Which cracker do you want to eat?

Importance of color

- For most people color is an integral part of living
- It is useful for identifying properties of objects
  - e.g., ripe fruit
Importance of color

- For most people color is an integral part of living
- It is useful for identifying properties of objects
  - e.g., raw meat

Importance of color

- Some judgments impossible without color
- It is useful for identifying properties of objects
  - e.g., raw meat
Importance of color

- Some stimuli are defined almost entirely by color
  - Isoluminant
- 'Impression Sunrise', Claude Monet, 1873

Importance of color

- Remove the color, and the sun almost disappears
- 'Impression Sunrise', Claude Monet, 1873
Importance of color

- People find colors beautiful
Importance of color

- We expect things to be certain colors
- When they are not, they look very odd

What is color?

- People used to think (up until the 19th century)
- That color was a basic property of objects
- It’s part of our language
  - The wall is red.
  - Her eyes are blue.
- But color is actually a percept
- It depends on
  - Properties of the object
  - Properties of the illuminating light
  - Properties of background stimuli
  - The physiology of the viewer
Some terms

- Wavelength: the frequency of light
- This is a physical measurement

![Wavelength Diagram]

Some terms

- Chromatic color: reds, greens, blues, and so on
  - Sometimes called *hue* or just *color*

- Achromatic color: white, gray, black

![Chromatic and Achromatic Colors]
Cones

- There are three kinds of cones that respond to different wavelengths of light
  - Short (blue)
  - Medium (green)
  - Long (red)
- This is the start of color vision

Trichromatic theory

- Thomas Young (1773-1829)
- Hermann von Helmholtz (1821-1894)
- Developed before knowledge about the photoreceptors of the eye
  - Predicted by psychophysical experiments
  - Color matching
- The color on the left could be any combination of wavelengths of light
Color matching

- Subject changes the intensity of the three colors to make the left and right rectangles look the same

You can always get a match!
Color matching

- Significantly, if I give you only two colors to work with, you cannot match some colors.

This is the best I could get without red.

Color matching

- You can always get a match with three colors because color perception is based on the responses of the three cone types.
- The two stimuli (though physically different) can activate the cones in the same way.
Color matching

- The same neurophysiological response must lead to the same percept
  - *Metamer* colors
- This is the basis for all color computer monitors and printers

By measuring the wavelengths of color metamers, Helmholtz derived how the photoreceptors must respond to different wavelengths of light
  - Not bad!
Color coding

- One can think of the representation of colors as a pattern of activity across the cone types.

Dichromats

- Some animals (and people) have only two cones.
- They can see color, but the same as normals.
- A picture like this.

PSY 310: Sensory and Perceptual Processes
Dichromats

- Some animals (and people) have only two cones
- They can see color, but the same as normals
- Looks like this (to a horse)

Conclusions

- Color
- Importance
- Trichromatic theory
- Color matching

- Note, we didn’t discuss the Garner interference
  CogLab assignment
  - I think there is a problem with the lab, so the data are no good
Next time

- Opponent-process theory of color vision
- Afterimages
- Color contrast
- Neural circuits