Tutorial 1 Creating a Photorealistic Image

This tutorial introduces you to the basic functions of ElectricImage™ while guiding you through the steps to create the photorealistic image shown below.

By working with this tutorial, you will learn:

- How to create a new ElectricImage project, including how to add models to the project, position the Camera and the models in a scene, and render and image.
- How to apply surface attributes such as color, reflectivity and transparency to models.
- How to apply textures and reflections to models.
- How to use lighting to achieve a photorealistic effect.

What You Will Need

To complete this tutorial, make sure that all of the ElectricImage application files and folders (including the Tutorials folders) have been installed on your hard disk in the same folder.

The models and textures you will need are located in two folders within the **Tutorial 1** folder:

- The **Models** folder, which should contain the following files:
  - Sphere
  - Cone
  - Room Model
  - Lamp Model
- The **Textures** folder, which should contain the following files:
  - Plaster SM Image
  - Sandstone SM Image
  - Weird Hi-Con

For processing, you will need at least 24 MB of RAM allocated to the Camera application, either physical or virtual (though processing will be extremely slow using virtual RAM).

Please note: It is very important that you pay close attention to detail during the course of this tutorial. Successful completion of this project depends on text entry of many precise values, and it only takes one misplaced decimal point to produce unwanted results. Should you find, at any time, that your results do not match those shown in the tutorial, it may be due to an incorrect or missing value, and you should go back over the steps to locate the error.

Also: This is a lengthy tutorial, and it has been split into sections so that you can take breaks between them. Remember, you don't have to complete the entire tutorial in one sitting. At any time you can save your project file and quit ElectricImage to return at another time.

Creating a Project File

The first step in creating an image (or animation) is to create a new project file.

1. Open the ElectricImage folder and double-click on the ElectricImage™ icon to launch the ElectricImage application.

   Information about ElectricImage will appear, with a request that you click to continue.

2. Click the mouse to continue.

3. Select **New.** from the File menu (keyboard equivalent is ⌘**-N**).

   A directory dialog box opens, requesting that you name and save the new project file.

4. Type "Tutorial 1" in front of the word "Project" and either click **Save** or press *return*.

   Another directory dialog box opens, this one prompting you to add a model to the project.

5. Locate and open the **Tutorial 1** folder, then the **Models** folder, and add the model named "Sphere".

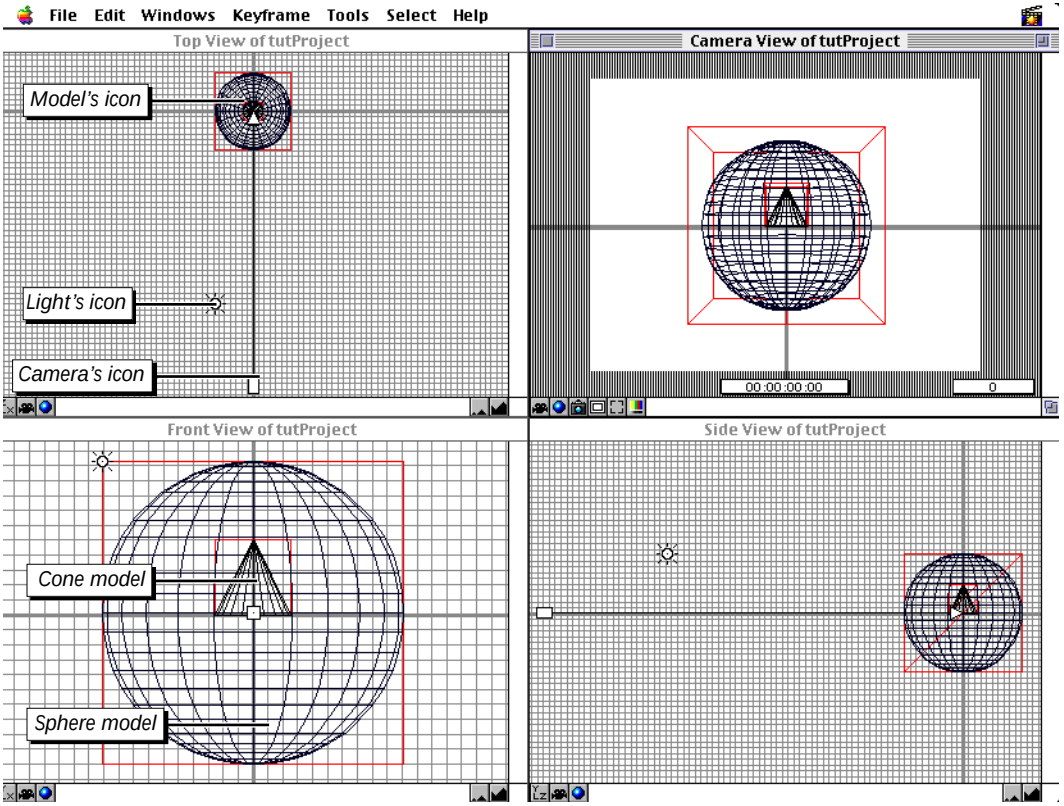
   The model is added to the project and the dialog box reopens.

6. Add the model named "Cone".

   The model is added to the project and the dialog reopens.

7. These are the only models we need right now, so click **Done**.

   The ElectricImage workspace opens, with the three World View windows (top, front, and side view) and the Camera View window arranged on your monitor as shown below



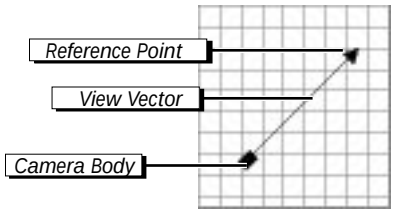
When a project is created, it contains a Camera and one radial light (plus any models that you've added). In the illustration above, we've indicated for you the appearance of the icons that represent the models, the Camera, and the Light.

Getting Acquainted With the Workspace

At this point, take some time to get a feel for moving things around in the World View windows (Top, Front, and Side). You can look at the Camera View window to see what the Camera sees.

8. First, drag each of the models around and watch how the Camera View window changes as you re-position the models.

9. Now move the Camera. First, drag the Camera body (the rectangle) only. Notice the effect of moving the Camera body without moving its reference point (the point at which the Camera is aimed).



10. Now drag the light icon to re-position the light.

If it falls within the view of the Camera, you will see it in the Camera View window (thought it will not be rendered as a visible object).

11. To preview the effect of the light on the models, click the shading button (the middle of three buttons) in the lower left corner of the Camera View window.

The models are shaded temporarily (until you change the scene).

This type of shading can be set as a permanent preference through the use of the Drawing... command in the Edit menu or by holding down the option key while clicking on the shading button.

12. Now change the area displayed in the World View windows:

- Use the zoom icons in the lower right corner of each window to zoom in and out on your view of the models, Camera, and light.
- Hold down the *option* key and drag a rectangle into which the view will zoom when you let go of the mouse button.
- Hold down the *option* key while clicking either of the zoom icons in the lower right corner of the window; this action centers the objects in the window.

Throughout the tutorials, when we say to "center the window", we are referring to this action; holding down the option key and clicking one of the window's zoom icons.

Now that you've had a chance to acquaint yourself with the workspace, we can clear the project of the Sphere and Cone models (we won't be using them in the final image).

13. Under the Select Menu, choose **By Type>Groups**.

    This selects all model groups in the project (currently, the cone and sphere).

14. Choose **Clear** from the Edit menu (or press *delete*).

    The Cone and Sphere models are removed from the project.

Please continue on to the next part of the tutorial.

Building the Scene

Now we can set the scene for the final image we want to create. There are two models in your Tutorial 1 Models folder, one for the lamp and one combining all of the room elements.

ElectricImage has two ways to add models to a project once you've created the project file. We'll use both methods, one for each model.

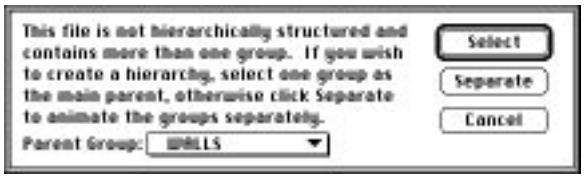
First, we'll use the File menu to add the room model.

15. Choose **Add**, then **Model**, then **FACT...** (**Add>Model>FACT...**) from the hierarchical File menu.

The directory dialog box used to add models to the project opens just as in step 5.

16. Find and select the model named "Room Model".

The dialog box shown below opens, informing you that the model is comprised of groups that are not hierarchically structured.



17. We want the **WALLS** group to be the parent group (to which all other groups in the model are linked), and since **WALLS** is already selected (in the Parent Group pop-up menu) either click **Select** or press *return*.

The model is added to the project and the directory dialog box reopens.

18. Although we still have one more model to add, click **Done.**

The other way to add a model is by using the Object Palette, which is a graphical interface for adding objects to the project. Let's use it to add the lamp model.

19. Choose **Object Palette** from the Windows Menu (⌘-E).

The Object Palette opens.

20. Click on the first button in the upper left of the palette, as shown in above (the button's icon represents a model in the ElectricImage FACT format).

The directory dialog box used to add models to the project opens.

21. Find and select the model names "Lamp Model".
Again, you are asked what to do about the hierarchical structure.

22. We want the **GLASSBASE** group to be the parent, and since it is already selected, either click **Select** or press *return*.

23. We now have all the models we need, so click **Done**.

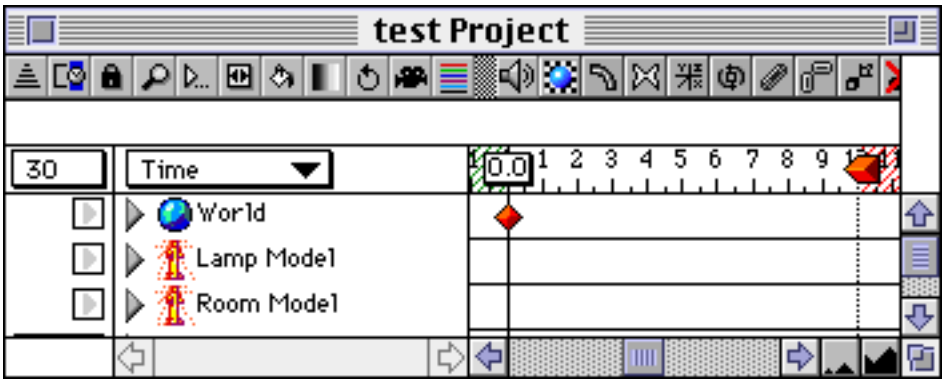
As for the Object Palette, you can either drag it out of the way or close it (we won't need it again for this tutorial).

Opening the Project window

Now let's open the project window where we can work with a listing of all the project's elements.

24. Choose **Project window** from the Windows menu (⌘-L).

The Project window opens, as shown below.



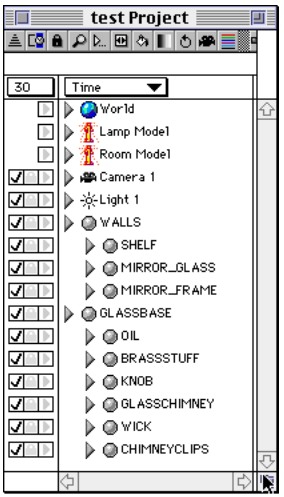
25. Use the resizing icon in the window's lower right corner to resize the Project window as it is shown on the next page, then drag it where you want it (so that it does not block the Camera View window).

While the Project window provides a complete overview of all project data (and is used extensively in animations), we'll only be using it in this tutorial to select objects for modification and manipulation (other tutorials will show you more of its uses).

Note that there are 16 objects listed in the Project window for this project:

- World – Used to set the parameters for fog, ambient light, backdrops, and global reflection maps.
- Two Model file icons – The statue represents a FACT model file. These can be used by the morphing engine in ElectricImage.
- Camera1 - The default camera.
- Light 1 – The default light source.
- The individual groups that comprise the Room Model and the Lamp Model.

Also note how the groups are hierarchically displayed according to the hierarchical structure of the models. The "children" in each model are shown indented beneath their respective "parents". As children, they will inherit certain characteristics from their parents (such as position and rotation).



Positioning the Camera

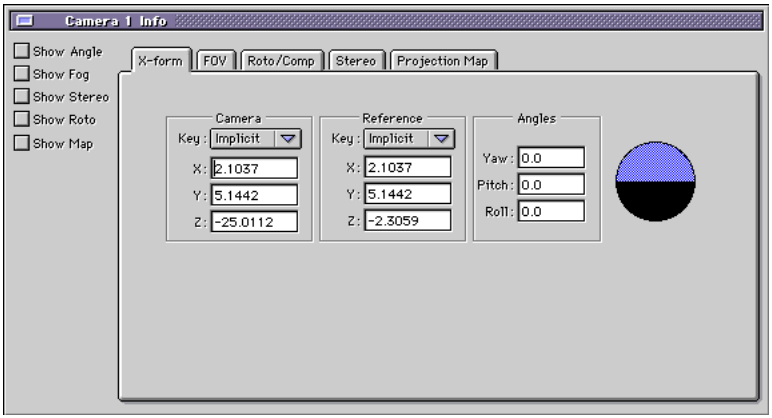
Now its time to position the Camera. As you've seen, the CAmera and its reference point can be moved by dragging them in the World View windows. For more precise placement, however, exact coordinates can be entered. We'll use the Camera Info window to enter the coordinates.

26. In the Project window, double-click on the Camera's icon – or single-click it to select the Camera (the Camera icon becomes highlighted) and then choose **Camera Info** from the File menu (**⌘-I).**

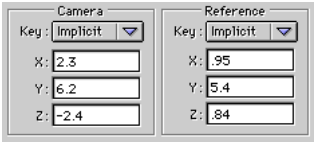
The Camera Info window opens with the Roto/Comp Tab forward.

27. Click on the X-Form tab to bring it forward.

The X-Form (transformation) tab contains the controls for position and rotation.



28. Position the Camera by typing the coordinate values shown below in the X, Y, and Z **Camera** and **Reference** edit boxes.



If you want to experiment with Camera roll, click and drag in the circle with the artificial horizon and watch the effect in the Camera View window. Just make sure you return the Roll value to 0.0 and that all of the values appear as shown above.

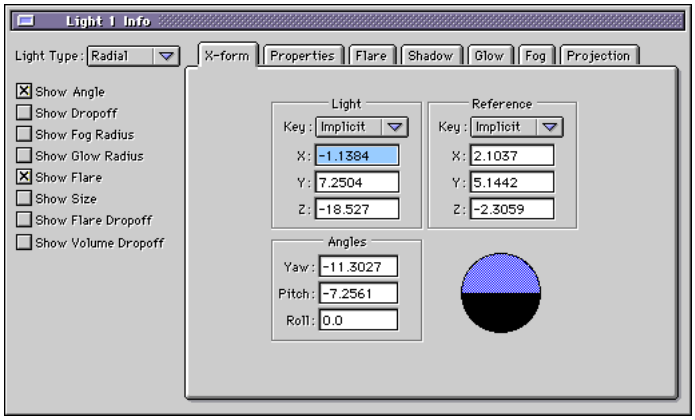
29. Close the Camera Info window (⌘**-W).**

Positioning the Light

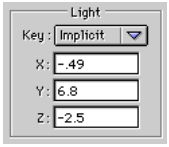
Now that we have our models in place and the Camera's coordinates have been set, let's place our default light source inside the Room Model so that we can see what's in there when we render the image.

30. In the Project window, double-click on the light's icon – or single click it to select the light and then choose Light Info from the File menu (⌘**-I).**

The Light Info window Opens.



31. Position the light by typing the coordinate values shown below in the X, Y, and Z edit boxes under the **Light** section of the window.



We are not considering the light's reference point at this time because the light is o f the radial type – that is, it gives off light in all directions, and so we don't need to aim it. (When we're dealing with shadows, we will need to aim the light – but that's for later.)

32. Close the Light Info window (⌘**-W).**

Rendering the Image

Now that the scene is set, let's save the project and render it.

33. Choose **Save** from the File menu (**⌘-S).**

As with any application, it is wise to save your work frequently.

34. Click and hold down the Snapshot icon at the bottom of the Camera View window (shown below) and select the first entry from the pop-up menu, **Window Size**.

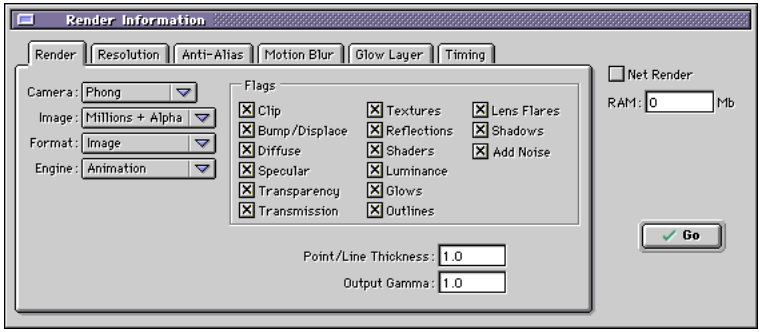
The renderer, Camera, launches and begins rendering the scene at the same resolution as the Camera Info window.

Since ElectricImage stays resident in memory while Camera is rendering the image, you must have enough memory free to contain both applications; approximately 50MB.

35. If you have enough memory to render the image while ElectricImage remains open, please continue at Step 43. OTherwise, we will use an alternate method that quits ElectricImage before launching the renderer.

36. Choose Render... from the File menu (**⌘-R).**

The Render Control window opens.



The Render Control window has extensive controls for image size and quality, for enabling special effects, for adding glow layers, for selecting which frames of an animation to render, and for launching the ElectricImage Camera to render the project. For this tutorial, we need not be concerned about all of these controls—they are not, for the most part, applicable, and the default settings will produce very pleasing results.

37. Click on the **Resolution** tab and note that the current setting for resolution is "Main Screen". That is, the rendering will be done at the resolution of your main monitor. If your monitor has a higher resolution than 640x480, choose **640 x 480** from the **Resolution** pop-up menu.

Rendering the image at a smaller resolution will speed processing, and since this is only a test, we don't need to render the image at the full resolution of your monitor.

38. Open the **Preview/Render...** dialog box under the Edit menu. Change the **Display Image In...** pull-down menu from Projector to ElectricImage™.

This causes the finished rendering to be displayed in the ElectricImage application instead of the Projector application.

Then save the project file again **(⌘-S).**

39. Click **Go** to launch the Camera application and begin rendering the scene.

    A dialog box opens, asking you to name and save the rendered image file (it defaults to "Tutorial 1 Image").

40. Let's use the default name, so either click **Save** or press *return*.

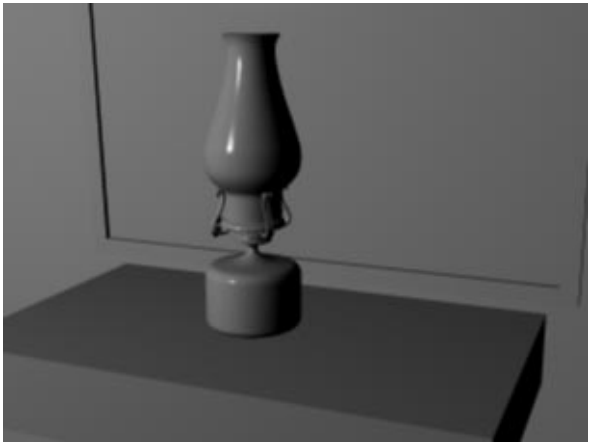
    The ElectricImage application closes and the Camera application is launched.

When the rendering has been completed, the Camera application closes and the ElectricImage application launches itself, reopening the Tutorial 1 project automatically.

41. Choose **Display...** from the File menu **(⌘-B).**

42. Find and select "Tutorial 1 Image".

    Your rendered image is displayed. It should look like the image below.



At this point in the project, the lamp, shelf, mirror and wall appear as solid, three-dimensional shapes, but they do not have any color or surface characteristics. Also, the mirror does not reflect and the glass elements are not transparent. We'll attend to these details as the tutorial proceeds.

43. When you are done looking at the image, clear it away by clicking on its close box in the upper left hand corner of the window.

Now that you've seen what the image looks like without modifying the original models, and using only the default light source, let's take a break.

In the next section of this tutorial, we'll apply surface attributes to the group components of the models, the first step in achieving a photorealistic image.

If you want, you can quit ElectricImage **(⌘-Q)** and reopen the project at another time, or continue on.

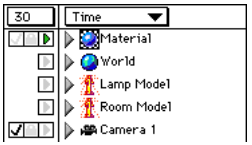
Applying Surface Attributes

Now it's time to apply surface attributes to our models (re-open the project if you had closed it at the end of the previous section).

We are going to begin by creating a Master Material for the brass parts of the lamp model. Master Materials can be shared by multiple groups. This keeps us from having to enter the data in more than once and allows the groups that share the Master Material to automatically update their characteristics when the Master Material is changed.

1. In the File menu, choose Add>Type>Material.

   A new entry for the Master Material is made at the top of the Project window.

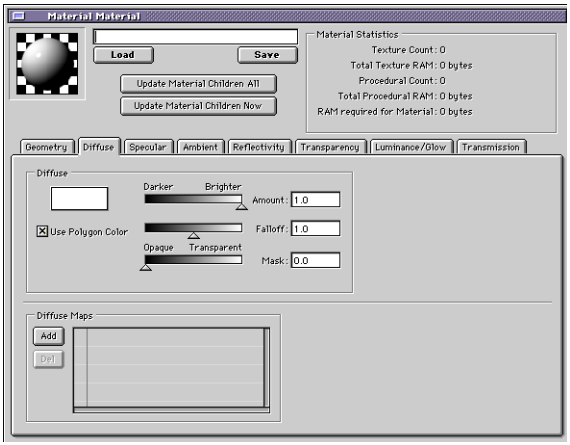


2. Double-click the Material icon to open the Material Info window.

   The Material info window opens as shown at the top of the next page.

Objects can reference a Master Material in one of two ways. The default is called, **Live Material**. When the object references a Master Material and has the **Live Material** checkbox turned on in its Group Info window, all changes to the Master are immediately reflected in the Group. If the checkbox is not on, the object does not reflect the changes until you explicitly tell it to using the **Update Material Children All** (to update the material across all keyframes) or the **Update Material Children Now** (to update the material at the current point in time only).

For this project, we will leave the brass parts set to **Live Material**.



The Material Ball, in the upper left, continually updates as you make changes to the material attributes. It allows you preview the final rendering characteristics of the surface of the model you are working on.

Empty white boxes, such as the one below the word diffuse, are color swatches. Clicking on them brings up a color picker. After you have chosen a color, the swatch will change to indicate the new color. The sliders are an interactive way of controlling attributes. You may also type exact numbers into the text edit boxes instead of using the sliders. In some cases, the numbers you enter can be outside the range of the slider.

3. First, we'll set the Diffuse Color attribute. Click on the white square under the word Diffuse to bring up the color picker.

   The color picker opens.

4. Set the Hue, Saturation, and Value as follows: H=43° S=100% V=100%. Then click **OK**.

   The diffuse swatch and the Material Ball change to an orange color.

5. Now choose the **Reflectivity** tab.

6. Click on the **Reflection Bias** box and set the Reflectivity Amount slider to 0.90.

The Reflection Bias box tints the reflection with the Diffuse color.

Alternately, we could have used the color swatch to the right of the amount to set a different reflection color.

As you can see from the change in the Material Ball, the resultant material will be reflective with a brass-like tint.

The background for the Material Ball can be changed from the checkerboard pattern to a solid black, white, or color. Hold down the option key while clicking the Material Ball. A pop-up menu opens to give you a choice of backgrounds. You can try different backgrounds, but be sure to return to the checkerboard pattern.

7. Close the Material Info window by clicking its close button in the upper left hand corner.

Now we'll create a relationship between the Master Material and the groups that will inherit its characteristics. The groups that we intend to make brass are BRASSSTUFF, KNOB, and CHIMNEYCLIPS.

8. Select these groups in the project window by holding down the shift key and clicking them one at a time.

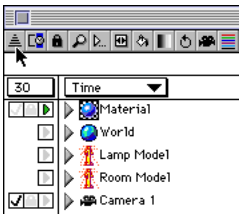
9. Choose **Link To Material** under the **Tools** menu.

   A message appears in the menu bar instructing you to select a new Master Material.

10. Click on the Material in the Project window.

    The Project window refreshes and the Camera View redraws the objects with their new material color.

Normally the Project window displays groups according to their hierarchy. You can change this using the **hierarchy** pulldown so that the Project window displays the relationship between Master Materials and groups.



11. Use the hierarchy pulldown, first button on the left at the top of the Project window, to set the Project window to display **By Material**.

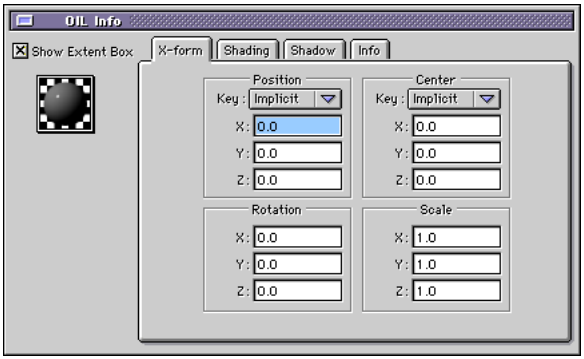
    The Project window updates to show the relationship between groups and materials. The BRASSSTUFF, KNOB, and CHIMNEYCLIP groups are shown indented under the Master Material.

12. Use the hierarchy pulldown to set the Project window back to its default setting, **Hierarchy**.

Let's move on to the oil in the base of the lamp. (The oil wasn't visible in your first rendering because it is inside the base of the lamp; after we assign transparency to the base you'll be able to see it.)

13. In the Project window, double-click on the icon for **OIL**.

The Group Info window for the Oil group opens.



The Group Info window contains controls for the objects position, its shading attributes, the way it reacts to shadows, and basic information about the number of polygons and vertices. There is also a representation of the Material Ball.

14. Click on the Material Ball in the Group Info window to bring up the Material Info window for the OIL group.

The Material Info window for the OIL group opens.

15. Set the group's Diffuse color to: H=0° S=0% V=0%

These settings, by reducing the diffuse level down to zero, will eliminate scattered light from the surface of the oil, helping to keep it transparent.

16. Click on the **Specular** tab.

The Specular attribute controls the size and color of highlights that might appear on the object's surface (depending on its position relative to a light source). The quality of the highlight can affect the apparent texture of the object, ranging from hard and shiny to soft and dull.

17. Set the value of the specular color, using the specular color swatch, to:
H=0° S=0% V=72%

This will reduce the brightness of the OIL's highlights.

18. Change the value in the **Size** slider to 99.

This setting will slightly increase the size of the OIL's highlights (spreading them out).

19. Click on the **Transparency** tab.

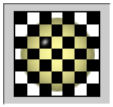
20. Click on the **Color Filter** button.

21. Click on the **Use Custom Color** button.

22. Click on the Custom Color swatch and set the colors as follows in the color picker:
H=58° S=32% V=70%

23. Slide the **Transparent/Opaque** slider full to the left (full transparency).

The resultant Material Ball, shown below, indicates an object that is subtractively transparent tinted to a dull yellow color.



Next, we'll adjust the Edge Characteristic of the model.

The Edge Characteristic attribute is used to enhance the appearance of a rounded transparent object by increasing the apparent opacity of the object as seen through its edges.

24. Switch the Edge mode from **Normal** (no edge density at all) to **Opaque**.

    This makes the object somewhat opaque at the edges tending toward full transparency in the middle.

25. Set the Edge Characteristic Amount to 0.5.

26. Set the Edge Characteristic Falloff to 1.0.

    Notice that the Material Ball now appears slightly darker (less transparent at the edges).

27. Close the Material Editor.

Now we'll set the set the material characteristics for the glass elements of the lamp, starting with the base.

28. In the Project window, double-click on the icon for **GLASSBASE**.

29. Open the Material Editor for the group.

30. Set the group's diffuse color to: H=237° S=9% V=97%

    This will give the glass a slightly off-white color

31. Click on the **Reflection** tab and set the **Reflectivity** amount to 0.0.

32. Turn on the **Reflection Bias** box.

33. Click on the **Transparency** tab.

34. Set the **Transparency** amount to 0.0.

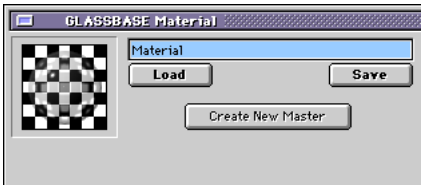
35. Click on **Color Filter** and make sure **Use Surface Color** is checked.

36. Set the **Edge Characteristic** mode to **Opaque**.

37. Set the **Edge Characteristic Amount** to 1.0

38. Set the **Edge Characteristic Falloff** to 0.1.

    The resultant Material Ball, shown below, indicates a transparent and reflective object that is slightly off white.



Now we will save this material to an external file so that we may easily apply it to the other glass object in the scene.

39. Highlight the material naming box, as shown above.

40. Type in "Glass Material" and click the **Save** button.

    The material is saved to disk in the EI Materials folder.

41. Close the Material Info window.

42. Open up the Material Info window for the GLASSCHIMNEY group.

You can open the Material Info window without going through the Group Info window by holding down the Command key and clicking on the group in the Project window, View windows, or Camera View window.

43. Click the **Load** button below the material naming box.

    A dialog box opens showing you the list of materials in the EI Materials folder.

44. Select the Glass Material and click **Open** or hit *return*.

    The Material Ball takes on the characteristics of the Glass Material.

45. Close the Material Info window for the GLASSCHIMNEY.

Note: We could have accomplished the same effect by using copy and paste. The Material Ball in the Material Info window can be selected and its attributes copied into the scrapbook by using Copy under the File menu (⌘-C). The material may then be pasted by selected the Material Ball in the other group and using Paste under the File menu (⌘-V).

Next we'll set the material attributes for the lamp's wick.

46. Open the Material Info window for the **WICK** group.

47. Click on the **Diffuse** tab and set the diffuse color to: H=0° S=0% V=100%.

48. Click on the **Specular** tab and set the Amount to 0.0.

    Because we want the wick to appear soft and dull, we use this settings to eliminate any highlights from appearing on the group when the lighting is set up.

Notice how the Material Ball changes to show a white group with no highlight.

49. Close the Material Info window.

Let's turn our attention now to the Room Model, beginning with the WALLS group.

50. Open the Material Info window for the **WALLS** group.

51. Click on the **Diffuse** tab and set the diffuse color to: H=45° S=19% V=100%

52. Click on the **Specular** tab and set the Amount to 0.0.

    This will eliminate any highlights from appearing on the group when the lighting is set up.

53. Close the Material Info window.

Next, let's do the shelf.

54. Open the Material Info window for the **SHELF** group.

We'll use the default diffuse color for the shelf because we're going to apply a texture map to it (in the next section of this tutorial), which will override the diffuse color. We will, however, need to assign a specular highlight value.

55. Click on the **Specular** tab and set the Amount to 0.0.

56. Close the Material Info window.

Next, let's do the glass of the mirror.

57. Open the Material Info window for the **MIRROR_GLASS** group.

58. Click on the **Diffuse** tab and set the diffuse color to: H=0° S=0% V=0%

59. Click on the **Specular** tab and set the Amount to 0.0.

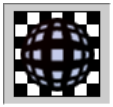
    The Material Ball appears black because we have eliminated the amount of light that will be scattered from the glass. If we were to use a bright diffuse color, the image in the mirror would be washed out.

60. Click on the **Reflectivity** tab.

61. Set the Reflectivity Amount to 0.96

62. Set the Reflectivity color (the swatch next to the amount) to: H=223° S=18% V=95%

    The resultant Material Ball shows an object that reflects with a slightly blue tint.



63. Close the Material Info window.

The last group to apply surface attributes to is the mirror's frame. For this group, you have free reign to apply surface attributes as you please (go for it).

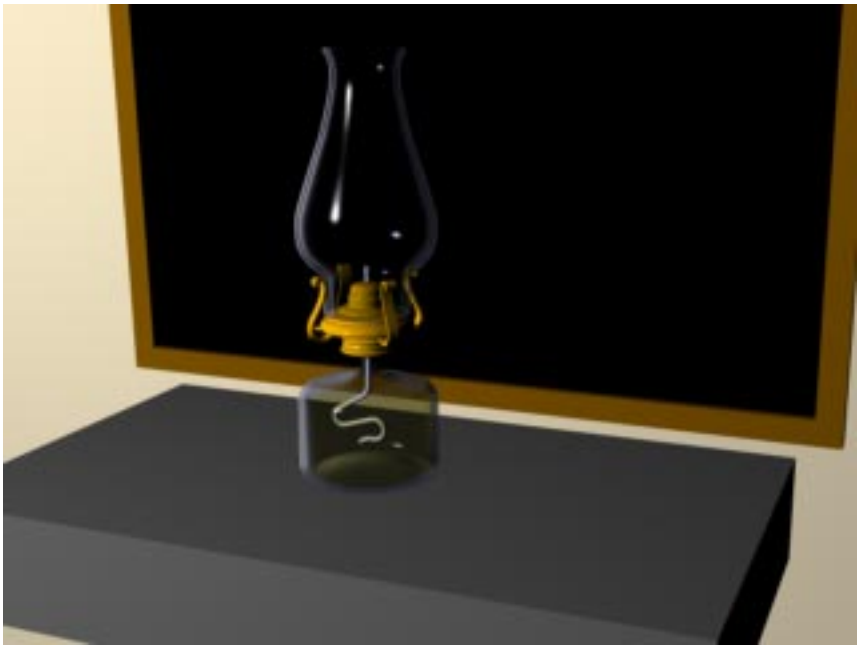
64. Open the Material Info window for the **MIRROR_FRAME** group.

64. Apply surface attributes as you see fit.

65. Close the Material Info window.

66. Save the project file (⌘-S).

Now lets render the image again following Steps 34-43 beginning on page 14.



We can now see color and transparency (though it is difficult to discern the lamp's glass chimney against the blackness of the mirror's surface, which still doesn't reflect anything). We need to add textures and reflections to the groups (that's coming next).

67. When you are done looking at the image, close it.

Applying Textures and Reflections

Now it's time to apply textures and reflections to our models (re-open the project if you had closed it at the end of the previous section).

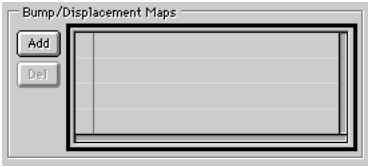
We'll begin with the walls of the room and will apply a map to the bump/diffuse material channel.

1. Open the Material Info window for the **WALLS** group.

2. Click on the **Geometry** tab.

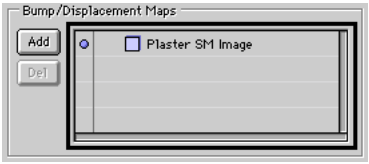
3. Click on the **Add** button next to the Bump/Displacement list (as shown below).

   A directory dialog box opens and you are asked to select the texture map.



4. Open the Textures Folder with the Tutorial 1 folder and add the texture named, "Plaster SM Image". Either double-click on it or single-click on it and click **Add**.

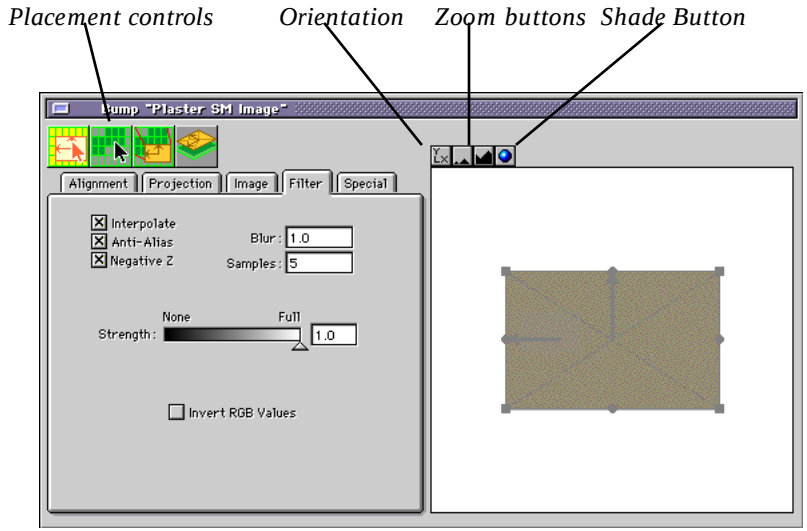
   The texture is loaded into the texture map list as shown below.



The blue circle to the left of the texture entry can be used to temporarily turn off the texture. Clicking the circle toggles the texture on and off. The flat square next to texture indicates that this map has been applied as a “flat map”. More on this a little later.

5. Double-click on the “Plaster SM Image” texture map to open the Texture Info window.

The texture window opens as shown below.



The window has two halves. The left half allows you to change the way the map is applied to the object. The right half displays the object and a series of symbols that depict the map’s projection.

The Orientation button switches the view of the display window. Your choices, Top, Front, Side, and Orbit, can be used to give a better view on the model as you are placing the map projection. While in the Orbit mode, you can hold the Command-Space key and interactively spin the object.

The Zoom buttons allow you to resize the object to fit the view or to zoom in to a particularly important part of the object.

The Shade buttons forces immediate shading. Holding the Option key down while selecting it brings up a pop-up menu that allows you to control whether vertices and edges are drawn and whether or not the object is always shown shaded.

The Orientation buttons allow you to interactively drag the map projection, to select a series of polygons on the object, to fit the texture map to the selected polygons, and to place the texture map normal, perpendicular, to the polygon you click on in the display window.

You can resize the Texture Info window by dragging in the lower right corner.

6. Click on the **Projection** tab.

7. Switch the **Map Type** from **Flat** to **Cubic**.

Textures can be mapped in a flat, cubic, spherical, or cylindrical projection. Because the shape of the WALLS group is closet to that of a cube, using a cubic mapping projection will provide the most pleasing result.

When a texture is mapped to a group, it is scaled to fit the entire group. This may cause unwanted distortions or a loss of resolution in the texture when it is blow up to fit, so we can scale the texture down in size and make it repeat in small sections or "tiles".

8. Notice that the bottom portion of the **Projection** tab window contains edit boxes for the X, Y, and Z scale of the texture. Type these new values in these edit boxes:
X= 0.003 Y=0.003 Z=0.003.

9. Switch the **Tiling** pulldown for both X and Y to **Repeat**.

Mirroring, the default, would cause the texture to map into a patter of adjacent tiles that are mirror images of each other. This would create a noticeable pattern on the walls.

10. Click on the **Special** tab.

The Special tab contains controls for Bump and Displacement strengths. There will also be controls to access the parameters of procedural shaders if you had applied one.

Bump actually changes the normals of the polygons to simulate the shading of an uneven surface. This works well except at the edges of a model where it becomes obvious, through the silhouette, that the geometry really isn't bumpy at all.

Displacement fixes the problem at the edges of the model. Unlike bump mapping, it actually moves the geometry. Therefore, at the edges the geometry appears bumpy because it truly is!

For this project the default Bump Factor of 1.0 and Displacement of 0.0 (meaning no displacement at all) is sufficient.

11. Close the Texture Info window and the Material Info window.

Now let's apply both a diffuse and bump/displacement texture to the shelf.

12. Open the Material Info window for the **SHELF** group.

13. Add the texture called, "Sandstone SM Image" to the Diffuse.

14. Click on the **Projection** tab.

15. Set the **Map Type** to **Cubic**.

16. Click on the **Alignment** tab.

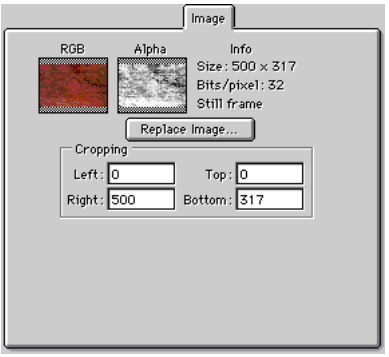
17. Switch the alignment to **Top**.

Textures can be mapped to any position or rotation you desire. The Alignment buttons on the left side of the alignment tab are a convenient series of predetermined map orientations. In this case, we want the texture to be mapped onto the top of the shelf rather than its midpoint.

18. Click on the **Image** tab.

The Image tab displays the RGB and Alpha images. It also has a Replace Image... button that allows you to replace a map without losing any of the setting contained in the Texture Info window.

Note this map has an RGB image of stone and a separate Alpha map that can be used to simulate the stones bumpiness.



19. Click on the **Filter** Tab.

20. Switch the **Use Channel** pull-down menu to Alpha.

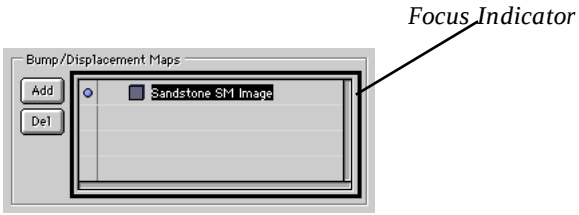
    Since we are planning to use the alpha channel for the bump map, we don't need the RGB channel here. We will use the RGB in the next few steps in the diffuse channel of this group.

The Filter tab also contains the Strength slider. This slider controls how much each individual texture map expresses itself on the object. You can add as many maps as you wish to each channel. Giving them varying strengths allows you to create complicated blends of maps. This can yield very sophisticated materials.

21. Close the Texture Info window.

22. In the Material Info window for the **SHELF** group, highlight the Bump/Displacement texture, "Sandstone SM Image" by clicking on it in the list box.

The texture entry is highlighted and the focus for copying and pasting is switched to the Bump/Displacement list box. This is indicated by the dark outline around the box as shown below.



23. Choose **Copy Map Type Bump** under the File menu (⌘-C).

This copies the texture entry into the temporary Scrap.

24. Click on the **Diffuse** tab.

25. Switch the copy focus to the Diffuse Maps list by clicking in the middle of the list box.

A dark outline appears around the Diffuse Maps list box.

26. Choose **Paste Texture** under The File menu (⌘-V).

The texture map, "Sandstone SM Image", is pasted into the Diffuse Map List box.

The copied map has all of the qualities of the original. We now need to set the filter for the map so the RGB channel is used instead of just the Alpha.

27. Open up the Texture Info window by double-clicking on the **Sandstone SM Image** entry in the Diffuse Maps list box.

28. Click on the **Filter** tab.

29. Switch the **Use Channel** pull-down menu to **RGB Only**.

30. Close the Texture Info window and the Material Info window for the **SHELF** group.

Now we'll paste the bump map onto the glass parts of the lamp. A slight bumpiness will lend more interest to the lamp when it is rendered.

31. Open the Material Info window for the **GLASSBASE** group.

32. Switch to the **Geometry** Tab.

33. Switch the copy focus to the Bump/Displacement maps list by clicking in the middle of the list box.
A dark outline appears around the Bump/Displacement Maps list box.

34. Choose **Paste Texture** under the File menu (⌘-V).
The texture map, "Sandstone SM Image", is pasted into the Diffuse Map List box.

35. Open the Texture Info window for the map you have just pasted by double-clicking on its entry in the Bump/Diffuse Maps list.

36. Switch to the **Projection** tab.

37. Change the **Map Type** to **Cylindrical**.

As shown below the cylindrical mapping type best approximates the shape of the **GLASSBASE** model.

38. Switch to the **Special** tab.

39. Change the **Bump Factor** to 0.5

We want the bumps to be very subtle on the glass parts so we set the Bump Factor to a lower amount.

40. Close the Texture Info window.

41. Close the Material Info window for the **GLASSBASE** group.

42. Open the Material Info window for the **GLASSCHIMNEY** group.

43. Switch the copy focus to the Bump/Displacement maps list by clicking in the middle of the list box.

44. Choose **Paste Texture** under the File menu (⌘-V).

The texture map, "Sandstone SM Image", is pasted into the Diffuse Map List box.

45. Open the Texture Info window for the map you have just pasted by double-clicking on its entry in the Bump/Diffuse Maps list.

46. Switch to the **Projection** tab.

47. Change the **Map Type** to **Cylindrical**.

40. Close the Texture Info window.

41. Close the Material Info window for the **GLASSCHIMNEY** group.

Creating Reflections

Applying textures is only part of the process to create photorealistic images. The surface of objects reflect light and the images of other objects, so we need to apply images to some of the groups as reflection maps. There are four ways to apply reflections to objects:

- Apply an image as a reflection
- Apply an image in the Global Reflection List as a reflection
- Apply automatic mirror mapping (for flat objects)
- Apply automatic environment mapping (for multi-sided objects)

First let's see how to apply and image as a reflection (in this case to the GLASSBASE group).

42. Open the Material Info window for the **GLASSBASE** group.

43. Switch to the **Reflectivity** tab.

This **Reflectivity** tab is divided up into two sections. On the left is **Reflectivity**. This controls how much the group reflects. One the right, is **Reflection**. This control what the group reflects.

Earlier in this tutorial, we gave this group a reflectivity level of 50% (Reflectivity Amount of 0.5). Now we will give it a reflection map. The map will control what is actually reflected.

44. Click on the **Add** button for the Reflection Maps list box.

    A directory dialog box opens for you to select a texture.

45. Find the map, "Weird Hi-Con" and add it.

    The texture is loaded in and appears in the Reflection Maps list box.

Now we'll copy this map into the scrap and paste it into the Master Material for the brass parts of the lamp.

46. Highlight the map entry for "Weird Hi-Con" in the Reflection Maps list box.

47. Choose **Copy Map Type Reflection** under the File menu (⌘-C).

48. Close the Material Info window for the **GLASSBASE** group.

49. In the Project window double-click on the Master Material, **Material.**

    The Material Info window for the Master Material opens.

50. Switch to the **Reflectivity** tab (if it isn't already forward).

51. Set the copy focus to the Reflection Maps list box.

52. Choose **Paste Texture** under the File menu (⌘-V).

    The Master Material and all the groups that reference it take on the added reflection map.

53. Click on the button **Use Bitmap Reflection (see list below).**

54. Close the Material Info window for the Master Material.

Our next task is to put an automatic mirror reflection on the mirror that hangs on the wall in our scene.

55. Open the Material Info window for the **MIRROR_GLASS** group.

56. Switch to the **Reflectivity** tab.

57. Click on the **Mirror** button under the **Environment Reflection** section.

    The Use Environment Reflection button turns on automatically.

58. Close the Material Info window for the **MIRROR_GLASS** group.

Finally, let's apply automatic environment mapping to the lamp's glass chimney.

59. Open the Material Info window for the **GLASSCHIMNEY** group.

60. Switch to the **Reflectivity** tab.

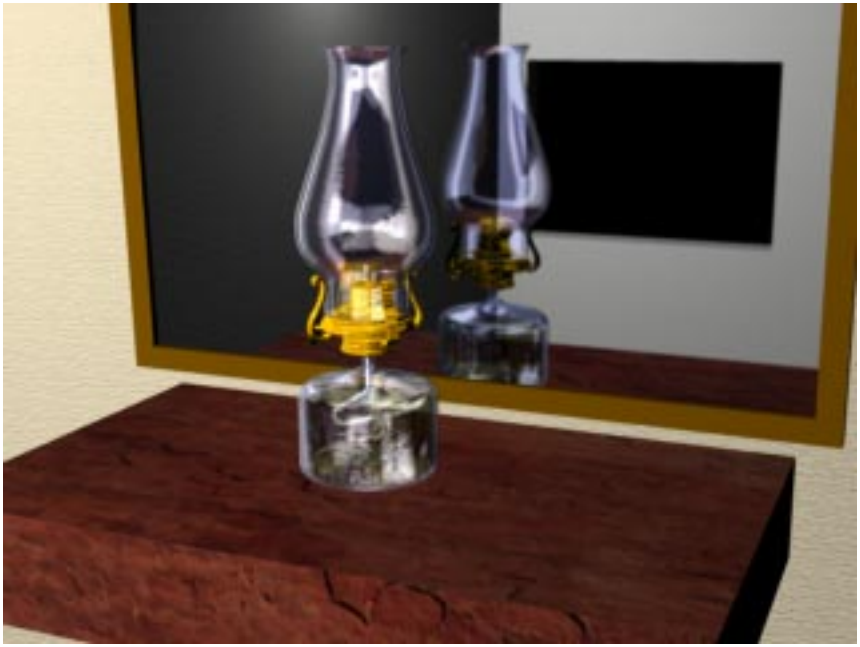
61. Click on the **Environment** button under the **Environment Reflection** section.

The Use Environment Reflection button turns on automatically.

Now that we have applied textures and reflections to our models, let's save the project and render it again to see how things look.

62. Save the project file (⌘-S).

63. Render the image again following Steps 34-43 beginning on page 14.



It took quite a bit longer to render the image this time. Since we have added a mirror map (1 rendering) and an environment map (6 renderings), there are now a total of 8 rendering passes required to make this image (the 8th is done when the other seven are combined with all the groups to form the final rendering).

64. When you are done looking at the image, close it.

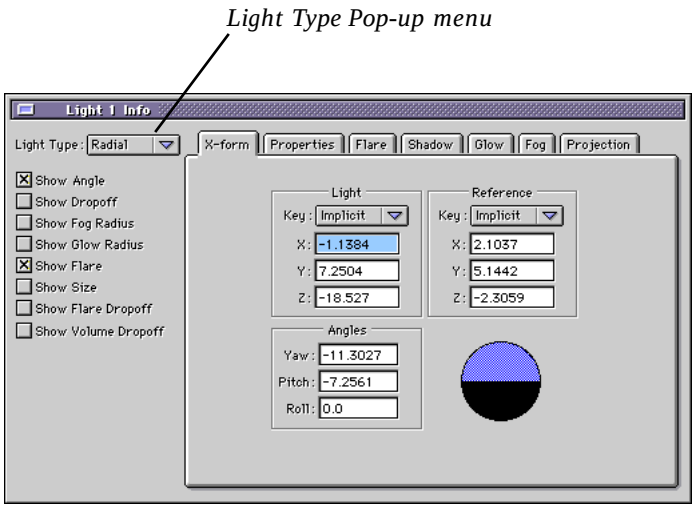
Lighting the Scene

Now it's time to create the lighting effects for the final image, the last step in making it photorealistic (re-open the project if you had closed it at the end of the previous section).

We'll begin by using our existing light source (**Light 1**) and changing its position and characteristics.

1. In the Project window, double-click on the icon for **Light 1** — or single-click to select it and then choose **Light Info** from the File menu (⌘-I).

The Light Info window for Light 1 opens.



Notice the **Light Type** pop-up menu in the upper left corner of the window. This is where we set the kind of light source (such as Radial, Parallel, Spot, etc.). Since the lamp in our scene is a light source that radiates in all directions, it is appropriate to use the default light type, **Radial**.

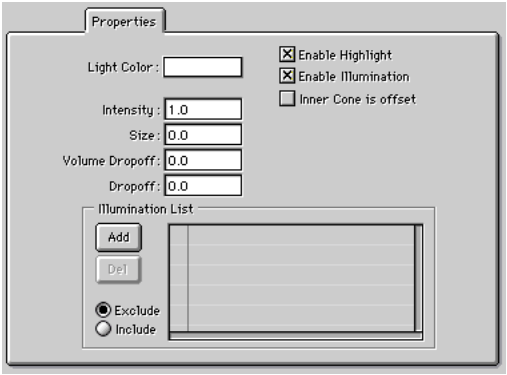
Let's set the light's position, color, shadow characteristics, and dropoff distance.

2. Make sure the **X-form** tab is forward and type the following into the X, Y, and Z position coordinates for the light: X=1.065 Y=5.7 Z=0.19

The light is now positioned at the top of the wick inside the lamp's glass chimney.

3. Click on the **Properties** tab to bring it forward.

In addition to the light color, size (used only by lens flares), and intensity, the Properties tab includes the Illumination List. This project won't use this extremely useful feature, but we suggest you review its capabilities in the ElectricImage Reference Manual.



4. Click on the **Light Color** swatch to open the color picker.

5. Set the light's color to: H=36° S=27% V=100%

The color swatch updates in the Light Info window indicating the new color.

6. Set the **Dropoff** to 7.0.

Dropoff refers to the distance from the light at which the light's illumination ends. The area beyond the dropoff distance will not be affected by the light. The Dropoff value is in scene units. You can view the scene units by using the Show Rulers command under the Windows menu (⌘-M).

Intensity, which defaults to 1.0, refers to the brightness of the light. It is especially important as a control when using multiple lights in a scene to avoid "over lighting" (over exposing) the scene.

Now we'll set up the light's shadow casting qualities.

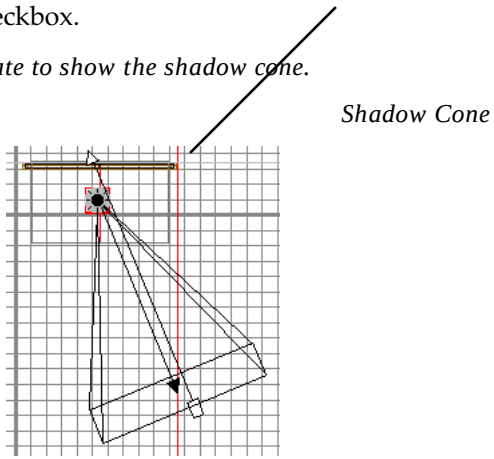
Lights do not automatically cast shadows in ElectricImage. You must enable shadows for each light. (By default, every group is set to cast and receive shadows, and you can disable shadow casting on a group level).

7. Click on the **Shadow** tab to bring it forward.

8. Click the **Enable Shadow** checkbox.

The world view windows update to show the shadow cone.

Shadow Cone



Even though the Radial light source radiates in all directions, you can control the angle of coverage for its shadow casting ability. This control is called **Shadow Cone** and we'll set it next.

9. Click on the **Properties** tab to bring it forward.

10. Set the **Shadow Cone** to 140.0 degrees.

Since the cone has a reference vector (that is, it points in a certain direction), we'll set that direction next.

11. Click on the **X-Form** tab to bring it forward.

12. Type the following X, Y, and Z coordinates into the **Reference** section of the window: X=1.065 Y=6.0 Z=1.5

The reference vector for the shadow cone swings around to point at the mirror.

Now we need to go back to the **GLASSCHIMNEY** group and make sure it doesn't cast shadows into the scene. This is necessary because shadows don't penetrate any objects, even transparent ones. Since **Light 1** is completely inside the chimney, the shadows, and hence, the light won't go beyond its boundaries unless we turn off shadow casting.

13. Open the Group Info window for **GLASSCHIMNEY** by double-clicking on it in the Project window (go ahead and leave the Light Info window open in the background).

14. Click on the **Shadows** tab to bring it forward.

15. Turn off the **Cast Shadows** checkbox.

16. Close the Group Info window for **GLASSCHIMNEY.**

Creating a Glow Effect

Up to this point, the settings for the light will only affect what the light illuminates, not how the light itself will look as a visible object. By default, lights in ElectricImage are not visible. To make the light visible, We'll enable the Glow effect.

17. In the Light Info window for **Light 1**, click on the **Glow** tab to bring it forward.

18. Click the **Enable Glow** check box.

A glowing light can be any color, and its color can modulate from the center of the light (the inside color) to its edges (the outside color). For this light, we want the outside of the glow to be white (the default) and the inside to be a pale yellow.

19. Click on the **Inside Color** swatch to open the color picker.

20. Use the color picker controls to set the inside glow to a pale yellow.

21. Set the **Inner Radius** and **Outer Radius** as follows:
Inner Radius=0.035 Outer Radius=0.045

The Inner and Outer Radii control the size and appearance of the glow. Within the Inner Radius the glow is opaque; at the Outer Radius it becomes clear (invisible). The rate of dropoff in opacity from the Inner to the Outer Radius is controlled by the Factor. The higher the Factor, the more abruptly the opacity falls off to transparency.

22. Close the Light Info window for **Light 1**.

Adding a Light for the Mirror

Our lamp light is now set. There's one more thing to consider, however — the mirror. In reality, the light from the lamp would not only illuminate the room directly, it would bounce off the mirror. To simulate this additional illumination, we need to add another light.

There are a number of ways to add lights to the project, including the Add Light command in the File menu and the Add a Light tool in the Object Palette. What we'll do here is add another light by duplicating our existing light.

23. With **Light 1** still selected in the Project window, choose **Duplicate** from the Edit menu (⌘-D).

    The new light appears in the Project window, with the same name as the original and already selected.

24. Click on the name of the new light in the edit area of the Project window as shown below.

25. Replace the name with "Light 2" and press return.

    The new light is renamed in the Project window.

Now we'll configure this second light to be a spot light.

26. Open the Light Info window for **Light 2**.

27. Choose **Spot** from the **Light Type** pop-up menu.

    This setting simulates a directional, limited area light source that places a pool of light over a specified area.

Because we created this light by duplicating our other light, it has the same attributes, including the glow effect. We don't what this light to be visible, however, so we need to diable the glow effect.

28. Click on the **Glow** tab to bring it forward.

29. Turn off the **Enable Glow** checkbox.

30. Click on the **X-Form** tab to bring it forward.

31. Set the light's position to: X=1.065 Y=5.8 Z=.62

    This moves Light 2 directly forward of Light 1 and places it against the face of the mirror.

32. Set the light's **Reference** to X=1.06 Y=5.7 Z=-1.5

    This points the spotlight away from the mirror into the main part of the room.

32. Click on the **Properties** tab to bring it forward.

33. Set the **Outer Cone** to 150 degrees.

34. Set the **Inner Cone** to 130 degrees

35. Set the **Dropoff** to 2.0.

36. Set the light's **Intensity** to 0.75.
We lowered the intensity to make sure the light that seems to be reflected from the mirror is 25% dimmer than the light coming directly from the lamp.

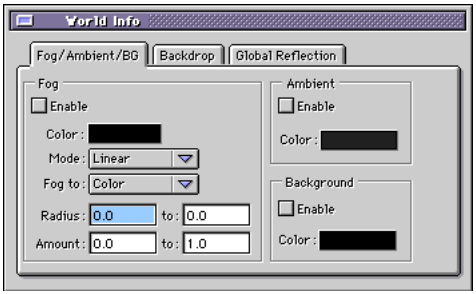
The inner and outer cones control the angle of coverage for the light. Within the angle of the inner cone, the spot provides full illumination; at the outer cone, the illumination drops off. The rate of dropoff is controlled by the Factor setting.

37. Close the Light Info window.

Changing the Background Color

The last thing we need to do is change the color of the background. When you last rendered the image, you could see a black background through a window reflected in the mirror (Page 41). To heighten the realism of the image, let's change the background color to a dark blue (to simulate a night sky).

38. Open the World Info window by double-clicking on the **World** icon in the Project window.



39. Click on the **Background** color swatch and set its color to: H=240° S=100% V=12%.

    The color swatch updates to show the new color and the Enable button automatically turns on.

40. Save the project file **(⌘-S).**

41. Now lets render the image again following Steps 34-43 beginning on page 14.