Programming Exercise: Voyager Light Sensor Drives a Scratch Program of the Eye

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Introduction

The eye is one of the many marvels of the human body. The colored iris of the eye, surrounding the pupil, acts as a diaphragm to keep the amount of light entering the eye fairly constant. If you walk out the door of your house to a sunny yard, the iris opening gets smaller letting less light into your eye. If you enter a dark room after watching your favorite television program, the iris gets larger to allow more light to enter your eye. This is a protective reflex, as too much light could damage the retina, which is where the image forms in the eye, similar to the film of a traditional camera or the CCD of a digital camera. In a similar way, seeing can become difficult it too little light enters the eye. In this lesson you will use Voyager's Light Sensor and design a Scratch program to model the behavior of the eye's iris. The iris will expand when the intensity of the light entering the sensor decreases, and will contract when the intensity increases.

One Approach to the Scratch Program

Although your students may come up with other approaches, Figure 1 shows the author's approach to a Scratch program to accomplish the desired results. A clipart of the eye with an iris is inserted as a base image. A ball from the Scratch sprite library is selected as the pupil and is filled with the color black. This sprite is controlled by the Scratch program shown in Figure 1.
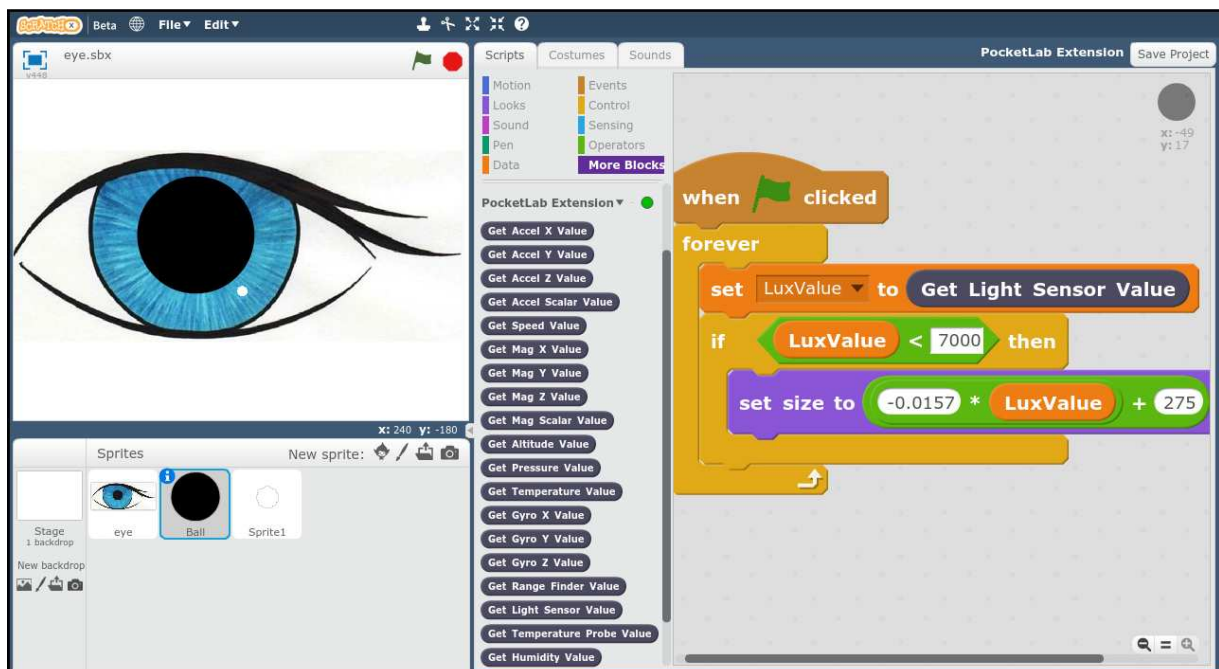

Figure 1

The author's basic idea is to linearly map the desired range of Lux values from Voyager's light sensor to the desired range of percent sizes of the Scratch sprite ball. The author decided to map a range of 0 to 7000 Lux to percent sizes from 275 to 165, respectively, as shown in Figure 2. The slope *m* of the linear fit red line is -0.0157, and the y-intercept *b* if 275, giving the equation shown in red in the Figure. This equation is used in the "set size to" block in the Scratch program. In the event that the Lux value exceeds 7000 Lux, the "if" block was introduced to avoid the pupil getting any smaller than 165%.
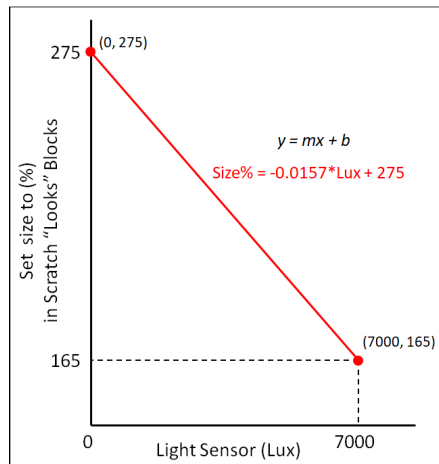

Figure 2

The tiny white circle on the colored iris is a static sprite representing a reflection of a light on the eye. This makes the eye look more like a real eye.

A video accompanying this lesson shows *contraction/expansion* of the iris as Voyager is moved *toward/away from* a desk lamp. A snapshot from this movie is shown in Figure 3.

Figure 3