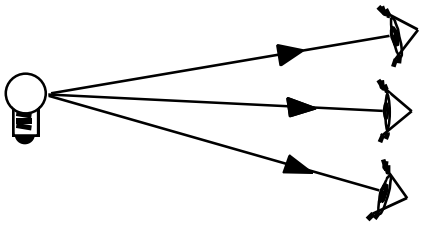
Particle Model of Light Reading 1:
The Nature of Light and Seeing

In order to see something, light must enter your eye. A laser battle in a dark room would be completely black unless the laser light hit you in the eye. A laser beam is only seen when the light bounces from particles in the air to your eye. You can show this with a laser or flashlight by placing smoke or dust in the beam so that the light can scatter off the particles and back to your eye. In the vacuum of space there are no scattering particles, so how do you see laser blasts in movies like Star Wars? These are special effects, not reality. In the original Star Wars movies, they actually painted the red marks directly on the film after the scenes had been shot. A real laser battle in space would be much less exciting.

In order to see an object, light from every point on that object must enter your eye, and there must be enough light to cause an electrochemical reaction on the retina in back of your eye. As you look at the night sky, there are countless distant galaxies sending light to your eye, yet you cannot see them because not enough light enters your eye for your retina to respond.

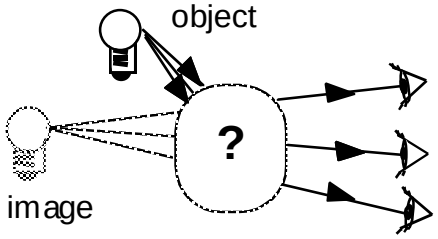
In general, an object is seen at the point from which light rays diverge. (fig. 1) Our brains have been trained by experience to believe that the light has traveled from the object to the eye in a straight line. In order to grab the light bulb, we reach in the direction that the light came from. Viewing the object from two slightly different directions allows us to determine the distance to the object, because the intersection of the light rays occurs only at their source.

fig. 1



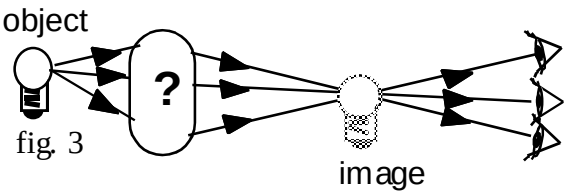
In the second case, (fig. 2) an unknown something such as a mirror, a lens, or a bottle of water, bent the diverging rays from the object and redirected them to the observer. The brain does not perceive the fact that the light changed direction while traveling from the object to the eye. The "sees" the object directly ahead. The apparent lamp is called an image, and because there is actually no light actually coming from that place, it is called a **virtual image**.

fig. 2



In the third case, (fig. 3) an unknown something bends the rays so that they converge and then diverge from a point in space between your eye and the bending object. The observer, using the same rules to locate things as before, will see an image of the lamp much closer. There is no actual lamp at that location, so this is again an image. Since light actually does diverge from the image point, the observer sees a **real image**.

fig. 3



In the previous example, the observer has to be in the cone of rays diverging from the image point in order to see the real image. If a screen is placed at the image point, (fig. 4) rays will be scattered in all directions so that many observers can see the same image. An example of a device that creates a real image is the movie projector in a theater.

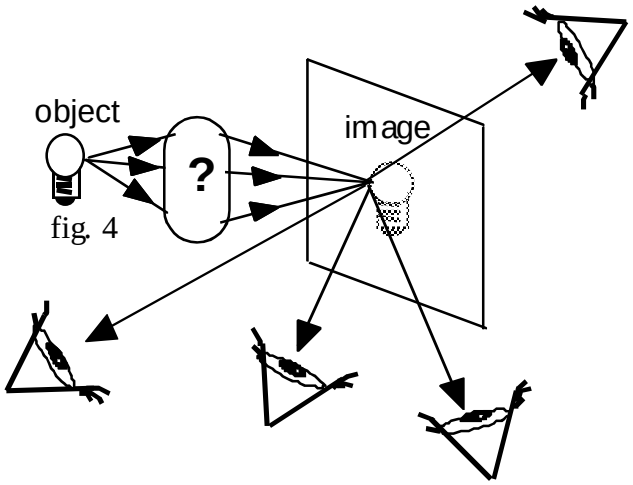
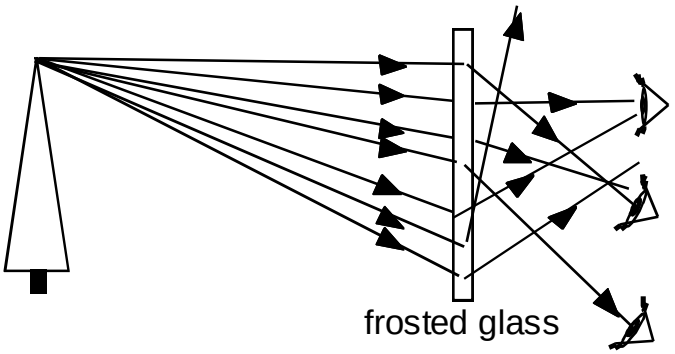


fig. 4

If something is placed in front of the object that scatters the light, such as a frosted glass, your eye will detect the light, but it will not see an image. The light from one point on the object reaches your eye from many directions, and in order to form an image, the light from one point on the object would have to appear to come from one place. In addition, light from all other points on the object will also reach your eye in a random fashion.



When we see most objects, we see them by reflected light. Light originates from the sun or a light bulb and then bounces off the object and into our eye. A more complete picture of what is happening would include the original source of light.