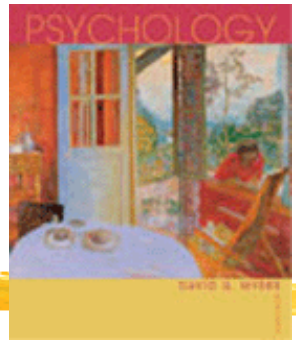
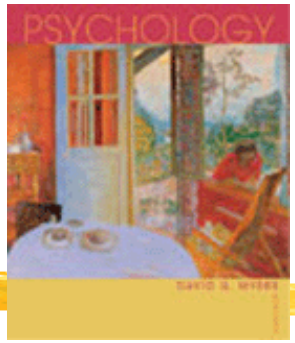
Audition

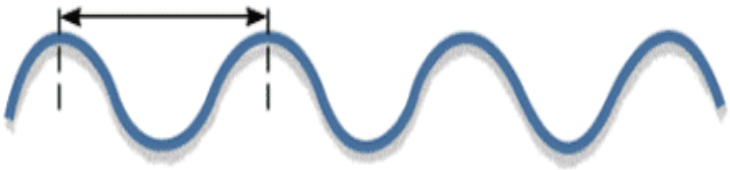


- Audition
  - the sense of hearing
- Frequency
  - the number of complete wavelengths that pass a point in a given time
- Pitch
  - a tone's highness or lowness
  - depends on frequency

Vision- Physical Properties of Waves



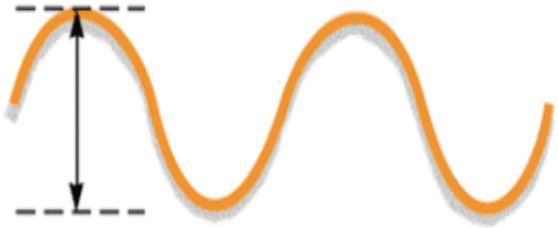
Short wavelength=high frequency
(bluish colors, high-pitched sounds)



Long wavelength=low frequency
(reddish colors, low-pitched sounds)

(a)

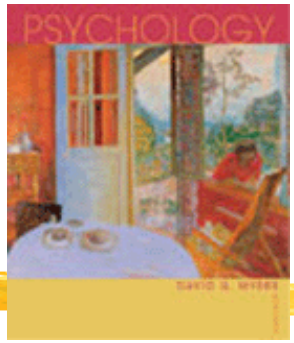
Great amplitude
(bright colors, loud sounds)

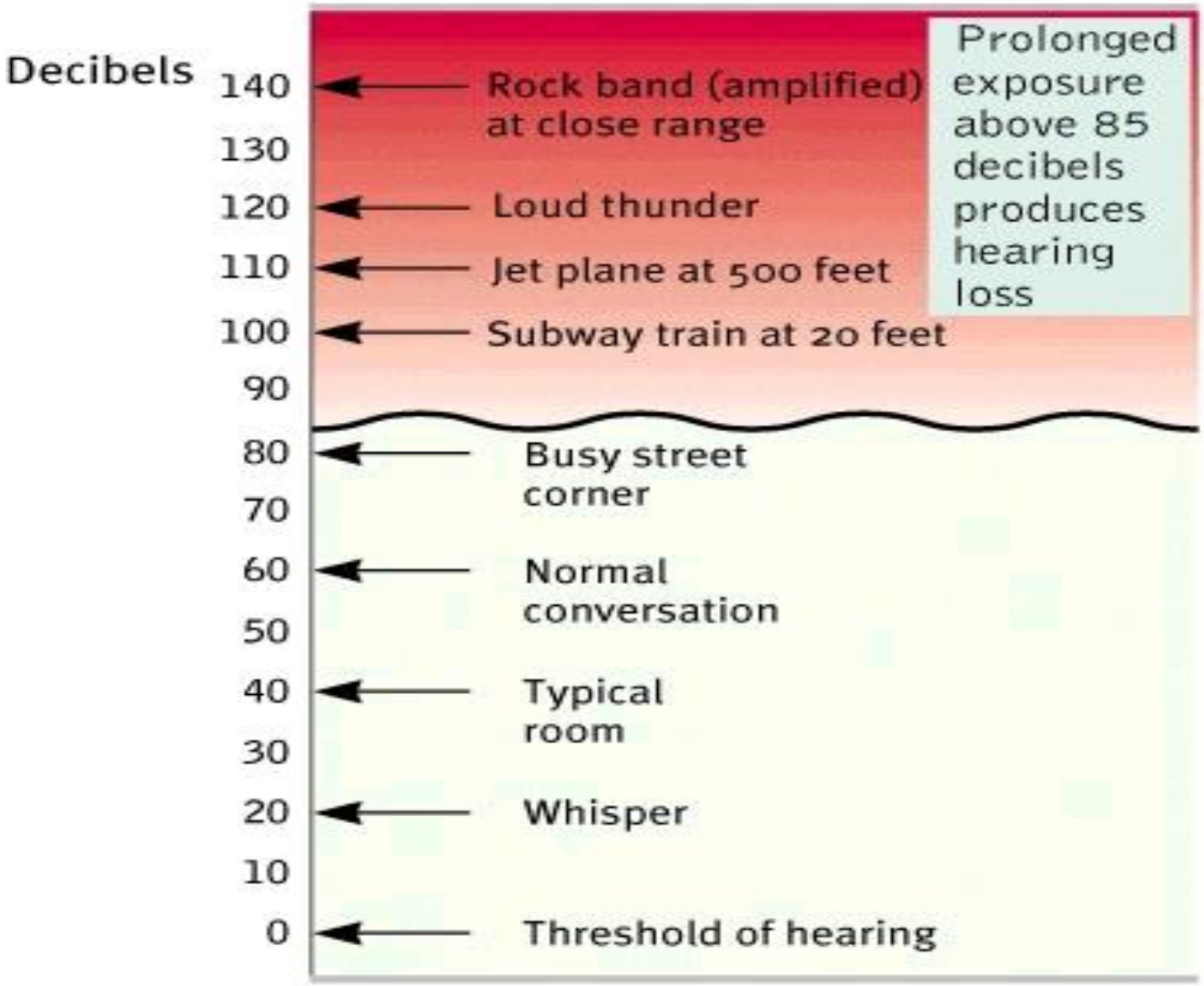


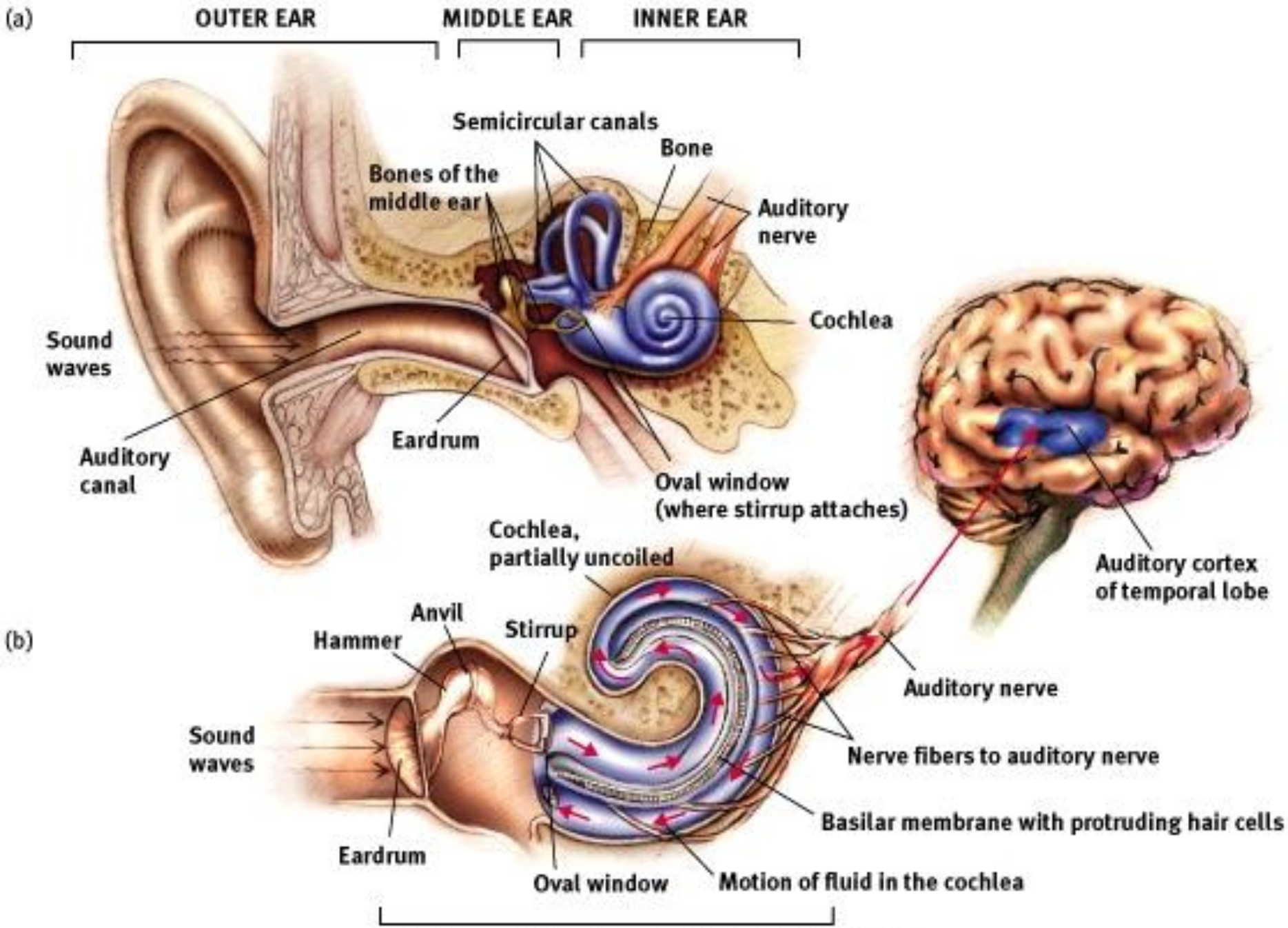
Small amplitude
(dull colors, soft sounds)

(b)

The Intensity of Some Common Sounds



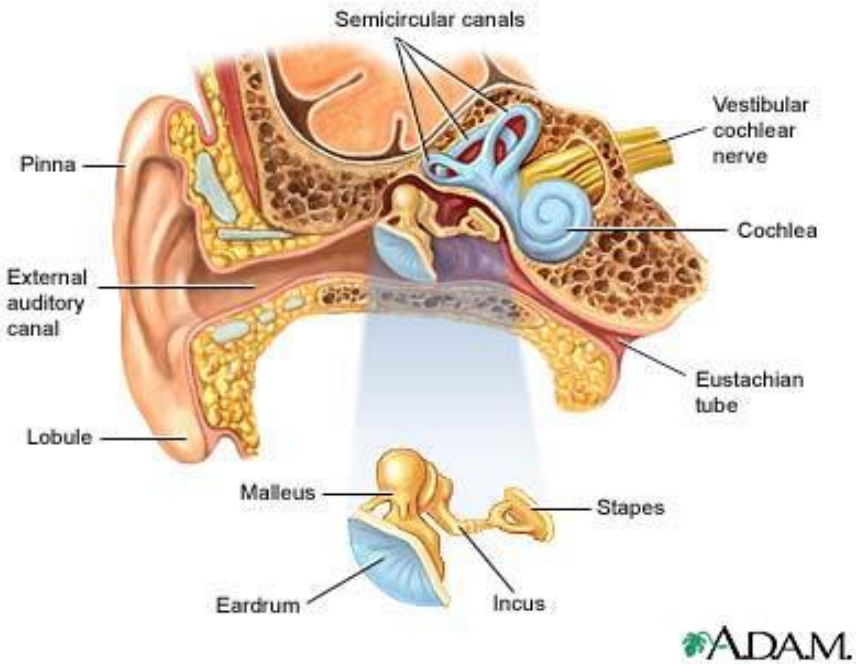


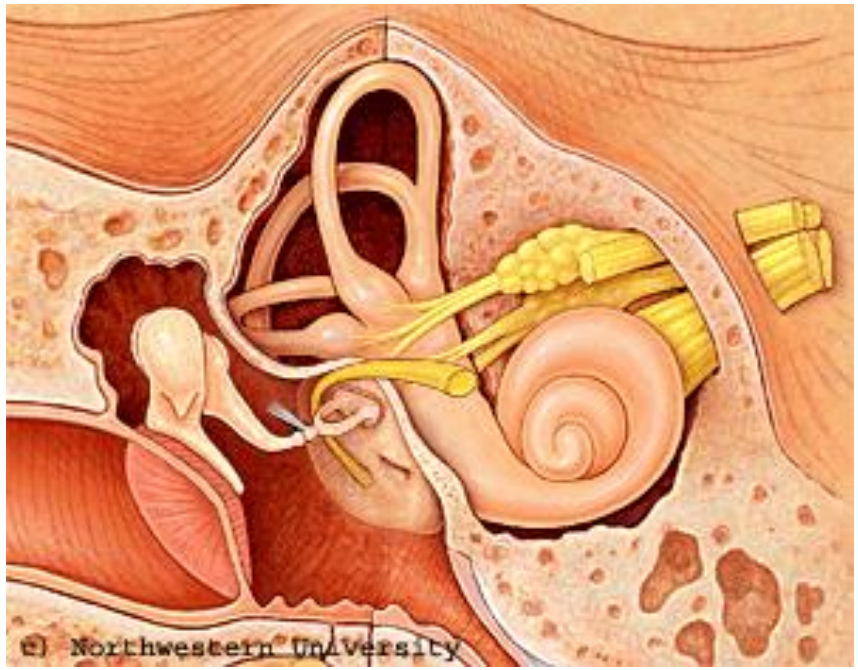


Enlargement of middle ear and inner ear, showing cochlea partially uncoiled for clarity

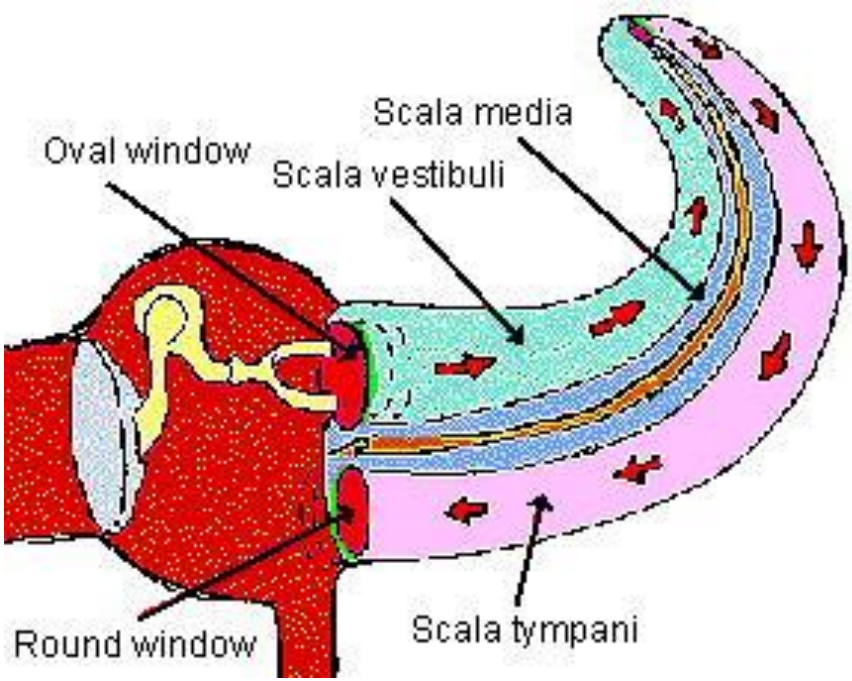
There are three parts to the ear: OUTER EAR, MIDDLE EAR, and the INNER EAR.

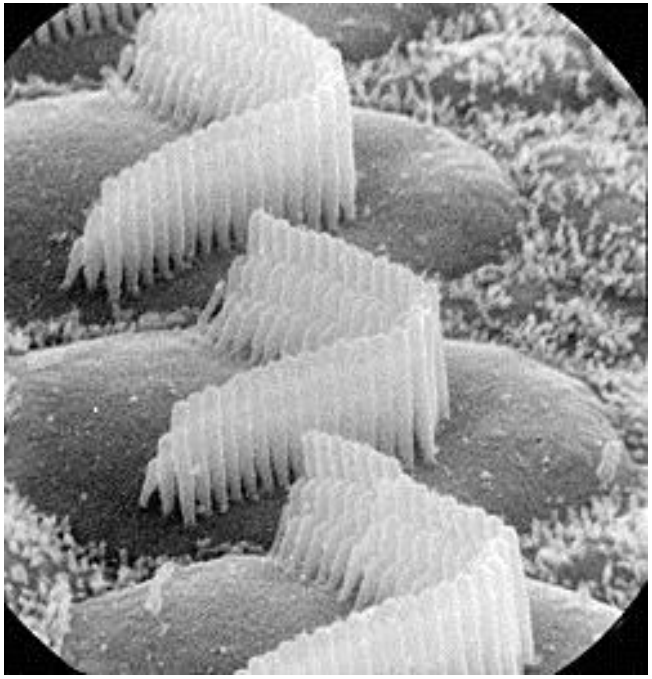
- The **outer ear** is composed of the PINNA the AUDITORY CANAL and the TYMPANIC MEMBRANE (EAR DRUM). The function of the outer ear is to focus the sound waves to the middle ear.
- The **middle ear** is composed of three bones, collectively called **ossicles**: the HAMMER (MALLEUS), the ANVIL (INCUS), and the STIRRUP (STAPES). The function of these bones is to amplify the soundwaves.
- The **inner ear** is composed of the COCHLEA and the SEMI-CIRCULAR CANALS. The COCHLEA is involved in hearing, whereas the SEMICIRCULAR are involved in balance.





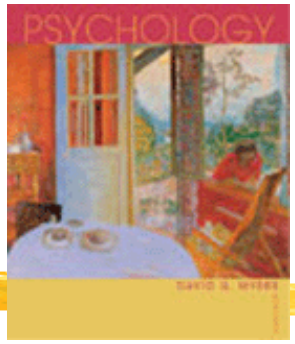
Inside the cochlea, there is a membrane (called the BASILAR membrane) covered in tiny HAIR CELLS Amplified sound waves cause a membrane at the base of the cochlea (called the OVAL WINDOW) to vibrate in a certain frequency. This, in turn, causes waves in the fluid of the cochlea, bending hair cells on the basilar membrane, opening ion channels and sending a neural message to the thalamus via the AUDITORY nerve. From there, the message is passed to the auditory cortex in the TEMPORAL lobe.





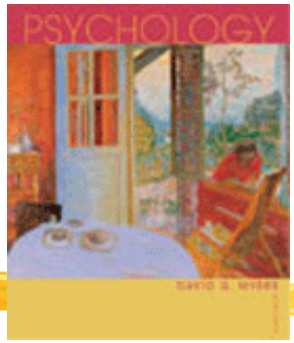
Hair cells

Audition- The Ear



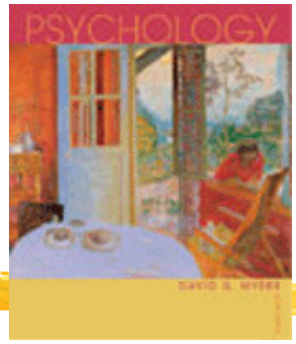
- Middle Ear
  - chamber between eardrum and cochlea containing three tiny bones (hammer, anvil, stirrup) that concentrate the vibrations of the eardrum on the cochlea's oval window
- Inner Ear
  - innermost part of the ear, contining the cochlea, semicurcular canals, and vestibular sacs
- Cochlea
  - coiled, bony, fluid-filled tube in the inner ear.

Audition



- Place Theory
  - the theory that links the pitch we hear with the place where the cochlea's 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

Audition



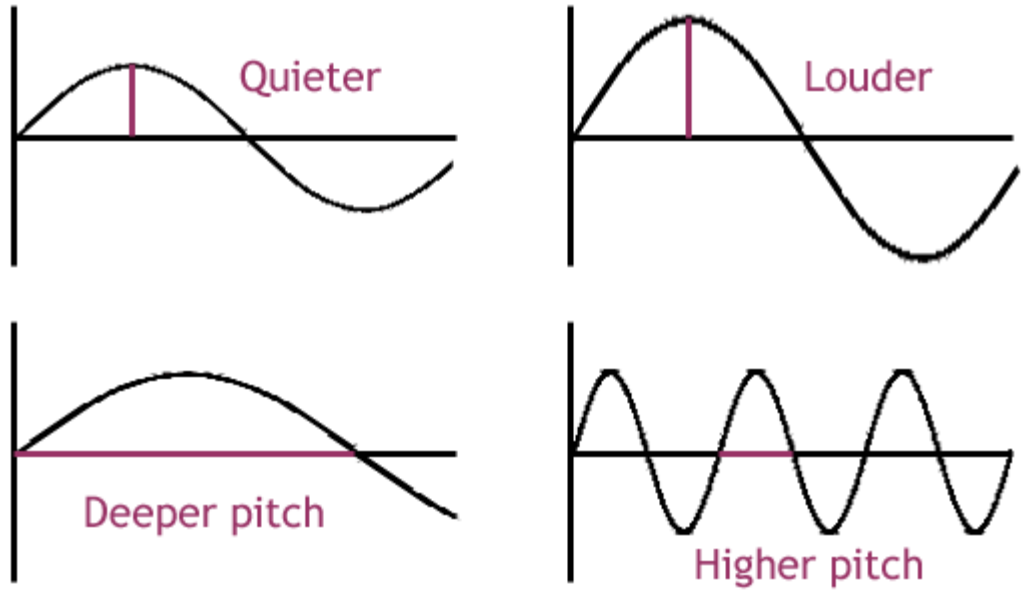
- Conduction Hearing Loss
  - hearing loss caused by damage to the mechanical system that conducts sound waves to the cochlea, example, a punctured eardrum, stiffening of the middle ear bones
- Nerve Hearing Loss (SENSORINEURAL)
  - hearing loss caused by damage to the cochlea's receptor cells or to the auditory nerve, caused by aging or prolonged exposure to loud noises

Hearing Review

The sense of hearing is also known as the AUDITORY system.

Sound travels in **waves** and aspects of these waves determine the sound we hear.

1) FREQUENCY -- (number of waves per second) determines the PITCH
2) AMPLITUDE -- (height of the wave) determines the VOLUME

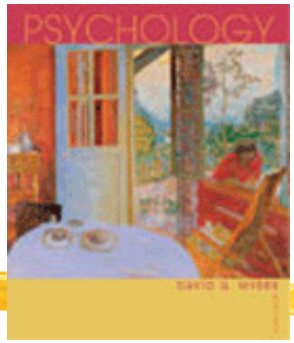


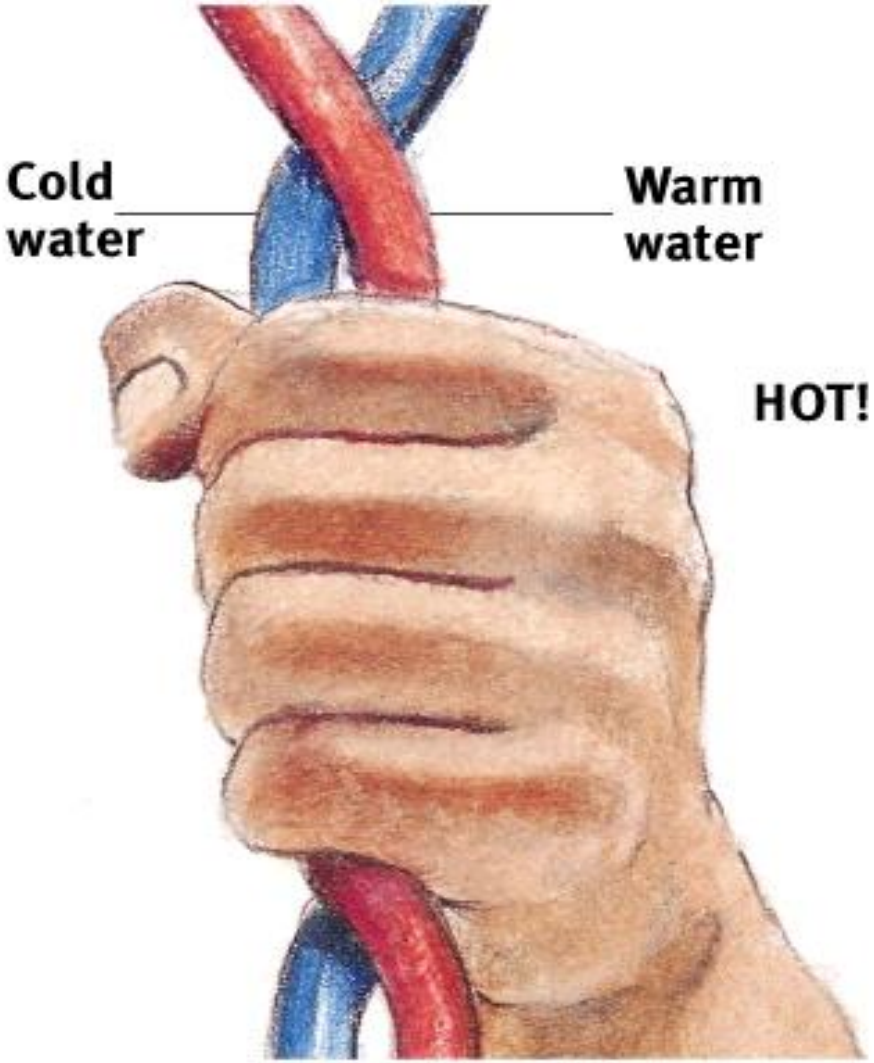
VESTIBULAR sense

– the sense of balance and equilibrium; controlled by the SEMI-CIRCULAR CANALS in the inner ear.

- Movement of fluid along hair cells located in the SEMI-CIRCULAR CANALS lets us know which way our head is tilted and whether or not we are moving. The spinning sensation you have immediately after spinning is caused by the fact that the fluid in the semicircular canals has not stops moving yet.

Touch



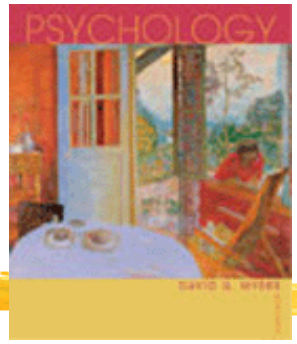


- Skin Sensations
  - pressure
    - only skin sensation with identifiable receptors
  - warmth
  - cold
  - pain

Pain

- Gate-Control Theory
  - theory that the spinal cord contains a neurological "gate" that blocks pain signals or allows them to pass on to the brain
  - "gate" opened by the activity of pain signals traveling up small nerve fibers
  - "gate" closed by activity in larger fibers or by information coming from the brain

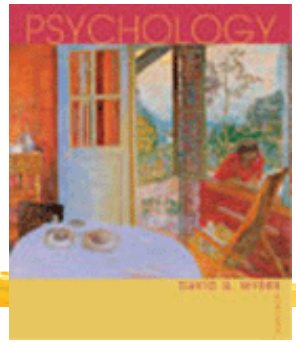
Taste

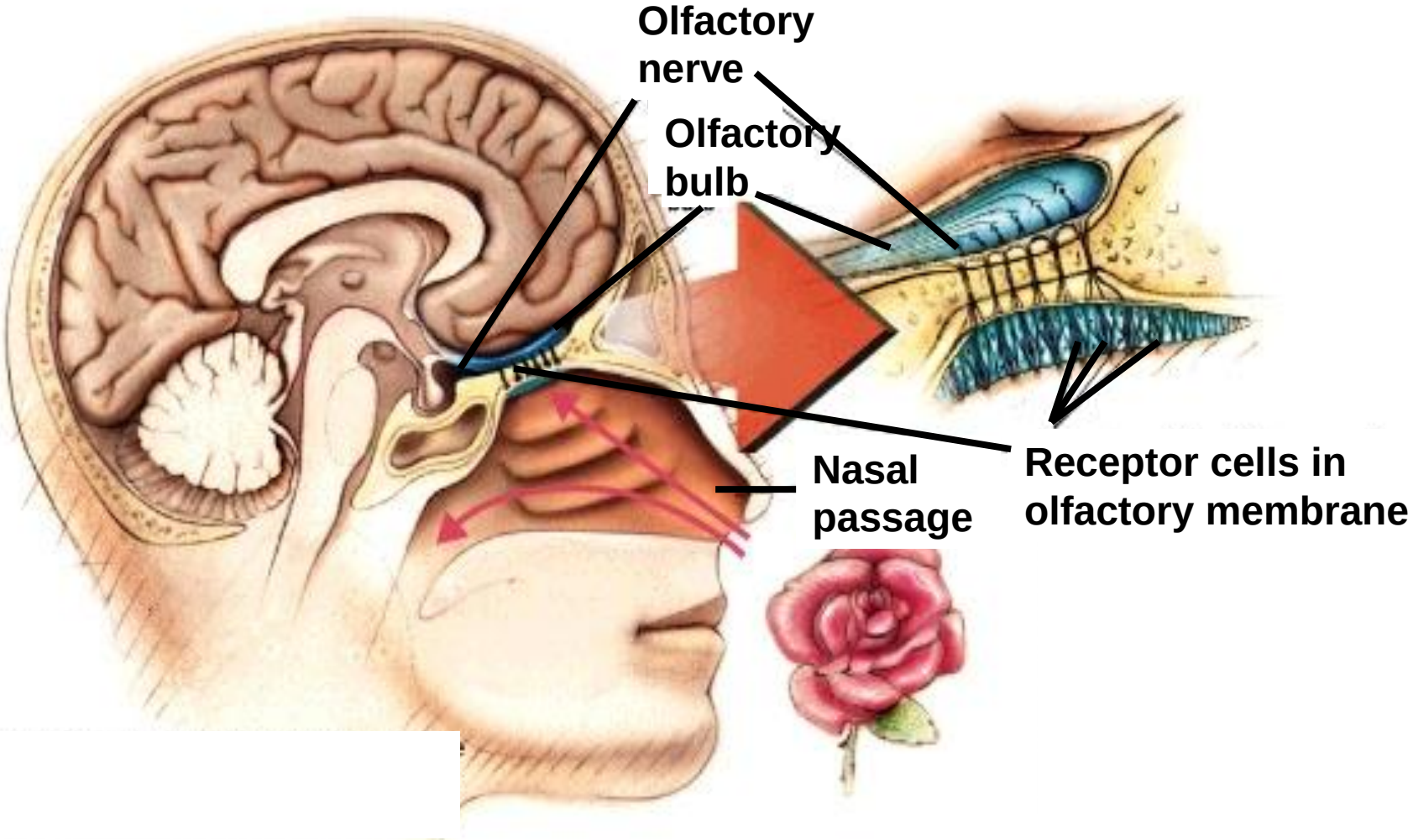


- Taste occurs when molecules are DISSOLVED in saliva and drip down to the GROOVES between the little bumps on your tongue where the taste buds are located. When molecules bind to the receptors, ACTION POTENTIALS are sent to the THALAMUS and then passed on regions of your cortex.
- Taste Sensations
  - sweet
  - sour
  - salty
  - bitter

- Sensory Interaction
  - the principle that one sense may influence another
  - as when the smell of food influences its taste

Smell

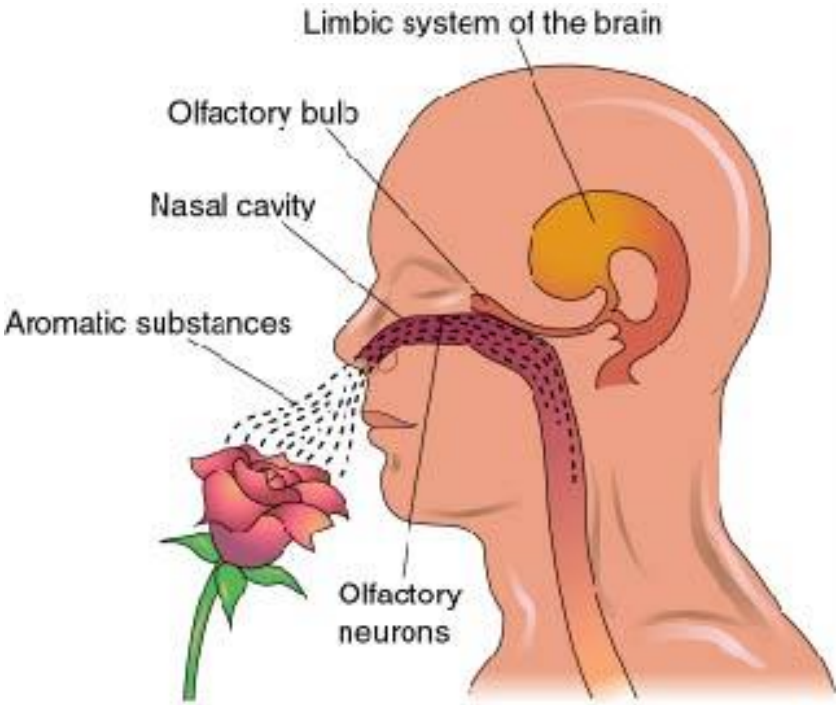

PSYCHOLOGY


Olfactory nerve
Olfactory bulb
Nasal passage
Receptor cells in olfactory membrane

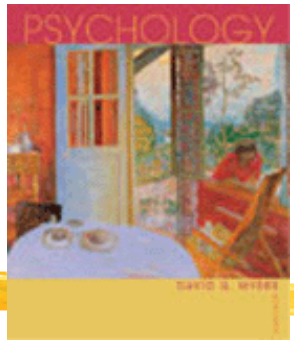
Smell

I **Smell** (also known as OLFACTION

- When we smell something, it is because MOLECULES in the air have entered our nasal passages and bind to SENSORY RECEPTORS. When bound, these cells send ACTION POTENTIALS to the brain via olfactory nerves. We have 5 million olfactory receptor cells with 1000 different receptor proteins. Different odors bind to different OLFACTORY RECEPTORS which is how the brain can distinguish the different smells.
- Unlike other senses, messages from the olfactory nerves go directly to the LIMBIC SYSTEM (without entering the THALAMUS first).



Body Position and Movement



- Kinesthesis
  - the system for sensing the position and movement of individual body parts.
  - The kinesthetic sense involves special sensory neurons, called PROPRIOCEPTORS which are located in muscles, joints, and the inner ear.

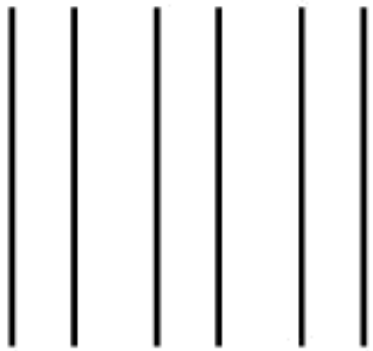
Perception

The process of organizing and interpreting information, enabling us to recognize meaningful objects and events.

Perceptual Organization- Gestalt

- Gestalt- an organized whole
  - tendency to integrate pieces of information into meaningful wholes
- Grouping Principles
  - proximity- group nearby figures together
  - similarity- group figures that are similar
  - continuity- perceive continuous patterns
  - closure- fill in gaps
  - connectedness- spots, lines and areas are seen as unit when connected

Perceptual Organization- Grouping Principles



Proximity

Similarity

Continuity

Connectedness

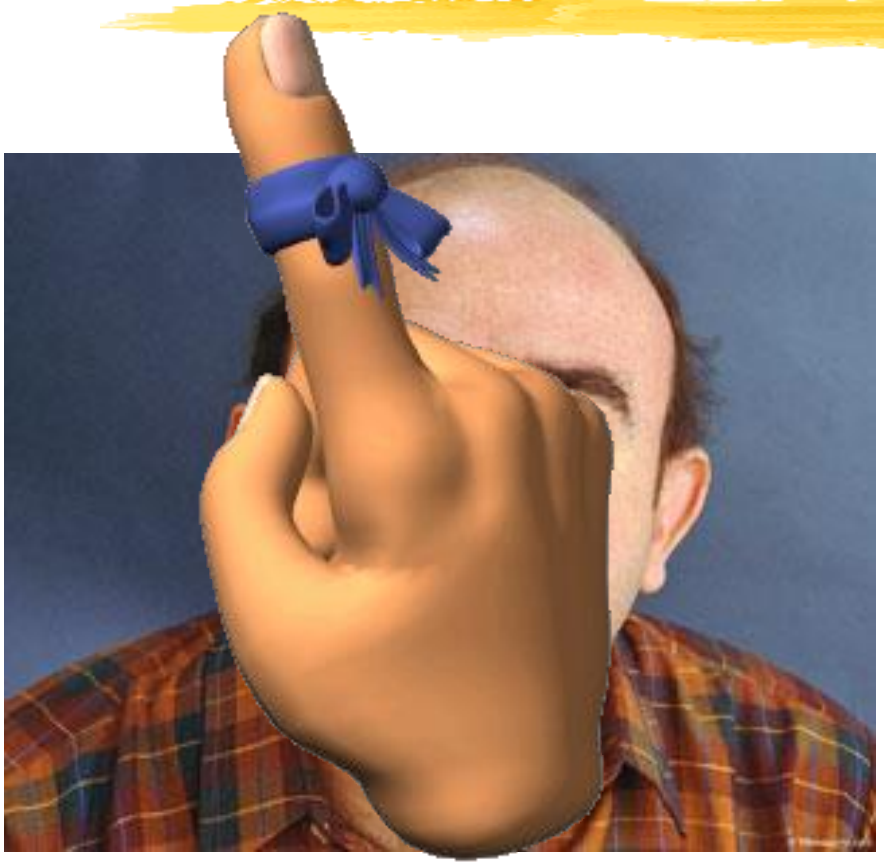
Figure Ground Relationship

Our first perceptual decision is what is the image and what is the background.

Perceptual Organization- Depth Perception

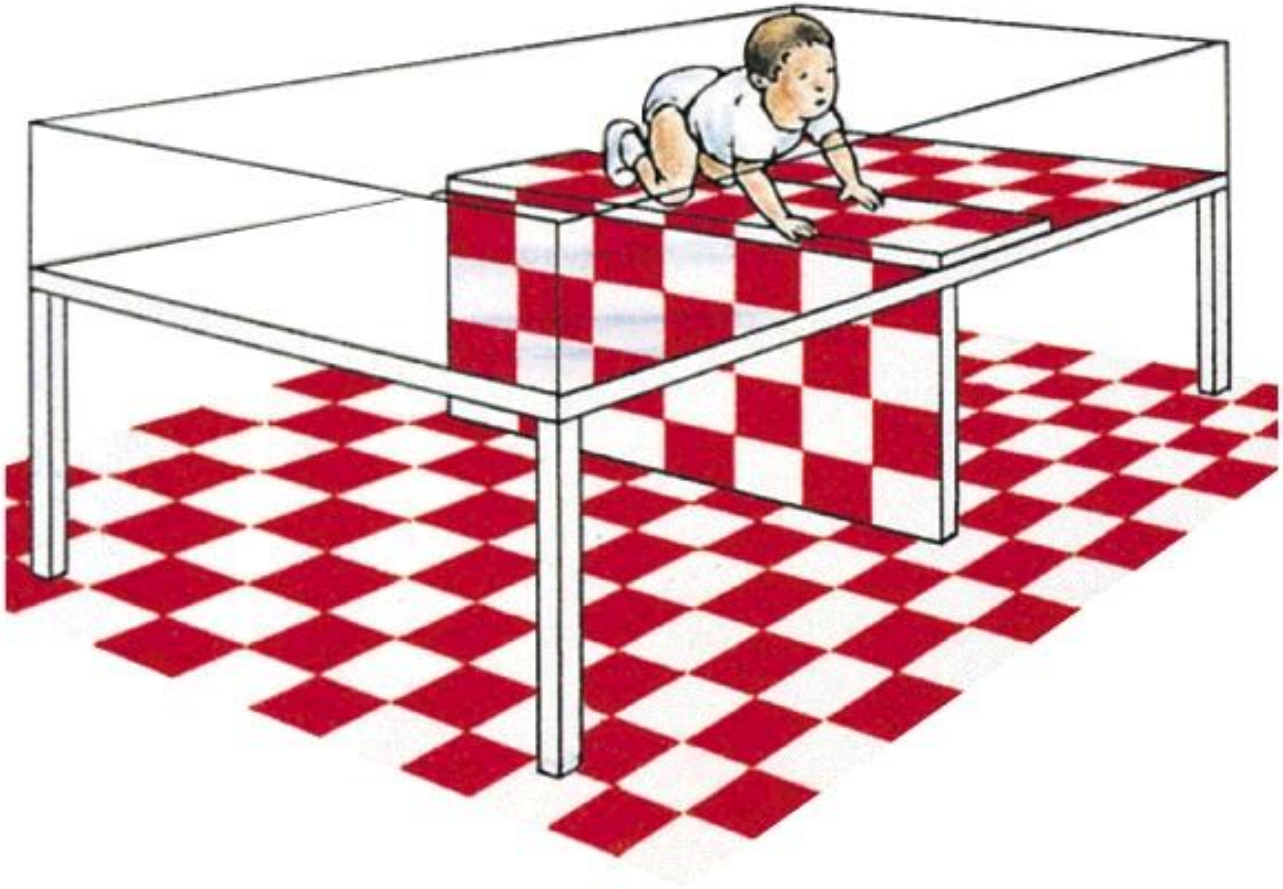
- Depth Perception
  - ability to see objects in three dimensions
  - allows us to judge distance
- Binocular cues
  - retinal disparity
    - images from the two eyes differ
    - closer the object, the larger the disparity
  - convergence
    - neuromuscular cue
    - two eyes move inward for near objects

Binocular Cues



- We need both of our eyes to use these cues.
- **Retinal Disparity** (as an object comes closer to us, the differences in images between our eyes becomes greater.
- **Convergence** (as an object comes closer our eyes have to come together to keep focused on the object).

Perceptual Organization-Depth Perception



Visual Cliff

Perceptual Organization- Depth Perception

- Monocular Cues
  - relative size
    - smaller image is more distant
  - interposition
    - closer object blocks distant object
  - relative clarity
    - hazy object seen as more distant
  - texture coarse --> close
    fine --> distant

Perceptual Organization-Depth Perception

Relative Size

Perceptual Organization-Depth Perception

Interposition

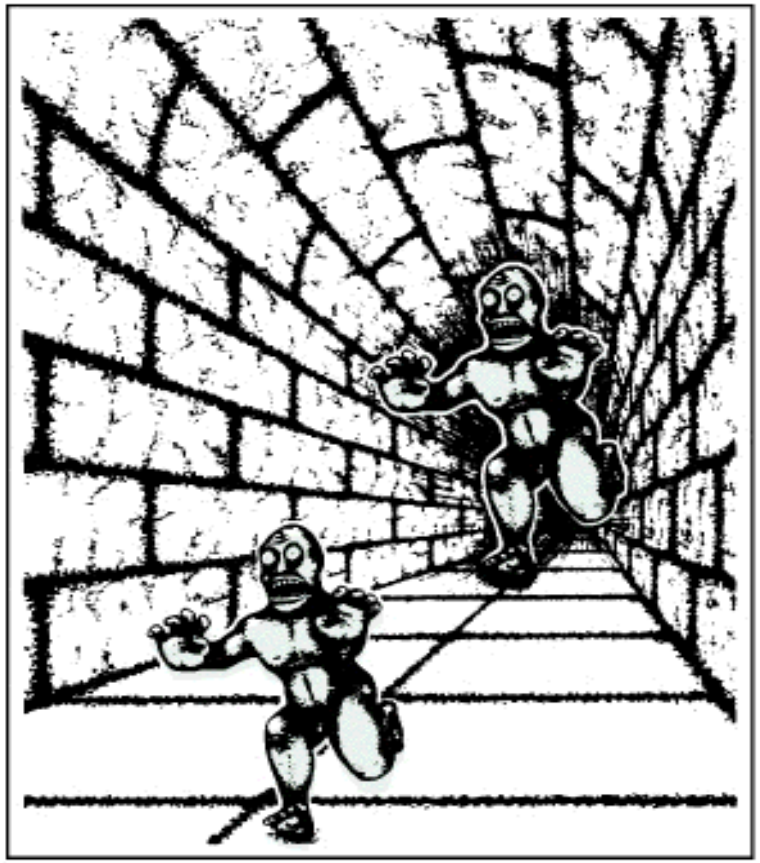
Perceptual Organization-Depth Perception

- Monocular Cues (cont.)
  - relative height
    - higher objects seen as more distant
  - relative motion
    - closer objects seem to move faster
  - linear perspective
    - parallel lines converge with distance
  - relative brightness
    - closer objects appear brighter

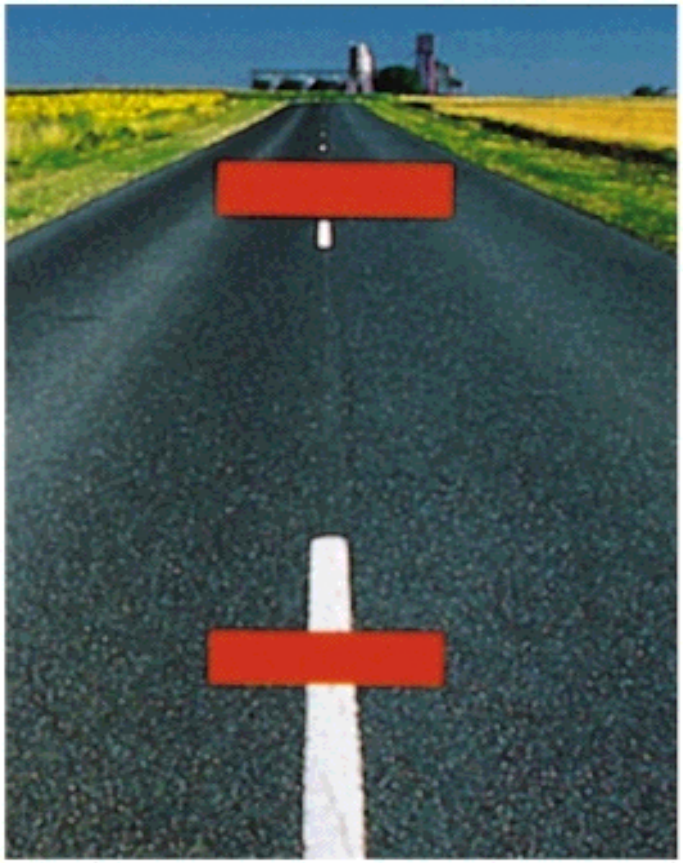
Perceptual Organization-Depth Perception

Perspective Techniques

Perceptual Organization

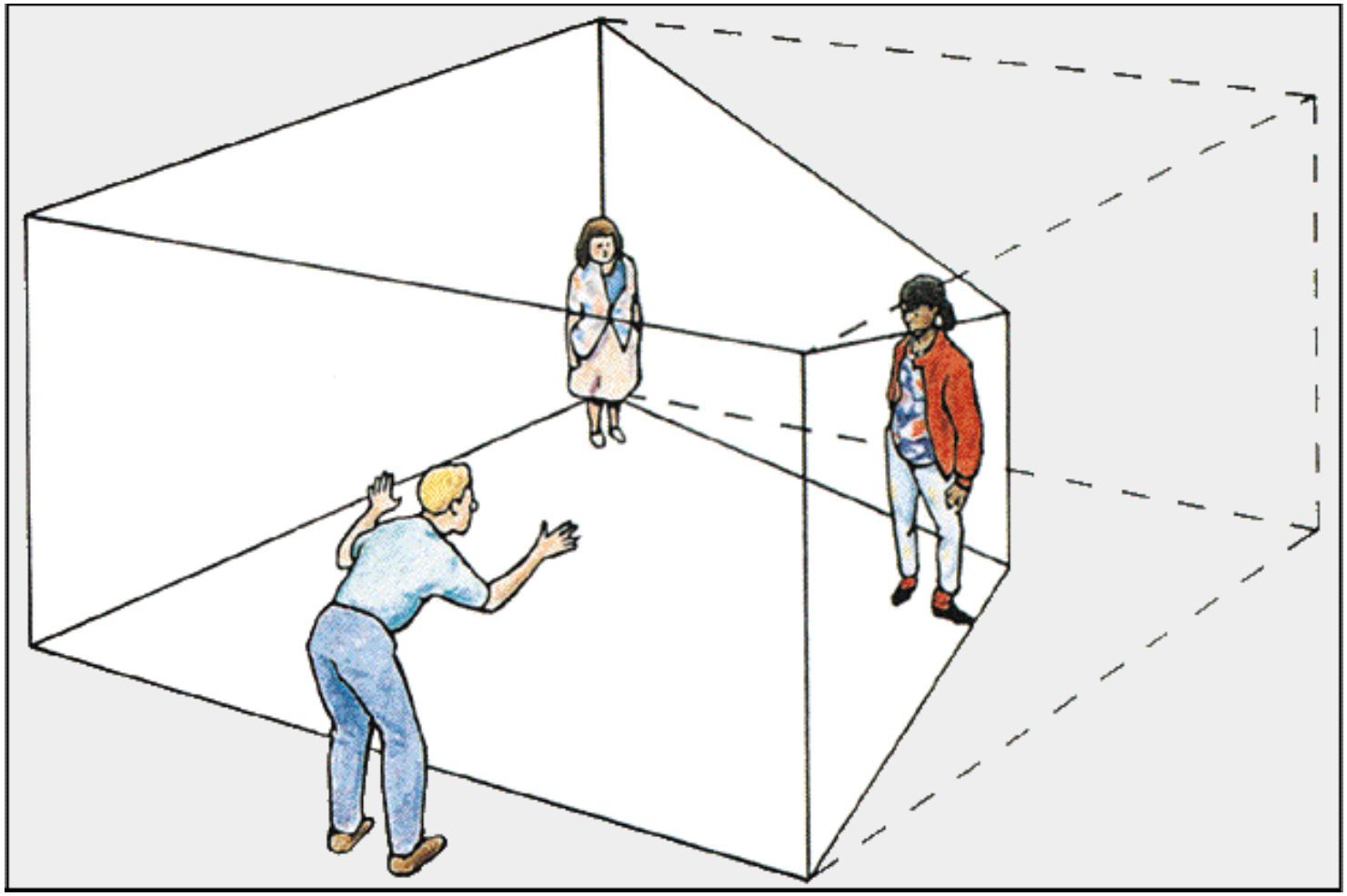


(a)



(b)

Perceptual Organization-Size-Distance Relationship



Perceptual Illusions

Perception without Sensation?

- Extrasensory Perception
  - controversial claim that perception can occur apart from sensory input
    - telepathy
    - clairvoyance
    - precognition
- Parapsychology
  - the study of paranormal phenomena
    - ESP
    - psychokinesis