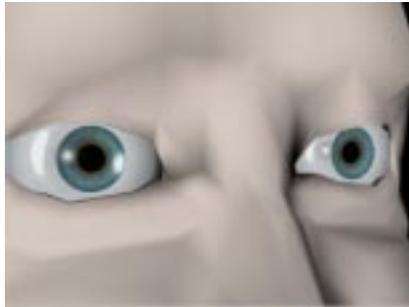




MODELING EYES

This tutorial will teach you how to model a pair of realistic-looking eyes and insert them into the head of a character.



ESTIMATED TIME REQUIRED

30 Minutes

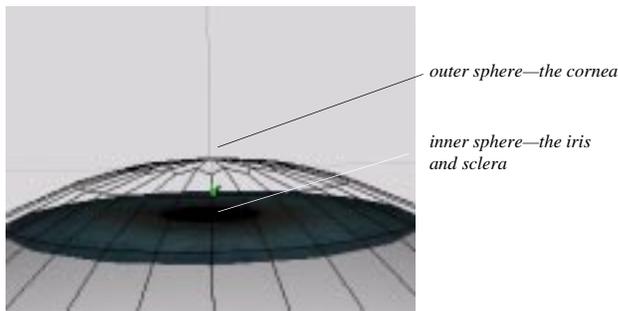
LEARNING GOALS

In this tutorial, you will learn how to:

- Model a pair of eyes.
- Insert the eyes into a character's head

MAKING AN EYE

As the figure below shows, the actual geometry for an eye can be quite simple. The eye that you'll construct in this tutorial will consist of just two spheres. One sphere will encapsulate another slightly smaller, slightly concave sphere.



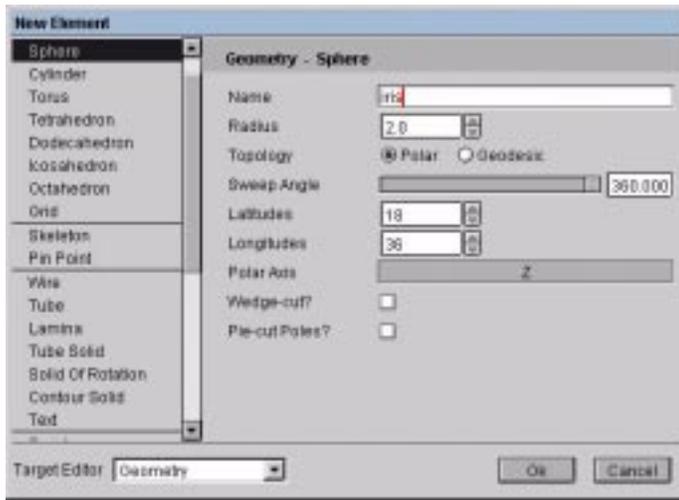
With the assignment of the right surface attributes—mainly low opacity and just a slight reflectiveness—the outer sphere will become the cornea (the clear covering over the front of the eye). With the assignment of a texture map, the depressed portion of inner sphere will become the eye's iris (the colored part with the fibrous muscle) and the remainder will become the sclera (the “white”). The overlapping surfaces of the spheres will give the eye a very deep, realistic look.

MODELING

Let's get started on modeling the eye:

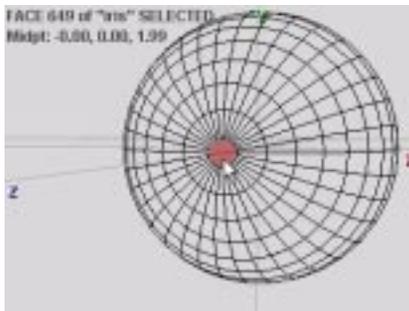
- 1 Open up the practice scene that accompanies this tip.
- 2 Press F5 to add the inner sphere to the scene. The New Element dialog box appears.
- 3 Make the following settings in the New Element dialog box.
 - Select *sphere* as the type of element that you want to add.
 - Type in “iris” as the name of the sphere.
 - Type in 2.0 for the radius.
 - Type in 18 for the number of latitudes, and 36 and the number of longitudes.
 - Select *Z* as the polar axis.

- Leave all the other properties at their default values.

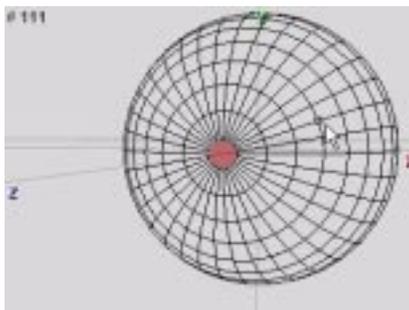


Now you need to add the concave depression to the “iris” sphere:

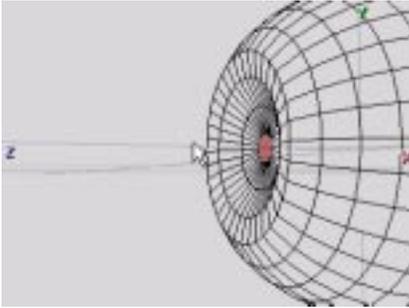
- 4 Select the polar face of the sphere that lies on the positive Z axis.



- 5 **[R]** on the face, then **Alt [L]** on *Axis Move*. (Holding down the Alt key invokes the magnet function. Clicking **[L]** uses the faces normal as the axis for the operation.)
- 6 You're prompted to select a vertex to define the boundary of the magnet falloff. Click on any point on the third or fourth latitude of the sphere.

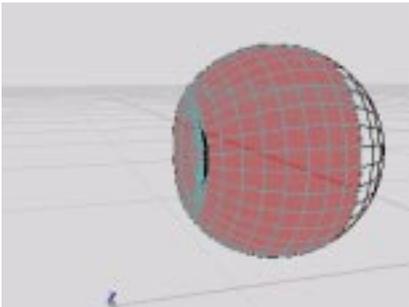


- 7 Move your mouse slightly to the left until a shallow depression forms, then [L] to complete the operation.



Now you need to create a face part that encompasses slightly more than half the sphere. You'll assign attributes to this part later on.

- 8 Select again the polar face of the sphere that lies on the positive Z axis.
- 9 Press “+” several times to grow the selection out a few latitudes past the sphere’s equator.

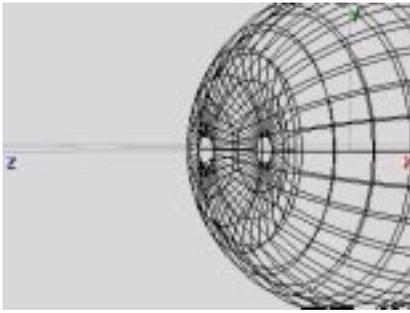


- 10 [R] on the selection, then [L] on *Add to Part>Make New Part* and name the new part “top-hemisphere,” or something to that effect.

Now for the outer sphere:

- 11 Press F5 and make the following settings in the New Element dialog box.
- Select *sphere* as the type of element that you want to add.
 - Type in “cornea” as the name of the sphere.
 - Type in 2.1 as the radius (so it’s just slightly larger than the inner sphere).
 - Type in 18 for the number of latitudes, and 36 and the number of longitudes.
 - Select Z as the polar axis.
 - Leave all the other properties at their default values.

The “cornea” sphere appears, encapsulating the “iris” sphere.



Now just to keep things tidy, restructure the “iris” and “cornea” spheres into a parent object:

- 12 In a Scene Graph, Alt **[M]** on the “iris” sphere and (while keeping the Alt key depressed) drag it on top of the “cornea” sphere. The two objects are restructured under a parent object called “cornea Group.”
- 13 In the Scene Graph, **[R]** on the “cornea Group” parent object and select the *Rename* command.
- 14 In the dialog that appears rename the “cornea Group” object “eye-left.”

ASSIGNING ATTRIBUTES

Now you’re ready to start texturing. Since the attributes for the “cornea” sphere will be very simple, you can assign them directly to its surface. No mapper is necessary.

You will, however, have to assign a mapper and texture to the “iris” sphere. You can choose from several textures that are included with the practice scene, or import your own.

Start by assigning attributes to the “cornea” sphere:

- 15 In the Scene Graph, **[R]** on the “cornea” sphere and select *Edit Attributes*. The Attributes dialog box appears.
- 16 Make the following settings in the Attributes dialog box:
 - Use *Options Menu>Render Domain>Mirai* to switch the editor to the Mirai domain.
 - Select *Phong* as the shader.
 - **[L]** on the *Smooth* checkbox to enable the property.
 - Move the *Diffuse* slider all the way to the left to make it completely black.
 - Move the *Specular* slider approximately an eighth of the way to the left, so that it’s a light gray.
 - Set *Shininess* to approximately 0.750.
 - Move the *Opacity* slider almost all of the way to the left, so that it’s a dark gray.
 - Move the *Reflection* slider just slightly to the right, so that it’s a very dark gray.

- Leave all the other properties at their default values.



Now you're ready to assign attributes to the "iris" sphere's "top-hemisphere" part. You won't need to worry about adding attributes to the rest of the sphere as it won't typically be visible to the camera.

- 17 In the Scene Graph, click on the minus sign next to the "iris" sphere to make its underlying part visible.
- 18 Alt [M] on one of the eye textures and drag it (keeping the Alt key depressed) on top of the "top-hemisphere" part. A dialog appears prompting you to select the domain and layer to which you wish to apply the image.

NOTE: *This tip will show the effect of applying the "human_eye" image, but you can choose any of the eye images included in the practice scene.*

- 19 Choose *Mirai* as the domain and *Diffuse* as the Attribute then click *Ok*.

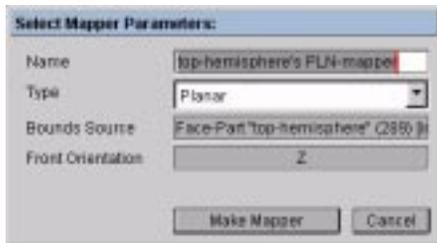
Now you've assigned the image to part's diffuse layer, but you need to map it using a planar mapper, rather than the sphere's default parametric mapper.

- 20 In the Scene Graph, [R] on the "top-hemisphere" part, then select *Edit Attributes*. The Attributes dialog box appears.
- 21 Make the following settings in the Attributes dialog box:
 - Use *Options Menu>Render Domain>Mirai* to switch the editor to the *Mirai* domain.
 - Select *Phong* as the shader.
 - [L] on the *Smooth* checkbox to enable the property.

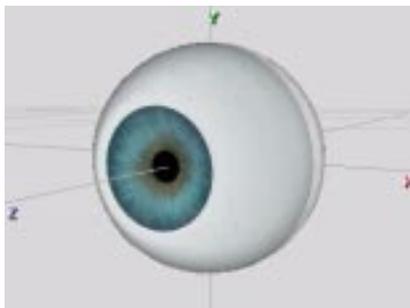
NOTE: *We won't ask you to do so in this tip, but in a more complex scene you might want to also enable the Ray Tracing attribute, so that you can see the contents of the scene reflected in the eyes of your character.*

- 22 Now click on the *Diffuse* channel of the Attributes dialog box.
- 23 [L] on the layer bar for the image that you assigned above (for example, the *eye_human* bar).
- 24 In the dialog box that appears, [L] on the *Mapper* field.

- 25 In the dialog box that appears, [L] on *Make New...* Another dialog box appears, which lets you define the properties of the new mapper.
- 26 Make the following settings in the dialog box:
 - Choose *Planar* from the *Type* field.
 - Choose the “top-hemisphere” part from the *Bounds Source* field.
 - Choose *Z* from the *Front Orientation* field.
 - Click the *Make Mapper* button.



- 27 Click *Ok* to close the diffuse layer dialog box.
- 28 Now make just the “iris” sphere visible (using a Camera Graph).
- 29 If necessary, use *Options Menu>Render Domain>Mirai* on the *Geometry* window in order to view the sphere in the *Mirai* domain.
- 30 Press “s” to turn on shading for the object. You should see something like the image below, depending on the image to chose for the texture. (If you don’t, walk back over the proceeding steps to make sure that you didn’t miss anything.)

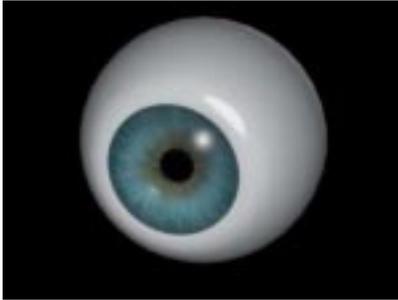


MAKING A TEST RENDER

Try making a test render just to make sure that you’ve correctly applied all the attribute settings so far.

- 31 Position the camera for a good view of the eye and press *Ctrl-r* to render a test frame using the default light.

You should see something like the figure below. (Once again, if you don't, walk back over the preceding steps to make sure that you didn't miss anything.)



FREEZING THE EYE'S MAPPER

The eye looks great now, but you need to freeze the planar mapper so that you can freely move the eye about the scene with the texture map intact. This is a simple matter:

32 Make the following settings in the Attributes dialog box for the “top-hemisphere” part:

- Use *Options Menu>Render Domain>Mirai* to switch the editor to the Mirai domain.
- Click on the dialog box's *Diffuse* channel.
- Click on the layer button for the texture map (for example, the *eye_human* button).
- Click in the *Mapper* field of the dialog box that appears.
- Click on the *Make Frozen* option of the dialog box that appears.
- Click on the planar mapper that you created above. It should be named *Global PLN-Mapper*, or something similar.
- Click on the *Make Mapper* button of the dialog box that appears.
- Click on *Ok* to close the diffuse layer dialog.

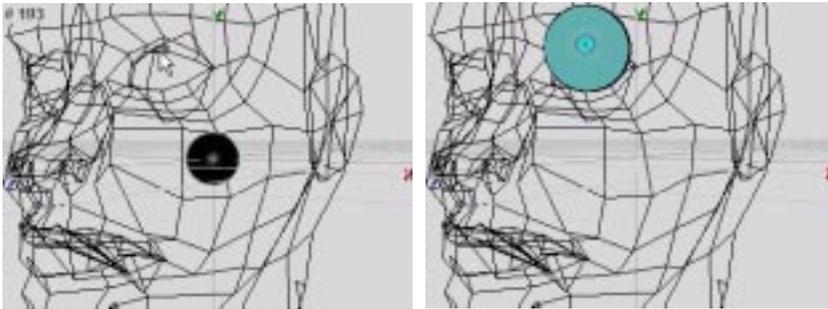
POSITIONING THE EYE

Alright, the eye is now completely modeled and textured. Now you're ready to position it in the provided head.

33 Make the “head” object visible in wireframe mode and the “eye-left” object visible in shaded mode.

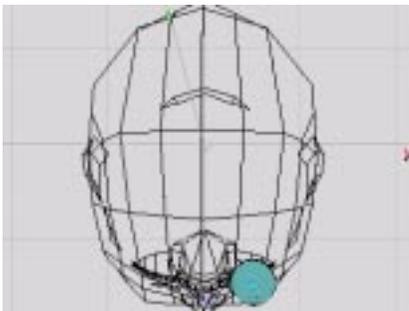
34 Ctrl **[R]** on the Geometry window, then **[R]** on *Edit Body* to select both the “iris” and “cornea” bodies. (Ctrl **[L]** on each body in order to select them both.)

- 35 [L] on *Position* and select a vertex on the upper left eyelid of the head. The the midpoint of both the “iris” body and the “cornea” body move atop the selected vertex. This is just a quick way of getting the eyeball close to where you ultimately want to position it.



Now fine tune the eye’s position. Perhaps the fastest way to do so is with a series of moves relative to the screen with the camera oriented along each of the global axes. Start with the Y axis:

- 36 Press the “y” hotkey to orient the camera on the global Y axis.
- 37 Use the *Edit Body* command to again select both “iris” and “cornea.”
- 38 [M] on *Move* to move the eyeball relative to the screen. Move the eyeball until it looks properly placed given the current view.



- 39 Repeat the above steps on the X and Z global axes.



- 40 If your not already in shaded mode, press “s” so you can see if the eye properly penetrates thought the socket.

- 41 Rotate the camera about the head to make sure the eye is right where you want it. If it's not adjust it as necessary with the *Move* [M] command. When you're done, your scene should look something like this:



- 42 You may also want to make another test render to make absolutely sure the eye looks properly positioned.

DUPLICATING THE EYE

Now all that remains is to duplicate the eye, and position the copy in the right socket. As you'll see, you can use the *Axis Scale* command to mirror the eye about the Y axis.

- 43 In the Scene Graph, [R] on the "eye-left" object, then select *Duplicate*.
- 44 Use the Scene Graph's *Rename* command to rename the copy "eye-right."
- 45 Use the *Edit Body* command to select iris and cornea of "eye-right."
- 46 Ctrl [L] on *Axis Scale*, then [M] on *X* and *Origin*.
- 47 When prompted to enter a ratio for the operation, type *-1* (that is, *negative one*) and click *Ok*. You should see "eye-right" take its position in the right socket. (If you don't press Ctrl-z to undo as necessary and walk back over the last few steps.)

Finally, you need to evert the copy's normals, as these were inverted as part of the *Axis Scale* operation:

- 48 Select the copy's iris and cornea using the 3D lasso or the *Edit Body* command.
- 49 [R] the selection, then [L] on *Evert*.
- 50 Make another test render to see how everything looks. You should now see something like this:

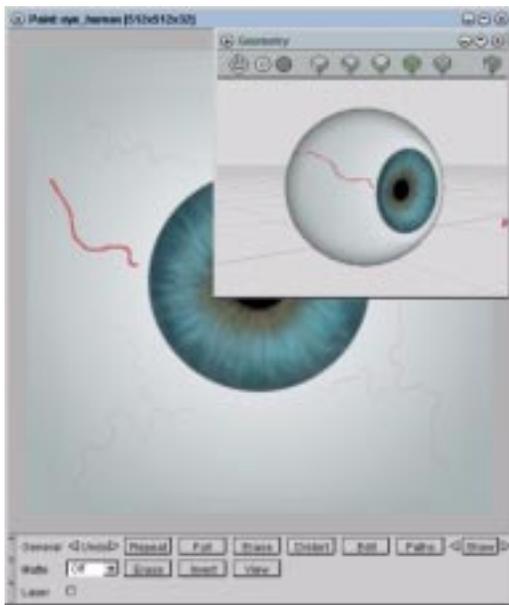


FOR FURTHER EXPLORATION

This tip has taught you that it's a simple matter to model, texture, and insert a pair of realistic eyes. We'll close this tip with suggestions for a few more enhancements which you might want make to the eyes. We won't discuss these enhancement in great detail, but if you have any questions you can find more detailed discussion of all of the operations mentioned below in the *Mirai Workbook*.

● ADDING MORE DETAILS TO THE TEXTURE MAP

Suppose you wanted the character to have very bloodshot eyes. Since you applied the same texture map to both irises, you could easily go into the Paint editor and add more veins. The easiest way to set up for this task is to make a Geometry viewer visible within your Paint configuration. You can then make one of the irises visible in the Geometry viewer, as you paint on the texture map. This way you can interactively see the effect of the paint on the actual model:

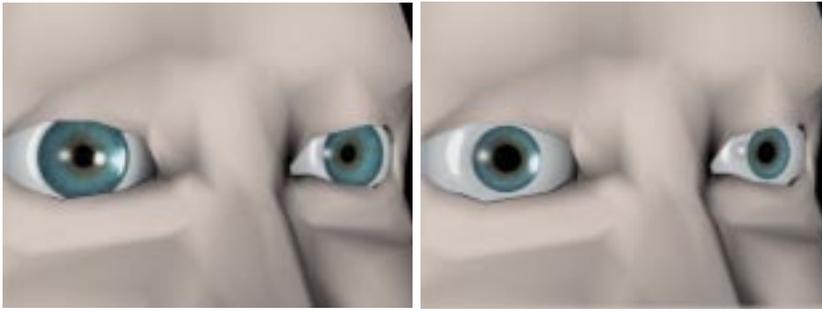


● ADDING DISPLACEMENTS

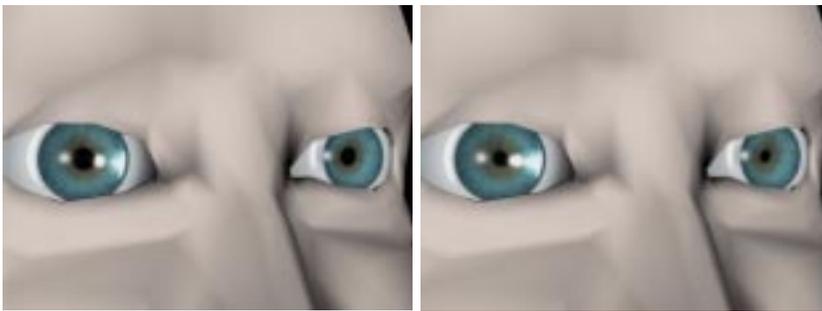
You might also add some displacements to the eyes to prepare for animating them. For example, to control the size of the irises, you could do the following on each eye:

- Collect the faces beneath the iris-portion of the texture map.
- Add these faces to a part.
- Scale the part down.
- Save the result as a displacement.

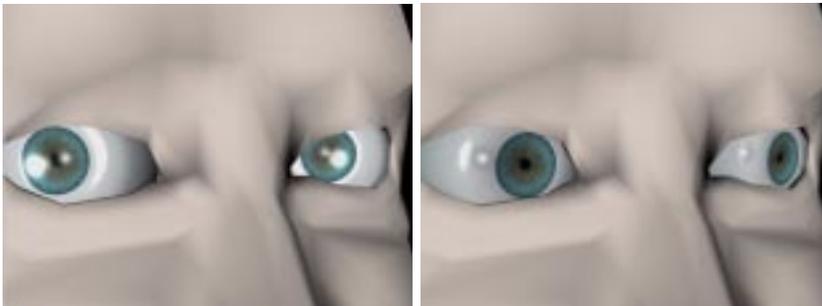
This would result in an effect like the following:



You might use the same technique to scale only the faces beneath the pupil-portion of the texture (this is a great way to have your character express anger!):



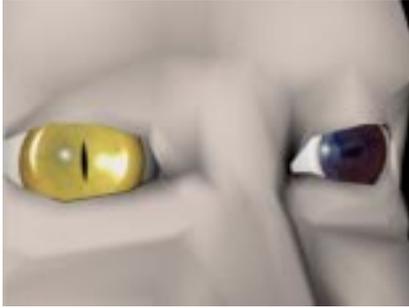
You could also save rotational displacements on the eyes in order to move them about in their sockets:



NOTE: *The Mirai Workbook also describes another method for moving the eyes in unison. Rather than using displacements, it discusses attaching the eyes to two bones, then posing them using a pin object.*

● EXPERIMENTING WITH OTHER TEXTURES

The practice scene a couple of other textures which you might want to try applying to the eyes to see the effect:



Or better yet, try painting and applying your own texture!