners of the feature bounds box of the tracker gizmo until the box encompasses the red sticker and a small border of tabletop.



5. Press **O** repeatedly to zoom out to see the outer box.

The outer box of the Tracker gizmo is called the *motion search bounds box*. The size of this box determines the frame-to-frame search area for that feature within the movie. Because the motion search box moves with the feature bounds box, it defines a relative search area on each frame.

- Adjust the motion search bounds box to at least twice the size of the inner box.



Tip: The bigger the motion search bounds box, the slower the tracking operation. However, if this box is too small, the feature might jump outside this box in one or more frames, causing an error. If you have extreme patience, you can review the movie watching each camera point's movement, looking for large frame to frame jumps. If you find these, you can actually animate the size of the motion search bounds box on those frames. As a general practice, it's more practical to keep the box on the large side.

#### Save tracker information:

Motion tracking data, such as the position and size of the tracking gizmos, is saved in a separate MOT file, not the MAX scene file. When you load the movie file in the Camera Tracker and there is a MOT file of the same name as the movie file in the same directory, it will load automatically. Otherwise, you will have to load the MOT file manually.

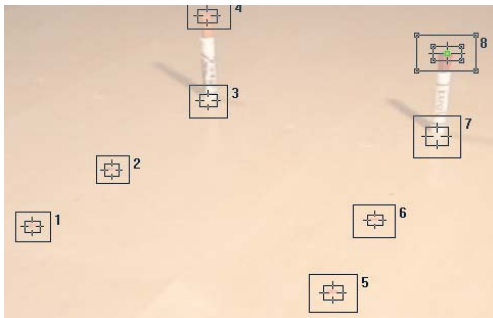
After you position the first gizmo, start a MOT file for this data.

- On the Movie rollout, click Save As. In the Camtracker File dialog, name the file **mycamtrack.mot** and save it to disk.

### Assign and size the other tracker gizmos:

- Repeat this process for the other trackers, setting up each motion tracker, adjusting its position, associating with a CamPoint in the scene and saving the tracker information.

As a practical matter, you can create the tracker gizmos first, associating each with a CamPoint, then do a separate pass to adjust the gizmo boxes. This illustration shows the final size and placement of tracker gizmos.



### Make a final check:

After you finished setting up the motion trackers, do a final check.

1. Zoom in on one tracker so you can see both its boxes. Then press TAB to jump from tracker to tracker. You'll quickly find out if there any boxes you forgot to resize.
2. Be sure to save a final version of **mycamtrack.mot**.
3. Save the scene file as **mycamtrack02.max**.

### Set Motion Tracker Ranges:

The next step in the process of camera tracking is to set the ranges for the trackers. In this example all the trackers stay in view for the entire animation, so there is no need to change the ranges for any of them.

When you do your own project you may find trackers that disappear from view. Here are the steps you need to follow to set the tracker ranges

1. Review the sequence using the RAM Player, or by rendering and playing an AVI file.

Carefully examine the file for trackers that disappear from view. Jot down the frame number where they disappear.

2. On the Motion Trackers rollout, click None to turn off all the trackers.
3. Select the tracker that disappears, and click On to enable this one tracker.
4. Open the Movie Stepper rollout. Set the Movie Frame field to the last frame number in which the tracker is visible.

5. On the Motion Tracker rollout, in the Tracker Setup group, click Set Stop.

In the Motion Tracker list, the tracker now has a range set correctly.

6. If a feature disappears and reappears, create an additional tracker gizmo and assign it to the feature with a new range, starting when the feature reappears in the scene. Thus, there will be two tracker gizmos with different ranges associated with the one feature.

---

## Tracking the Features

In this step, you use Movie Stepper controls, much like VCR buttons, to track the features individually.

### Track the first feature:

1. On the Motion Trackers rollout, click None to turn off all the motion tracker gizmos.
2. Highlight the second motion tracker in the list, and then click On.

We chose the second tracker to start because the first tracker changes color around frame 200.



3. On the Movie Stepper rollout, click the Feature Tracking Off button.

The Off button turns bright red and switches its name to On. Feature tracking is now operational.

4. Click the button marked >10 to advance the movie 10 frames, one frame at a time.

The selected tracker follows its feature in the movie. A red trail line is gradually displayed showing the movement of the feature in the movie.

5. Track the feature 10 frames at a time. Or you can click the button marked >> to track all the way to the end at once.

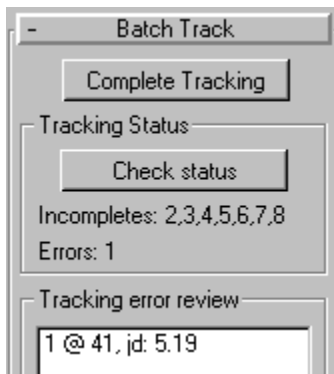
If you do 10 frames at a time, you can see if errors occur as the Tracker progresses.

The movie window may become hidden during the tracking and then redisplay. If you track a single frame at a time, it should stay visible.

When you finish tracking the feature, it's time to check for errors.

#### Check status:

1. Open the Batch Track rollout.



2. In the Tracking Status group, click Check Status.

An error detector identifies possible instances of incorrect tracking, and also reports any features that have not been completely tracked.

Potential errors are listed in the Tracking Error Review window. The list displays the tracker number that failed, the frame number in which the error occurs, and the type of error.

An error with the code “jd” represents a jump delta error. This means that the camera has moved a greater distance than the jump threshold allows. You probably have errors displayed with this code.

#### Fix tracking errors:

1. In the Error Thresholds rollout, increase the Jump Delta to 10.
2. If there is an error, in the Tracking error review window, highlight the error and then click Clear.

The error disappears from the list.

3. In the Movie Stepper, go to the frame the error occurred.

The movie advances to that frame, centering the tracker gizmo in the movie window.

4. Zoom in on the tracker using the I key. Adjust the gizmo to position it properly over the red sticker.

The keyframe is automatically revised for the tracker.

5. In the Movie Stepper rollout, click Clear Tracking To End.
6. Repeat the tracking from that frame to the end using the >> button in the Movie Stepper rollout.

Note: If you move or resize the tracker gizmo at any frame, you set a keyframe for the change in the gizmo itself. This keyframe is indicated as a green box on the trail of the tracker gizmo.



### Recheck status:

- On the Batch Track rollout, click Check Status. There should be no errors for tracker number 2. The others are listed as incomplete. There are two ways to proceed.
- You can select the next tracker and repeat the process tracking each tracker individually. This is time-consuming, but lets you watch what is happening, and spot any problems as they occur.
- You can track all the remaining trackers using Batch Tracking > Complete Tracking. If sufficient errors are encountered, however, the tracking halts, and you must correct the problems for each tracker individually.
- We also provide a finished MOT file if you don't want to do all the tracking yourself at this time.

If you get a tracker with many errors, you should track it one frame at a time, allowing the tracker to remain visible in the movie window. If you see it is off, you can simply move it into place to correct it. This is tedious, but effective.

Camera errors are based on the Error Threshold settings. You can also reduce errors by raising these settings. If there is extreme camera movement you should increase the Jump Delta threshold, which will eliminate errors preceded with a *jd* code. For this example the Jump Delta works best at about 9.5.

The other error threshold settings, Match Error and Variance Delta flag frames in which the shape or the color of the feature changes. If you find “*me*” and “*vd*” errors, go to those frames and manually reposition the tracker gizmo, then click Clear Tracking To End and track again.

### Clear and start over:

1. If you want clear all trackers and start over, open the Position Data rollout.
2. In the Apply To group, turn on All, and then click Clear All.

### Save your work:

Once you have feature tracking completed, you should save the tracker setup and the feature-tracking data.

- On the Movie rollout, click the Save button. This saves your current MOT file, for example, *mycamtrack.mot*. If you're starting fresh, clicking Save creates a file in the same directory as the movie file being tracked. The file is the name of the movie with the extension MOT.

### Load a correctly tracked file:

Rather than spending your time slowly tracking all eight trackers in this scene, you can load a completed MOT file, *table\_correct.mot*.

1. On the Movie rollout, click Load.
2. In the dialog that appears, answer Yes to save the tracker state.
3. On the Camtracker File dialog that appears, select *table\_correct.mot*.

---

## Match Moving the Camera

Once you've completed feature tracking and reviewed the tracking for errors, you're ready to

match the movement of the real camera. This is the payoff for the Camera Tracking feature: the animated camera that results should match the movements of the real camera that shot the movie.

#### Create the matching camera:

1. Create a Free Camera in any viewport. Name it something distinctive such as **matchcam**.
2. In the Camera Tracker, scroll down and open the Match Move rollout.
3. Click the button at the top of the Match Move rollout in the Camera group.
4. Press **H** and select the camera you just created.
5. At the bottom of the Match Move rollout, click the Match Move button to animate the camera.

If everything goes well, the camera tracking is now complete. The match-move camera has been keyframed to follow the movements of the original movie camera.

Frequently you will experience problems at this point. If you have a problem at the initial frame of the animation, you should use the Camera Match utility to create a camera. This will allow you to verify that your CamPoints positions are correct to begin with. If the Camera Match utility cannot create the camera, you know you've made a mistake either in positioning the CamPoints or in your initial measurements.

If you experience a problem after the initial frame, the problem is not with the CamPoint positioning, but with the tracking. In some cases, the tracking needs manual correction at a particular frame because the appearance of the feature in the video has changed. In other cases errors are induced because there the trackers in the scene are not spread out enough to give a good match.

#### Check the results:

- To see the effect of camera tracking, change the Perspective viewport to a Camera viewport assigned to the matched camera. Then advance through the frames by scrubbing the time slider or playing the animation.

#### Limit the match:

- Match options are on the Match Move rollout, in the Match group. By default, all options are turned on, but you don't necessarily need them all. For example, if the camera was always on a tripod and only panned, you could try turning off everything in the Match group but the Pan option. Limiting options should help to reduce errors in the camera match.

---

## Move Smoothing and Compositing

Match move estimates the correct camera motion based on feature tracking and field measurements. Errors in these factors can sometimes cause errors or noise in the generated match move. Under certain conditions, you can use *move smoothing* to reduce the noise.

For example, if your real camera moved smoothly, or was fixed in one location, you can use controls on the Move Smoothing rollout to clean up the generated match move. In the video used in this tutorial, the camera was hand-held, so the motion is inherently noisy and would not improve with smoothing. But the lens was zoomed smoothly in and out, so you can smooth Field-of-View.

When a particular camera parameter is smoothed, Camera Tracker can make a further, compensating match-move pass that re-estimates all the other parameters using the smoothed parameter. This often results in a better overall match. In the case of a camera on a tripod making a pan, for example, you could have the Camera Tracker estimate all

the camera motions and then smooth the results to better match the real camera moves.

#### Use move smoothing:

1. Open the Move Smoothing rollout.
2. In the Channel To Smooth group, turn on FOV.
3. On the Smooth Type rollout, turn on Low Pass Filter and Re-match After Smooth.
4. At the bottom of the rollout, turn on Smooth.

The tracker first smooths the FOV, and then rematches the position and rotation moves of the camera.

#### Composite:

You are now ready to composite 3D models into the filmed scene.

1. On the File menu, choose Merge, and then *deskrino.max*.
2. From the Merge list, choose *RINIRRHINO3*.

The rhino appears in the scene. You can rotate, scale, or move the rhino on the table top as you like.

If you had any trouble getting the camera to match, you can also merge in the animated Camera, named *Camera01 – matched*.



If you want the rhino to cast shadows on the tabletop, or reflect in the tabletop, merge in

the lights found in *deskrino.max*. Or you can create your own.

3. Change the Perspective viewport to the matched camera, if you haven't already.
4. Scrub the time slider and see the match.
5. If you like, you can render the animation, or play back *rinodesk.avi* to see the finished result.

## Summary

In this tutorial, you have learned to use the Camera Tracker to match the movement of the virtual camera to real-world footage. You have learned to create camera match points and track the movie, then make corrections and use move smoothing. Finally you have composited the tracked shot with 3D geometry using the Merge command and then rendering your animation.

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