**Chapter 5: Color [Jenn's study guide;**[**slides**](https://drive.google.com/open?id=1J5DfrG6PAYD0T4OtZBoHy-V70tO2MZnBrQeRw2IxNRE)**]**

* Trichromacy theory-the theory that the color of any light is defined in our visual system by the relationships of three numbers. The outputs of three receptor types now known to be the three cones. This theory is also called the “Young-Helmholtz theory.”
* Univarience- this is a problem that an infinite set of different wavelength-intensity combinations can elicit exactly the same response from a single type of photoreceptors. One photoreceptor type cannot make color discriminations based on wavelength.
  + Our human visual system has solved this problem in most situations, but in dimly lit scenes we have some problems.
* Color opposition-
  + Hering:
    - Opponent color theory- all perceptions of colors are outputs of three oppositional colors.
      * Red-green
      * blue-yellow
      * black-white
    - color-opponent cell- a neuron whose output is based on a difference between sets of cones.
* Metemers- different mixtures of wavelengths that look identical. More generally, any pair of stimuli that are perceived as identical in spite of physical differences.
* Subtractive and Additive color mixing
  + Subtractive- a mixture of pigments. If pigments A and B mix, some of the light shining of the surface will be subtracted by A, and some by B. only the remainder contributes to the perception of color.
    - Ex: when you take red paint and green paint almost all wavelengths are absorbed by one pigment or the other so we perceive the color to be a dark brown.
  + Additive- a mixture of lights. If light A and light B are both reflected from a surface to the eye, in the perception of color the effects of those two lights add together
    - Ex: Blue and yellow lights make white light. Red and green makes yellow.
* Hue cancellation with lights(examples/combinations)
  + These experiments start with a color and attempt to determine how much of the opponent color of one of the starting color’s components must be added to eliminate any hint of that component from the starting color. So like, how much red must I add to eliminate any hint of green.
    - Unique blue- a blue that has no red or green tiny
    - Unique hue- any of four colors that can be descried with only a single color term: red, yellow, green, blue.
* Color consistency- the tendency of a surface to appear the same color under a fairly wide range of illuminants.
  + The brain makes intelligent guesses about the illuminant.
  + Reflectance- the percentage of light hitting a surface that is reflected and not absorbed into the surface.
* After image (
  + examples
  + what colors pairs belong to each other (I.E. you see red when you stare at green)
* RGB scale
  + what percentages of RGB make colors. Play with the color picker tool in paint to see percentages (i.e. 100% red, 50% green, 0% blue is the color orange)
* Disorders that causes one to not be able to perceive color
  + Achromatopsia- an inability to perceive colors, caused by damage to the central nervous system.
  + Deuteranopia (Green)- color blindness due to absence of M-cones. (common)
  + Protanopia (Red)- color blindness due to the absence of L-cones
  + Tritanopia (Blue)- color blindness due to the absence of S-cones (rare)
  + Color-anomalous- color-blind. Can still make discriminations based on wavelengths but they are different from normal
  + Cone monochromat- individual with only one cone type. Truly colorblind.
  + Rod monocromat- no cones at all. Truly color blind and visually impaired in bright light.
  + How do these different cones respond at night or day (photopic vs scotopic)
    - Photopic- The light is bright enough to stimulate cone receptors and saturate rods.
    - Scotopic- the light is bright enough to stimulate rods but not cones.
  + Repacking of the Retina information
    - (L-M)- good at telling you if a fruit is ripe
    - (L+M)- excited by light onset
    - (L+M)-S
    - L and M responses contains information about color. Like blood in the skin, blushing.
* The color violet. Why is it unique? Who/what can see it?
  + Violet is unique because it is a pure spectral color and it has a very short wavelength.
  + Purple is not unique, it’s a mixture of blue and red. Humans cannot distinguish between violet and purples.
* How do animals see color differently than humans?
  + tetrachromats- birds
  + dichomates- dogs and most mammals. Similar to R and G colorblind in humans.
  + trichromats- cats and humans