Vision Lab –Teacher Instructions

List of materials:

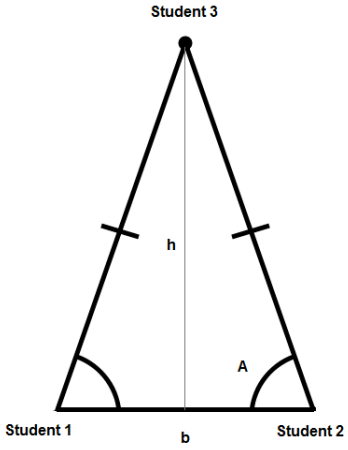
1 meter stick or measuring tape for every group of 2-3 students
blank sheets of paper
a cup/container
10 pennies or buttons
computer

The lab is split into two stations. One station covers peripheral vision, the blind spot, and depth perception. To test peripheral vision, we will examine how far students can see by counting the number of fingers that are held up as those fingers are positioned farther and farther away from them. To examine the blind spot, we will trace out the diameter of it to measure the size of the blind spot. We will use a simple coin drop test to examine depth perception. The second station (at the computers) covers color vision. Here, you will examine afterimages and optical illusions. Please finish one station before moving onto the next. Answer the questions at the end. Those questions marked with (*) can be found in the textbook. Those questions marked (**) will require some critical thinking.

Answers to questions:
Peripheral Vision, Blind Spot, and Depth Perception

I. Peripheral Vision

1. Approximately what is the extent of your peripheral vision?
   Student answer.
2. Convert this into an angle measurement. Assume that the distance between the two seated people is the base of an isosceles triangle and the distance from each seated person to the standing person is equal.
   Student answer.



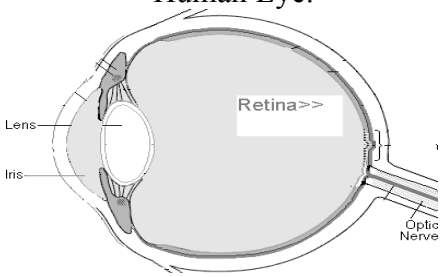
$$A = Tan^{-}\left(\frac{height}{\left(\frac{base}{2}\right)}\right)$$

3. (*) Peripheral vision, especially in distinguishing color and shape, in humans is weaker than in animals. What is a possible reason for this? (Think about the location of receptor cells on the retina).

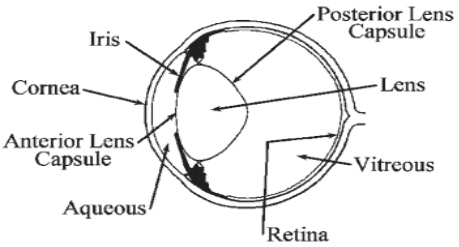
Receptor cells on the retina are greater at the center and lowest at the edges. Additionally, the rod cells, unable to distinguish color, are predominant at the periphery and the cone cells are concentrated in the center of the retina.

Example:

Human Eye:



Animal Eye:



II. The Blind Spot

1. Where was the blind spot relative to your peripheral vision? Approximate answers are acceptable.

Student answer.

2. What is the diameter of your blind spot? Is it larger or smaller than you would expect?

Student answer.

3. (*) What are scotomas?

Scotomas are blind spots (this is a general term).

4. (**) Why do we not normally notice our blind spot when we have both eyes open?

We do not normally notice our blind spot because with both eyes open, the visual fields of both eyes overlap.

III. Depth Perception

1. Under what circumstances did the most number of pennies end up in the cup, that is you had the best depth perception?

2. Is there improvement of depth perception with two eyes open?

Yes

3. Is there improvement with the cup is closer to the subject?

Yes

Color Vision:

I. Color Vision-

1. At what intensity could you begin to see the colored numbers? Explain what you saw in terms of the types of photoreceptors in the retina.

These are student answers.

2. Where is the retina and where in the eye is it located?
The retina is the innermost layer of the eye. The retina contains photoreceptors in the pigmented part that receive light and then pass the signals to the neural part.

3. Name two types of photoreceptors in the retina and describe what they do.
The retina contains two types of photoreceptors called rods and cones. Rods only detect whether light is on or off, so they cannot detect colors. Cones are sensitive to color, so they are important to our color vision.

4. What is photoreception?
(*)Biological responses to stimulation by light, most often referring to the mechanism of vision.

II.-After Images
1.What were the colors in the after image behind each colored square?
Green behind red. Red behind green. Yellow behind blue. Blue behind yellow.

2. What are opsins and how do they work?
Opsins are the proteins within photoreceptors that are responsible for detecting light (or photons). Opsin functions by sensing changes in the shape of another molecule (retinal) that straightens when hit by a photon.

3. Use bleaching to explain the after image.
The afterimage occurs because the cones become fatigued when they receive too much light stimulation. Bleaching occurs because the retinal recovery is not fast enough to accommodate the number of photons being detected, thus many opsins within the photoreceptors lack retinal.

4. What is the wavelength of the visible spectrum?
Between 700nm and 400nm

5. Arrange the following in increasing order of maximum wavelength absorbed- red cones, green cones, and blue cones
Blue(~460nm)<Green (~510)<Red (~700)

III. Swirling Ring Illusion
1. Describe what you saw in these two optical illusions.

References

Depth Perception and Blind Spot
http://faculty.washington.edu/chudler/blindspot.html
Cassin, B. and Solomon, S. *Dictionary of Eye Terminology*. Gainsville, Florida: Triad Publishing Company, 1990.
http://www.britannica.com/EBchecked/topic/69390/blind-spot
Color Vision
http://faculty.washington.edu/chudler/chvision.html