Sensation vs. Perception

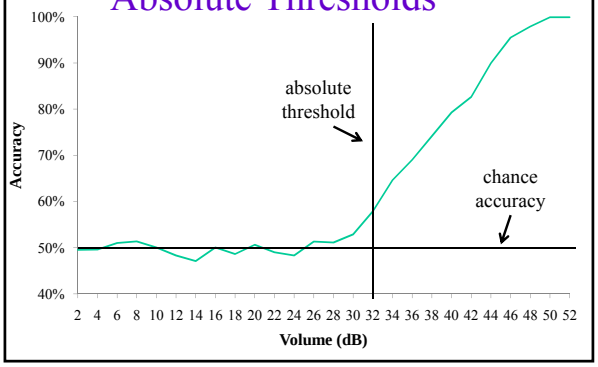
- Bottom-Up Processing (sensation)
  - analysis that begins with the sense receptors and works up to the brain's integration of sensory information
- Top-Down Processing (perception)
  - information processing guided by higher-level mental processes
  - as when we construct perceptions drawing on our experience and expectations

Sensation: just a bunch of black and white colors. Perception: a Dalmatian.

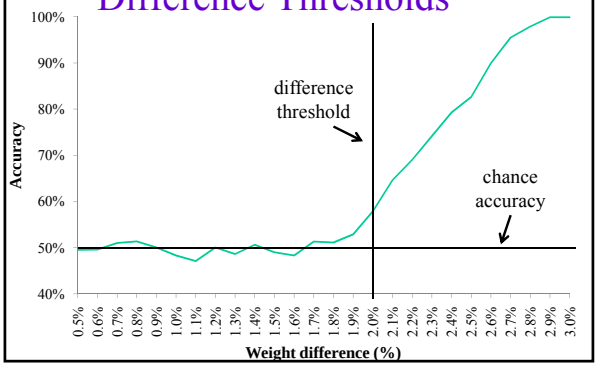
Sensation- Thresholds

- Absolute Threshold
  - minimum stimulation needed to detect a particular stimulus
  - usually defined as the stimulus needed for detection 50% of the time
- Difference Threshold
  - minimum difference between two stimuli that a subject can detect 50% of the time
  - just noticeable difference (JND)

Absolute Thresholds



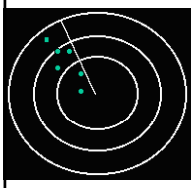
Difference Thresholds

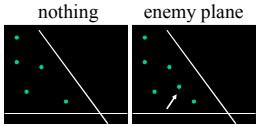


Explaining thresholds

- Signal Detection Theory (SDT)
  - explains what affects sensory thresholds
  - assumes that there is no single threshold
  - threshold depends partly on personal traits and situational elements.
    - How motivated are you to detect stimulus or difference between stimuli?
    - Are you naturally gifted at detesting stimuli?
    - Is there anything in your environment that is making you better or worse at detecting stimuli?
  - SDT first developed during World War II to select soldiers to operate radar.

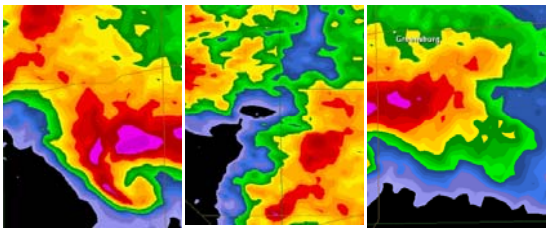
Signal Detection





	Signal Not Present	Signal Present	
Signal Not Detected	Correct Rejection	Miss	*conservative*
Signal Detected	False Alarm	Hit	*liberal*

Is there a tornado in these radar images?

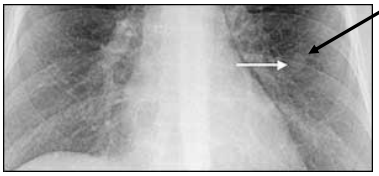


Greensburg, KS May 4, 2007

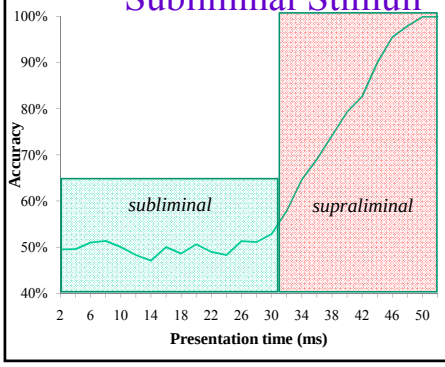
95% destroyed
5% severely damaged

SDT and X-Ray Screenings

- Even trained MDs can have difficulty spotting possible cancers in x-rays.
- Signal detection studies can help determine ways to improve detection.



Subliminal Stimuli

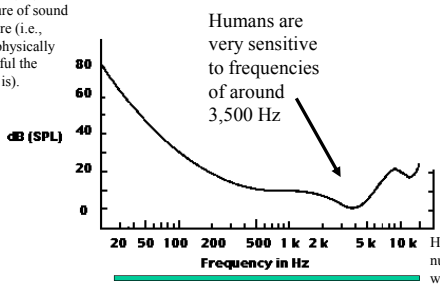


When stimuli are detectable less than 50% of the time (i.e., below absolute threshold), they are "subliminal".

We often reduce intensity even more to make stimulus even less detectable.

Absolute Thresholds

Decibel (dB) = Measure of sound pressure (i.e., How physically powerful the sound is).

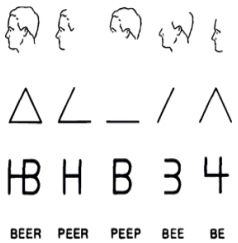


Range of human hearing

Hertz (Hz) = number of sound waves that pass by a point every second.

Vision- Stabilized Images on the Retina

(a)



(b)

Difference Thresholds

- Weber's Fraction- to perceive a difference between two stimuli, they must differ by a constant proportion
  - light intensity- 8%
  - weight- 2%
  - tone frequency- 0.3%

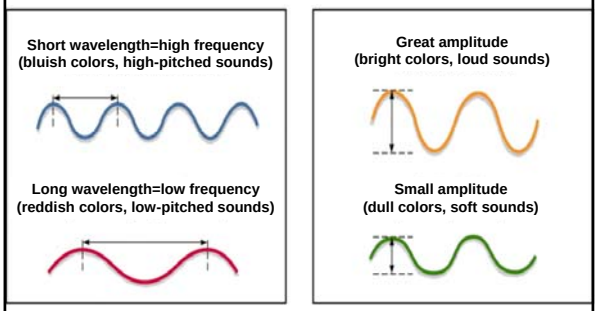
$$\frac{\Delta I}{I} = K$$

Change in intensity divided by the original intensity.

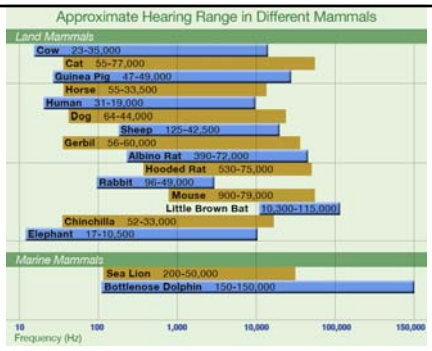
$$\frac{\Delta I}{100} = .02$$

How much change in weight do we need to notice a difference from 100 pounds?

Physical Properties of Waves

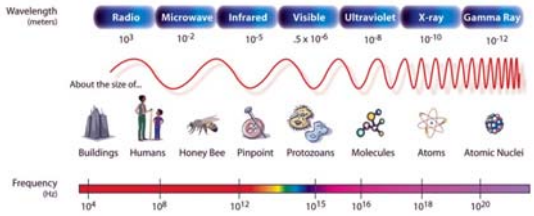


Note: Sound and light waves travel at constant speeds of approximately 700 MPH and 670,000,000 MPH, respectively. So frequency is based entirely on how long a wave is.

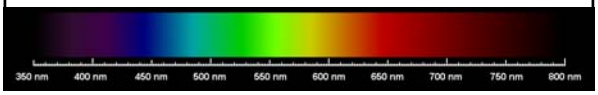


Humans hear sound waves that are anywhere from less than an inch to more than 30 feet long. Your dog and cat can hear sound waves that are even shorter. Elephants can hear sound waves that are even longer.

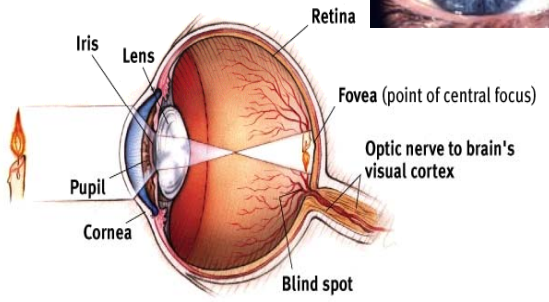
Light Waves and What We See



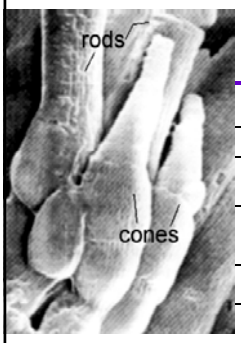
Humans only see light waves that are between about 350-800 nanometers long. The vast majority of light is invisible.



Vision



Rods and Cones

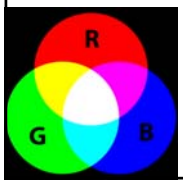


Receptors in the Human Eye

	Cones	Rods
Number	6 million	120 million
Location in retina	Center	Periphery
Sensitivity in dim light	Low	High
Color sensitive?	Yes	No

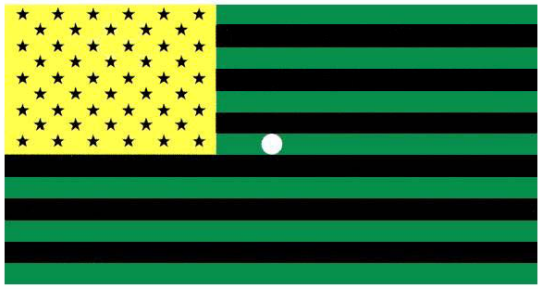
How do we see color?

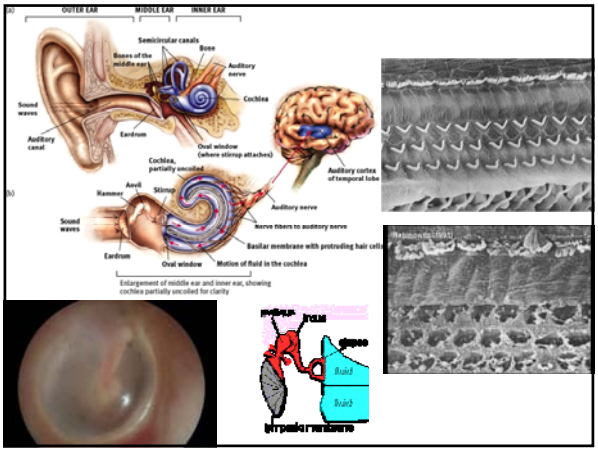
- *Nobody fully understands how*
- Trichromatic (three color) Theory
  - three different cones: red green blue
  - Different wavelengths activate one or a combination of cones to produce color.



Close up of LED lights that make up single pixel on LED TV.

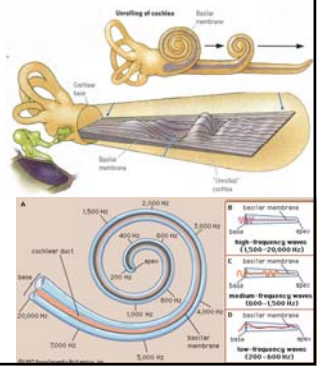
Color Afterimages

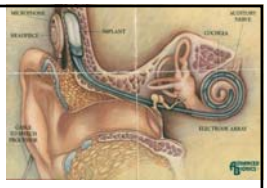


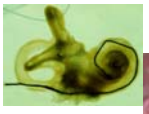


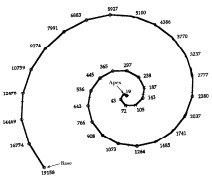
Audition

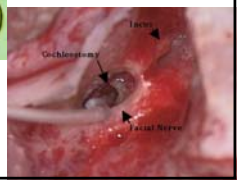
- Place Theory
  - the theory that links the pitch we hear with the place where the basilar membrane is stimulated
- Frequency Theory
  - the theory that the rate of nerve impulses traveling up the auditory nerve matches the frequency of a tone, thus enabling us to sense its pitch



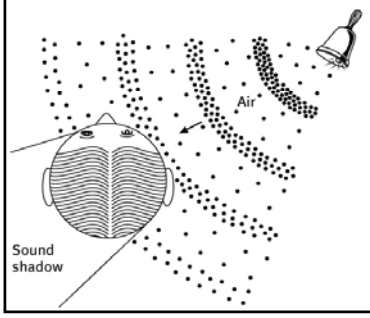


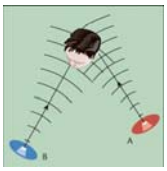






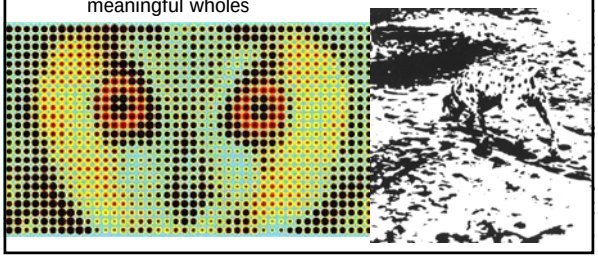
How We Locate Sounds





Perceptual Organization-Gestalt

- Gestalt- an organized whole
  - tendency to integrate pieces of information into meaningful wholes



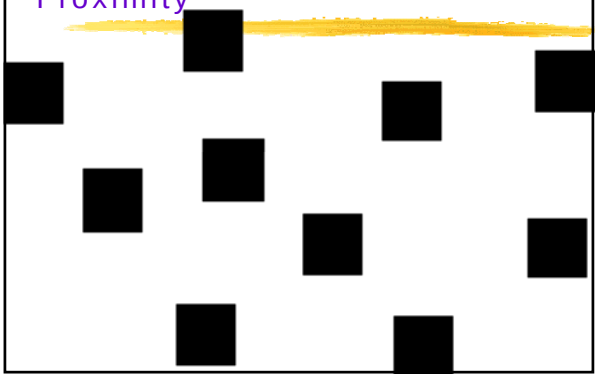
Seeing things as wholes

Aoccdrnig to rscheearch at an Elingsh uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, olny taht the frist and lsat ltteres are at the rghit pcleas. The rset can be a toatl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae we do not raed ervey lteter by ilstef, but the wrod as a wlohe.

Perceptual Organization

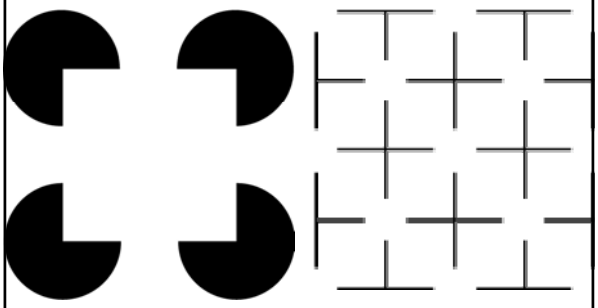
- Figure-ground
  - The object that we see is called the figure.
  - The background on which the object lies is called the ground.
  - Figure and ground are NOT constant (they can change)!

Grouping Principles: Proximity



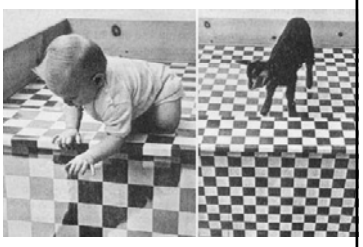
Grouping Principles: Proximity

Grouping Principles: Closure



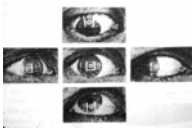
Perceptual Organization- Depth Perception

- When and how do we develop depth perception?

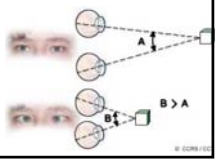


Perceptual Organization- Depth Perception

- Binocular cues
  - retinal disparity
    - images from the two eyes differ
    - closer the object, the larger the disparity



  - convergence
    - neuromuscular cue
    - two eyes move inward for near objects



Relative Size

Interposition

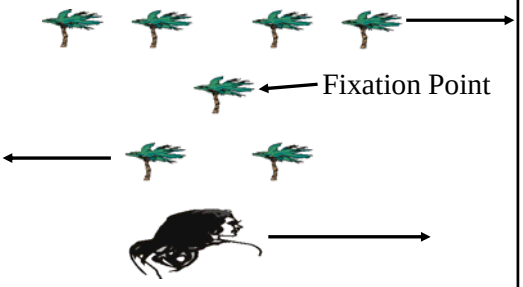
Texture Gradient-Relative Clarity

"Paris street, rainy day"

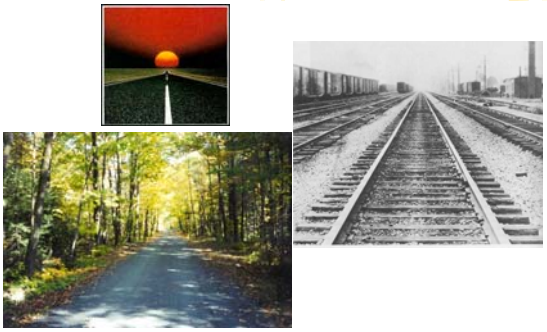
Gustave Caillebotte, 1877

Relative Height

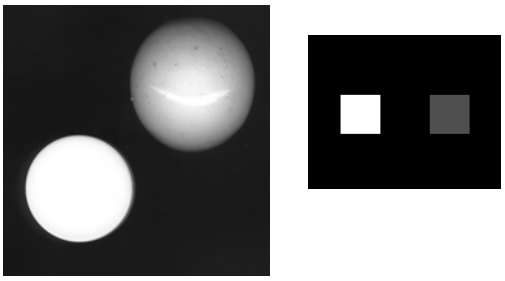
Motion Parallax



Linear Perspective



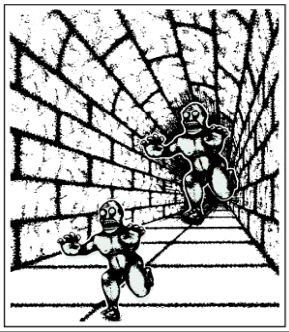
Relative Brightness

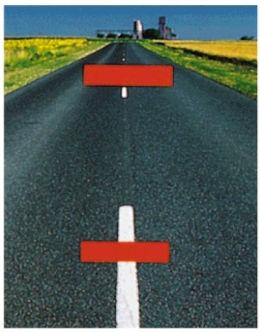


Perceptual Constancy

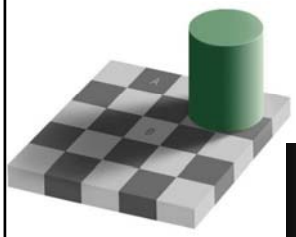
- Perceptual Constancy
  - perceiving objects as unchanging despite changes in retinal image
    - shape
    - size
    - color/light

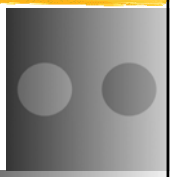
Perceptual Constancy

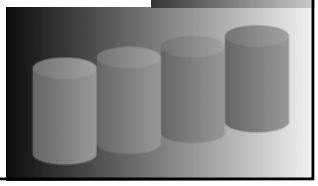




Perceptual Constancy







Perceptual Constancy

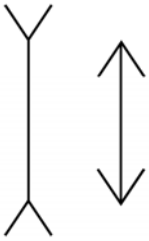
Eyes are exact same color even though they look completely different. (brain thinks…if eye looks orange under blue filter, then it must by purple when filter is removed because purple + blue = orange)

Perceptual Set-

Perceptual Set-

Perceptual Set-

Experience and perception

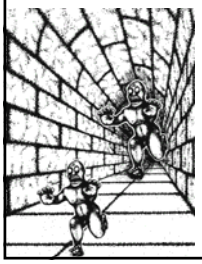


Muller-Lyer Illusion
Most people say the line on the left looks longer than the one on the right, even thought the lines are the same length.

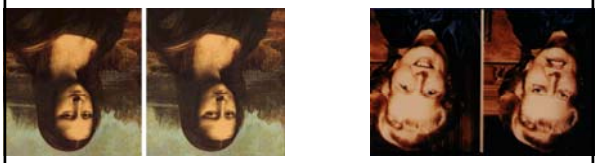
This is because we live in a world where edges facing away from us look like what appears on the left. Edges facing toward us look like what appears on the right.

People who grow up with round rather than box structures aren't fooled by this illusion.

How Does Context Affect Our Perceptions



Schemas



Schemas