Ray-tracing is used to produce mirrored and reflective surfaces. It is also being used to create transparency and refraction (bending of images through transparent surfaces—like a magnifying glass or a lens). With ray-tracing, all Blender lights can cast shadows if you desire. Ray tracing can produce some stunning effect, but can come at a high cost in rendering times. Use it only where needed. Don’t try to ray-trace everything. The professionals don’t even do that. Watch any 3D show on T.V. and you will see it being used selectively. You can get some great shadow and texture effects with Blender’s traditional spotlights and material settings at a fraction of the render times.

To get ray-tracing to work, you need to go to the Render settings and turn on “Ray Tracing” in the Shading panel (see previous chapter). Now you are ready to apply some of the ray-tracing features to your objects. Until you do that you won’t see any difference in your renders.

**Lighting and Shadows**

To get a ray shadow for a lamp, select the lamp you want to cast shadows (all types work with ray-tracing), go to the Lamp settings, find the “Ray Shadow” button and activate it.

When you activate ray shadow, you will see a few setting for most of the lamp types. You will see “Soft Size” settings for edge softness and “Samples” for improved quality.

You will also see two options called “Adaptive QMC” and “Constant QMC”. These are just ways to generate the shadows with Adaptive being quicker while Constant can give better quality, but slower renders.

You will notice a few extra setting options for a ray spotlight. Spotlight Size, Spotlight Blend, and Halo Intensity work the same as they do for a buffer shadow spotlight.

Notice the shadows above. The left image was rendered with Samples at 1 and Soft at 0. The right image was 10 and 1.
Reflection (mirror) and Refraction (transparency)

To create a mirror, or reflective surface on an object, select that object and add a material. You can also add textures to an object and have a mirror surface. In the Material buttons, you will find a panel called “Mirror”. All of the ray-mirror features are found in that panel. Check the “Mirror” button and experiment with the reflection settings. The **Reflect** slider controls the amount of mirror. A full slider would be a perfect mirror.

For **Transparency**, press the “Transparency” button to activate it. Two main adjustments are **IOR** (Index of Refraction) is used to create the Lens effect and bends light. **Fresnel** is used to control the amount of transparency. There are some other setting that you may feel free to experiment with, but these are the main settings.

**Alpha**: This transparency setting can also be used with Ray Transparent.

**IOR**: (Index of Refraction) Controls the amount of distortion.

**Depth**: If you cannot see through the object properly, Depth needs to be set higher.

**Reflect**: Controls the amount of mirror. Full reflect will give you the effect of a real mirror or chrome.

**Distance and Fade**: Controls how much is actually reflected and what it should fade to when it reaches that maximum distance. 0 means no limit.

The image to the left uses a small amount of ray mirror on the floor and a high ray mirror reflection on the back monkey head to simulate chrome. The front monkey head and sphere are using a high fresnel and IOR setting to simulate glass and distortion.
Since we don't have many objects that would work well with mirror/transparency in our lighthouse scene (except the water, which would create a slow rendering), we will create a new scene for our ray-tracing exercise. Since we have experience using the Extrude command from our lighthouse modeling, let's use it to make a drinking glass. Start a new scene and erase the Cube. Next, add a Circle mesh in the Top view and check the "Fill" option in the Tool Shelf.

Now switch to a Front view, switch to Edit mode and Wireframe shading. Begin Extruding ("E" key) to shape a simple drinking glass. As you extrude upward, scale the top out a bit to show taper. When you reach the top, extrude back down inside the glass to show wall thickness. When you finish, go back to Object mode, Solid shading, and hit "Smooth" in the Tool Shelf.

It's now time to add a Plane for the glass to rest on. For fun, let's also add a monkey head to the scene. Set the monkey head Smooth from the Tool Shelf, then go to the Modifiers panel and add a Subdivision Surface modifier to shape up the monkey. Sub-Surf adds imaginary rows of vertices to an object in order to improve image quality. Adjust your lights and camera angle to get a scene something like the one shown below:

Now that we have our basic scene, it's time to add materials and texture to our objects. Add an appropriate texture to the floor of your choice and give it a small amount of Ray Mirror as discussed on the previous pages. Also, add a material to the monkey head and take Ray Mirror up to simulate chrome.
You should now have a scene that looks something like this. You may notice the tile floor I used looks like it has depth to it. In the Texture settings, I applied a "Normal" map to it, like we did with the water in our lighthouse scene. If you need help, refer back to the chapter on materials and textures.

It's now time to place a material on the glass. For the glass, you will want to apply Ray Transparency (fresnel) and a small amount of IOR for refraction. When you render the scene, you will probably notice that you can't see through the entire glass and will look dark. Take the Depth setting up to 5 in the Transparency panel. This will correct the problem. You may also want to apply a Stucci texture to the glass to show waviness. Try taking the Size down to 0.15 and add some Normal as well. You will need to get rid of the pink color. Try setting it to white. Experiment with your setting until you are pleased with the results.

When finished, render your results and save it as a JPEG image.

**Call the instructor when finished**