

Eyes and Sight

1/26/15 10:41 PM

THE PSYCHOPHYSICS OF SEEING

How we experience the physical characteristics of sight:

- Light waves – brightness
- Light – the visual stimuli
 - Brightness (amplitude)
 - Dim light = low amplitude
 - Bright light = high amplitude
 - Color (wavelength)
 - Reds = long wavelengths
 - Blues = short wavelengths

THE VISIBLE SPECTRUM

Different species see the world differently.

- Bees have UV receptors
- Dogs and cats are blue, green, and red deficient

THE PSYCHOLOGY OF COLOR VISIBILITY

The human eye can see 7,000,000 colors.

Color can affect your mood and productivity.

ANATOMY OF THE HUMAN EYE

Cornea

- 80% of focusing

Lens

- 20% of focusing
- Accommodation
- Lens changes shape
- Focus near or far

Iris

- Colored muscle around pupil

Pupil

- Hole admits light into eye
- Dim light vs. bright light

Retina

- Light-sensitive surface
- Back of the eye

- Photoreceptor Layer
 - Transduces the light into neural impulses (account for nearly $\frac{3}{4}$ of all sensory receptors)
- Rods
 - Most responsible for light sensitivity and motion
- Cones
 - Responsible for color vision and acuity/sharpness
 - Two layers of cones (for each color) to refine vision
- Ganglion cells
- Bipolar cells
- Receptors
 - 6 million cones – center (color)
 - 120 million rods – periphery (light)

Fovea

- Area of maximum acuity
- Cone concentration
- Center of focus on the retina (very back)
- Cones are located in the center of the fovea
 - Day vision and color
- Rods are located in the periphery
 - Black, white, and night vision

Optic Nerve

- Cell axons from retina to the visual cortex in the brain

Blind Spot

- Hole in retina where optic nerve exits
- Insensitive to light
- Brain fills in what thinks should be there

HOW DO WE SEE IN COLOR?

Trichromatic Theory

- Patterns of activity in three different cone types:
 - Red
 - Green
 - Blue

Opponent Processing Theory:

- Colors arranged in pairs and when one is activated, the other is inhibited
 - Red \leftrightarrow Green
 - Blue \leftrightarrow Yellow
 - Black \leftrightarrow White

Color Deficiency

- Red-green, blue-yellow
- Can see brightness differences
- Cannot distinguish opponent pairs

PATHWAYS TO THE VISUAL CORTEX

Retina \rightarrow optic nerve \rightarrow thalamus \rightarrow visual cortex (perception)

VISUAL PERCEPTION IN THE CORTEX

Feature Detectors

- Neurons that respond to individual features
- Combine to make meaningful patterns
 - Ex: shape, angle, motion, direction, edges