

Understanding the Optics of the Eye using a Light Sensor and Plastic Bottles



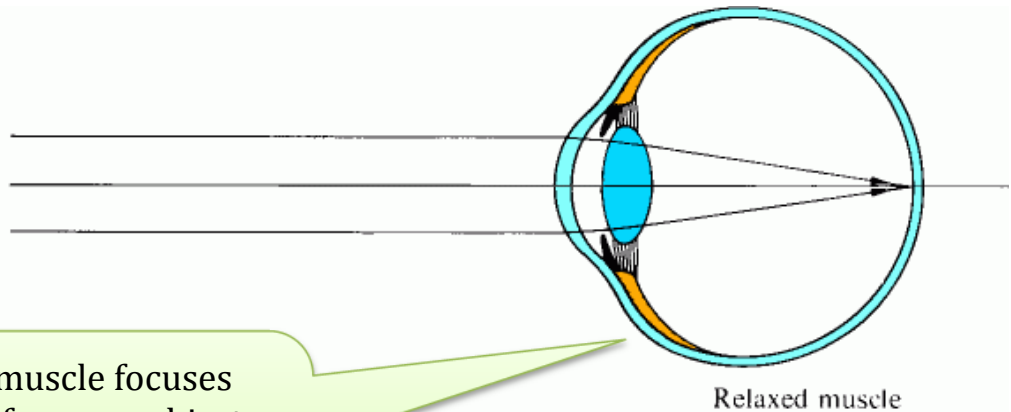
What you will need:

- Scratch sensor board with a light sensor.
- A few plastic bottles with different elliptical/convex shapes (minimum of 3)
- Ruler
- Flashlight/torch/LED light on a mobile phone.

Safety: Please note that you use these resources at your own risk. Correct use of some components requires care.

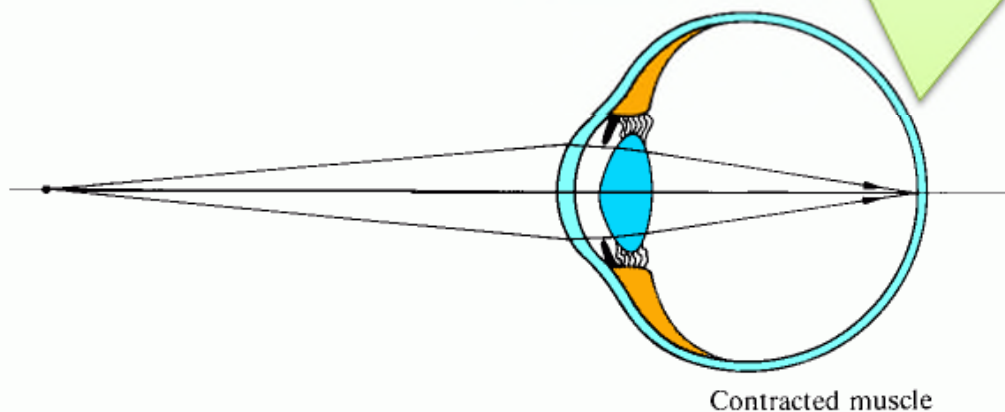
A Simple Model of the Eye

The eye can be simplistically modelled as a lens that focuses the image of an object onto the retina, as is shown below.



A relaxed eye muscle focuses the image of a far away object, such that the light rays incident on the eye are approximately parallel.

A contracted eye muscle focuses the image of an object much closer to eye, such that the rays incident on the eye are initially divergent. In order to focus these divergent rays, the muscle surrounding the lens contracts resulting in an increased curvature of the lens.



Figures adapted from www.lhup.edu/~dsimanek/scenario/miscon
[accessed 29/07/14]

The Idea

The idea is to use a set of lenses/plastic bottles to model the eye in order to understand how far sightedness is rectified using glasses. Far sightedness is caused by the muscle in the eye not being able to contract the lens enough for it to focus on objects a short distance away e.g. reading text in a book.

This system can be constructed by using two plastic bottles, one representing the lens of the eye and the other the glasses/contact lenses, and a light sensor to represent the retina of the eye. When light rays are focused, the intensity of light incident on the sensor will be a maximum and hence so will the readout from the sensor.

The task is to find the correct lens to focus the rays onto the sensor for a given configuration.

Connect the Sensor

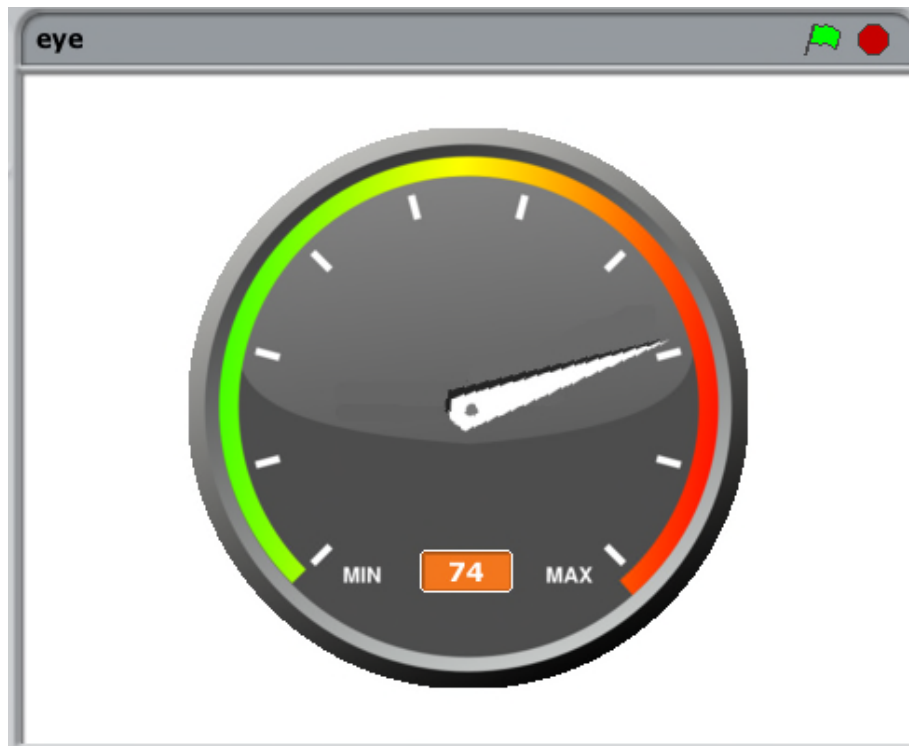
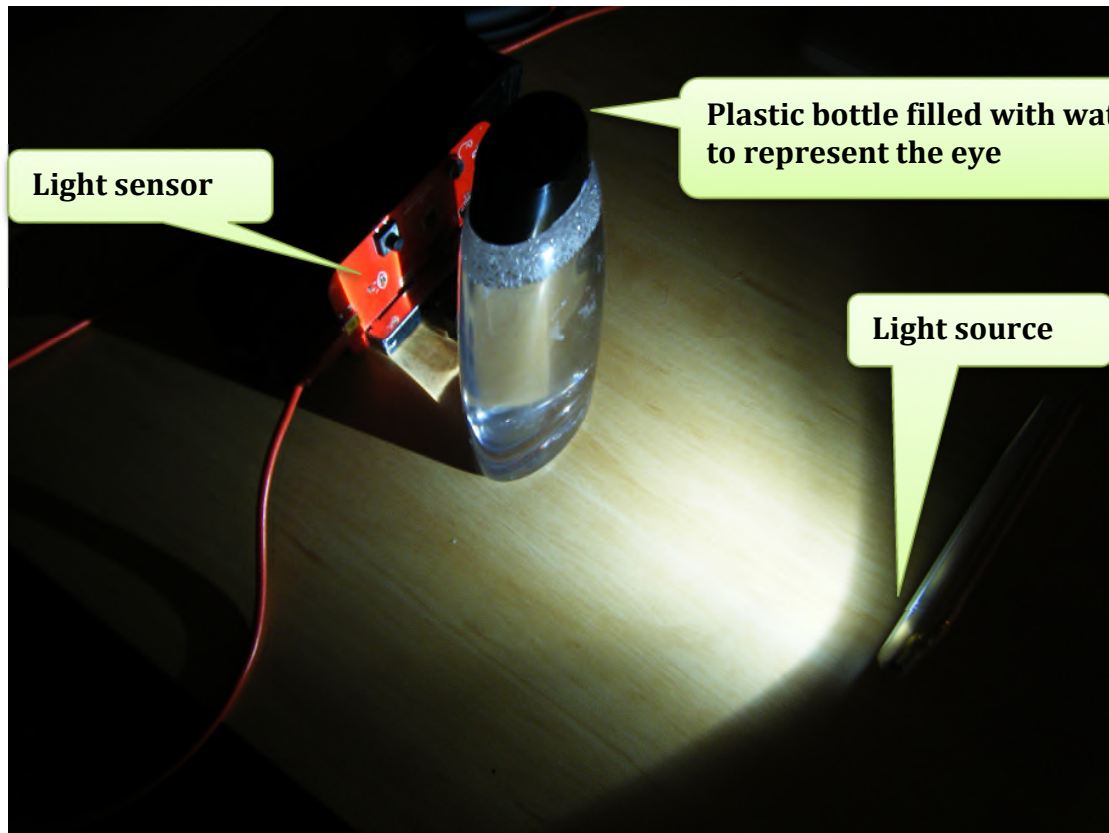
In order to use your light sensor you'll need to plug in your scratchboard.

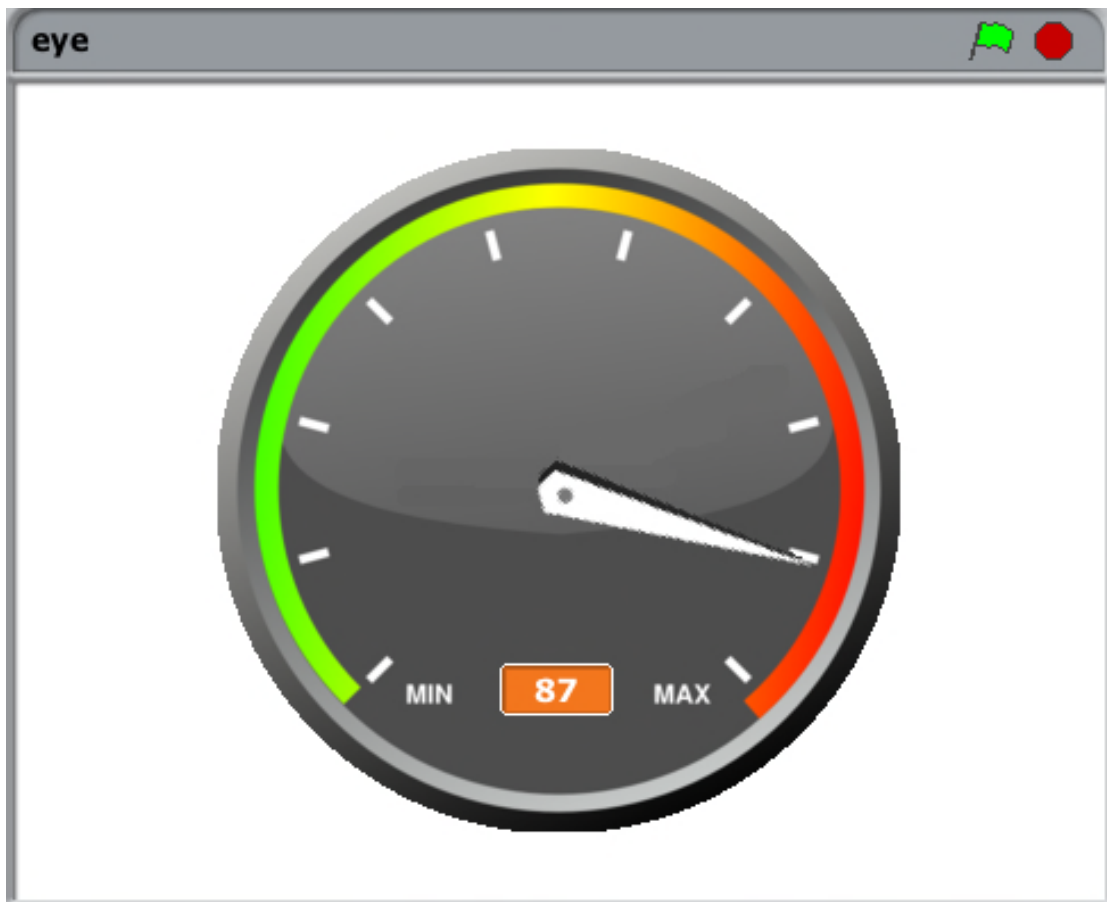
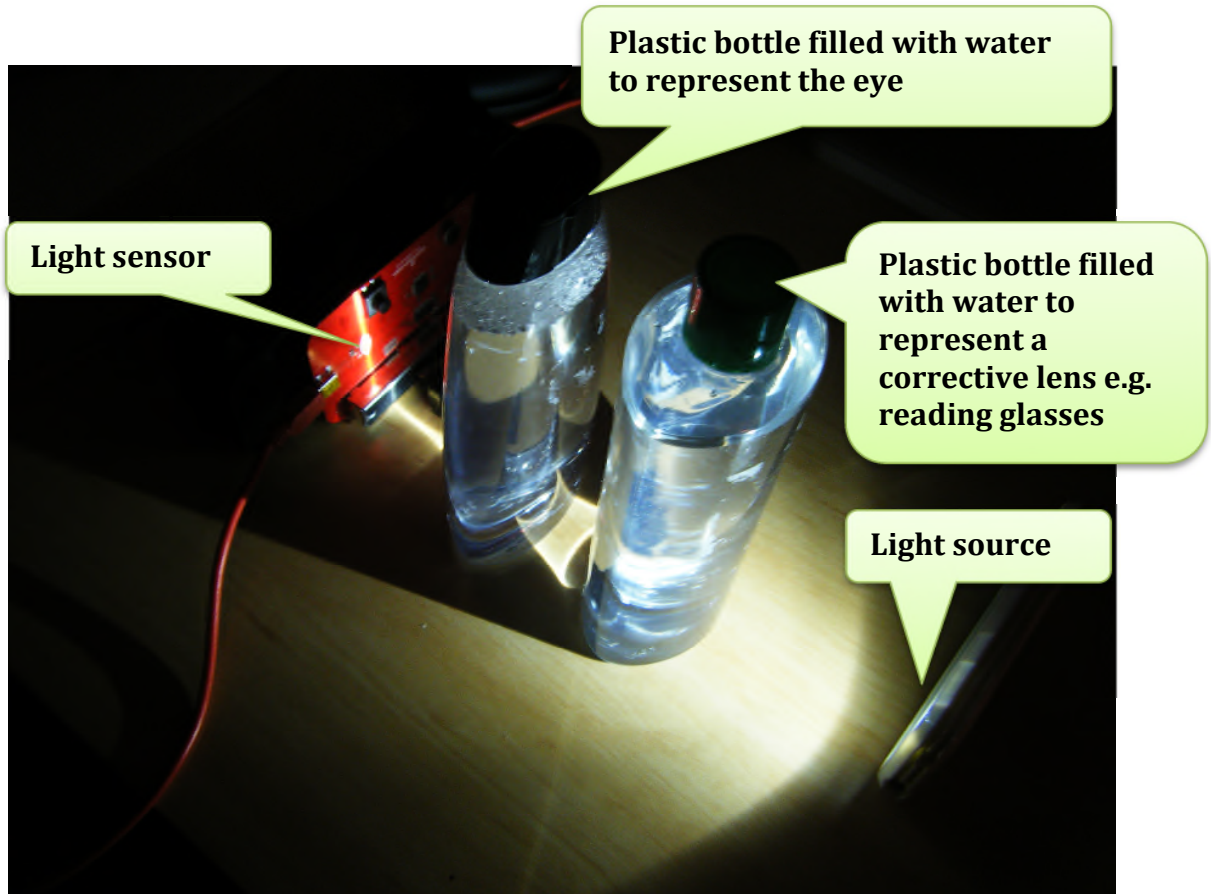
Plug the Scratchboard into the computer.

Scratch sensors give readings from 0 to 100. A bright light incident onto the light sensor will give a large value, whereas a less bright light will give a lower value. Remember, although Scratch sensors can give a reading from 0 to 100, it is likely that your homemade sensor will give readings with a smaller range.

To create a light sensor meter in scratch refer to the worksheet: *How to Make a Light Sensor Meter*.

The Experiment





Summary

The sensor value increases when the beam is focused onto the sensor. This is how reading glasses work; in order to focus on the text close to the eye some people need a set of glasses that enables them to focus on objects at closer distances.

Further experimentation:

- Filling the bottles with different liquids.
- Moving the object.