Week 8 Lecture 2
80% of the information that we process is collected through the eyes. The eye is basically a camera (Figure 1); it captures visual information. The parts of the eye most important/relevant for this class are the pupil, the retina and the fovea. Light enters the eye through the pupil. The retina is the screen at the back of the eye and the fovea is responsible for collecting the information needed for high resolution image processing.

We dont process whole scenes at once, we can see and process only small regions of the scene at a time. We see small portions at a time. Additional Example: This is similar to taking a picture in “Panorama” mode on a smartphone: the camera (or eye) captures small parts of the scene and stitches them together.

The fovial (high quality/resolution) image occupies 1% of retina but 50% of visual cortex and is approximately 1% of the visual angle. To see what this looks like, look at your thumb at arm's length, that is the amount of the scene you can see in high resolution.

Visual stimuli include physical properties of light like frequency and intensity as well as subjective properties like color. Color is subjective. Something that is red to some one may not be red to others although the wavelength is the same. Additional Example: For example, for two days the internet and even national news shows like the Today Show debated the colors of the dress shown in Figure 2. While some people see the dress as white and gold, others see it as black and blue. Some people even see the dress change colors.

Figure 1. The Eye. Source: https://www.nei.nih.gov/health/eyediagram

Figure 2. The Infamous “Dress”. Source: http://swiked.tumblr.com/image/112166688660
The colors that we see, the visible light spectrum, have wavelengths that range from ~400 to ~700 nanometers. Although this seems to be a wide range, it is only a miniscule part of the entire electromagnetic spectrum (Figure 3).

Researchers mainly study eye movements to learn about aging and usability. Two pieces of data that are often studied are fixations and saccades. Fixation occurs when the eyes are stationary for at least 200 ms. When a user is fixating, they are taking in visual detail from the environment. Saccade is the rapid repositioning of the eye to fixate on new locations approximately every 120 ms. In saccade eyes move from target to target.

In Yarbus’ seminal research, he found that there is similarity in how different people look at a picture. He also found that there is a different eye movement pattern depending on the stimulus. Flash forward to today and even though we know how peoples eyes move, we are still figuring out how we can change that pattern by giving different tasks. One problem in this field of research is that findings don’t always match. These differences are possibly a result of different questions being asked to participants.

The most popular way to visualize eye movements is a scan path (Figure 4). These graph like images use markers to depict fixation (circles) and saccades (straight lines).

Figure 3. The Electromagnetic Spectrum. Source: http://www.colourtherapyhealing.com/colour/electromagnetic_spectrum.php

Figure 4. Scan Path on a webpage. Source: http://www-boxesandarrows-com.zippykid.netdna-cdn.com/wp-content/uploads/2013/10/Fig.-4-Scan-path.jpg