



# Sensation and Perception



START  
HERE

# What will we learn in this chapter?



FINISH LINE

What is sensation and how does it enter the central nervous system?

What are sensory thresholds, and who were some of the early pioneers in the study of sensory thresholds?

What are some of the factors that influence our ability to perceive, and how do they relate to such concepts as sensory adaptation, intentional blindness, signal detection theory, and the Muller-Lyer illusion?

What is light, and what are the three aspects related to light?

How are “waves” related to vision and sound, and what is meant by amplitude, wavelength, and frequency?



**A face**

**An eskimo**

What do you see?

**Sensation** - the activation of receptors in the various sense organs

**Sensory receptors** - specialized forms of neurons that respond to specific types of stimuli



# SENSATION

**Sense organs:**

- eyes
- ears
- nose
- skin
- taste buds

**Transduction** - the conversion from sensory stimulus energy to action potential

# How Many Senses Do We Have?



Five basic senses:

Seeing (vision)

Hearing (audition)

Smell (olfaction)

Taste (gustation)

Touch (somatosensation)

Other senses:

Balance (vestibular sense)

Body position and movement (kinesthesia)

Pain (nociception-response to harmful or potentially harmful stimuli)

Temperature (thermoception)

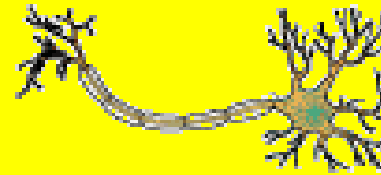
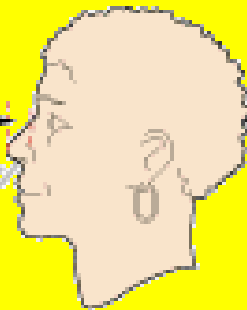


**Stimulus energy**  
Light, sound, smell, etc.

**Sensory receptors**  
Eyes, ears, nose, etc.

**Neural impulses**

**Brain**  
Visual, auditory, olfactory areas



**Sensation**

**Perception**

# Sensory Thresholds



**Sensory threshold** – lowest level of strength necessary for detection.

**Absolute threshold** - the smallest amount of energy needed for a person to consciously detect a stimulus 50 percent of the time it is present (nothing to something)

I.e. diming of a light



**Just noticeable difference (jnd, or the difference threshold)** - the smallest difference between two stimuli that is detectable 50 percent of the time

I.e. cell phone lighting – ability to detect illumination



# Just Noticeable Difference—An Example

---

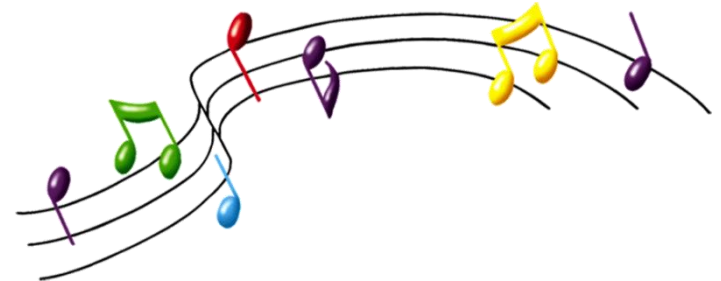


An individual is not likely to notice a slight, gradual increase in the volume of music if the change in volume remains below the threshold of detection. At a certain point, however, the individual notices that the volume of the music has increased. **The volume at which the increase was noticed demonstrates the concept of *just-noticeable difference*.**



In other words, the threshold of detection has been surpassed, and the individual is now able to perceive that a change in volume has occurred.

<https://www.youtube.com/watch?v=wVhiezByMSU>





# Perception and Processing of Sensory Information

Perception (psychological process)

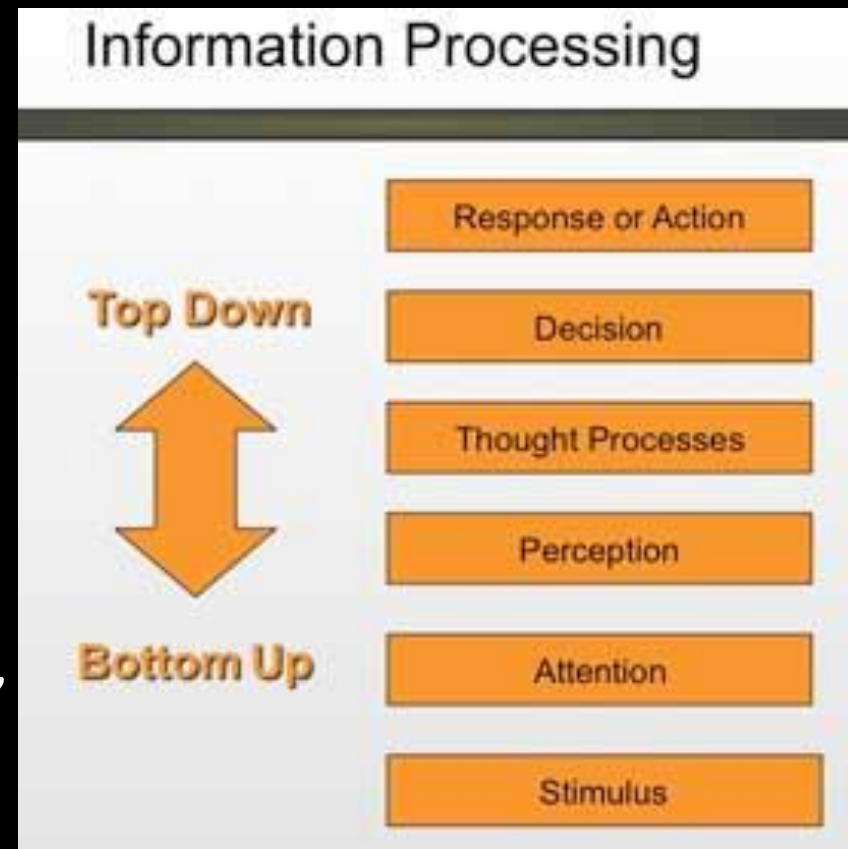
Sensory information → organized, interpreted, and experienced

## Bottom-up processing

perceptions are built from sensory input

## Top-down processing

perceptions are influenced by our available knowledge, experiences, and thoughts



# Perception and the Processing of Sensory Information—Try It

- ▶ Look at the image to the right. What do you see?
  - In *bottom-up processing*, the image is simply a meaningless blob, as there has been no context associated with the picture.
  - In *top-down processing*, you may see a woman's face or a man playing a saxophone because your brain is adding meaning to what you perceive based on what it already knows or expects.



# How Did I Not Notice That?

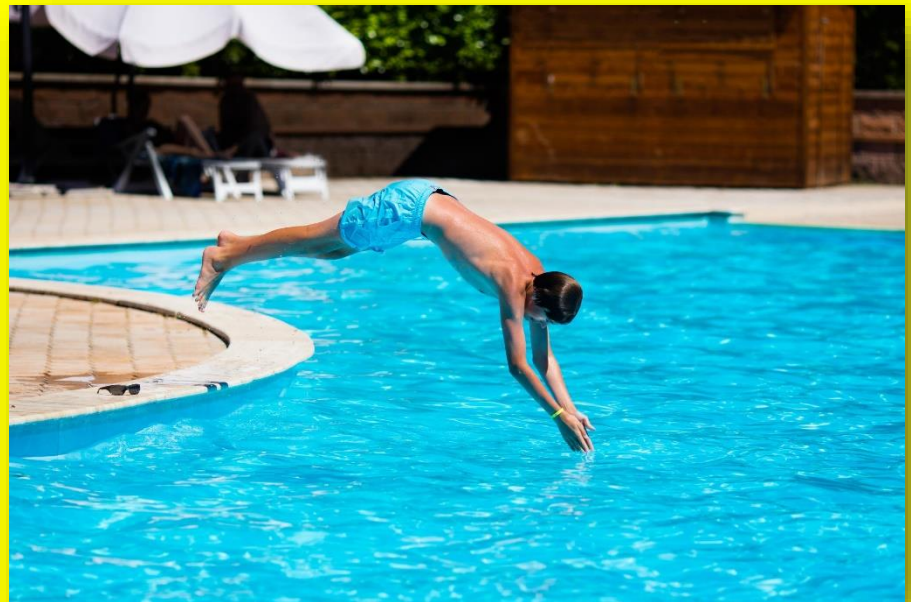
## Factors that Influence Perception



### Unchanging stimuli

**Sensory adaptation** - tendency of sensory receptor cells to become less responsive to a stimulus that is unchanging

- E.g., An individual speaking in a constant monotone voice (an unchanging tone) can often be unintentionally ignored.

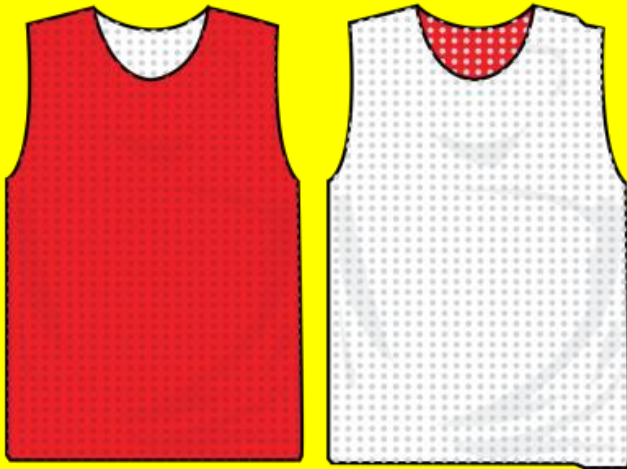


# How Did I Not Notice That?

## Factors that Influence Perception

🕒 **Inattention blindness** - failure to notice something that is clearly visible because of a lack of *attention*

*E.g., A saying commonly used to express this idea is, "If it was a snake, it would have bitten you."*



# How Did I Not Notice That?

## Factors that Influence Perception

### Motivation

**Signal detection theory** – the ability to identify a stimulus when it is imbedded in a distracting background (i.e. mailman)





**What affects our  
perception?**

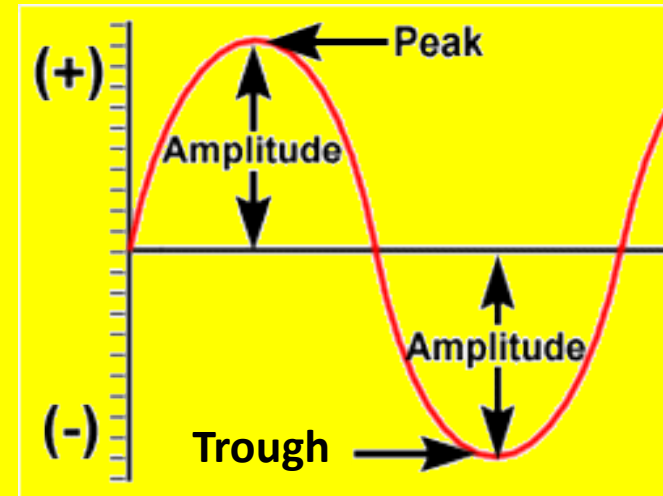
# Waves: Amplitude and Wavelength

Visual and auditory stimuli both occur in the form of waves.

There are two physical characteristics of visual and sound waves:

**Amplitude** - the height of a wave as measured from the highest point on the wave to the lowest point on the wave

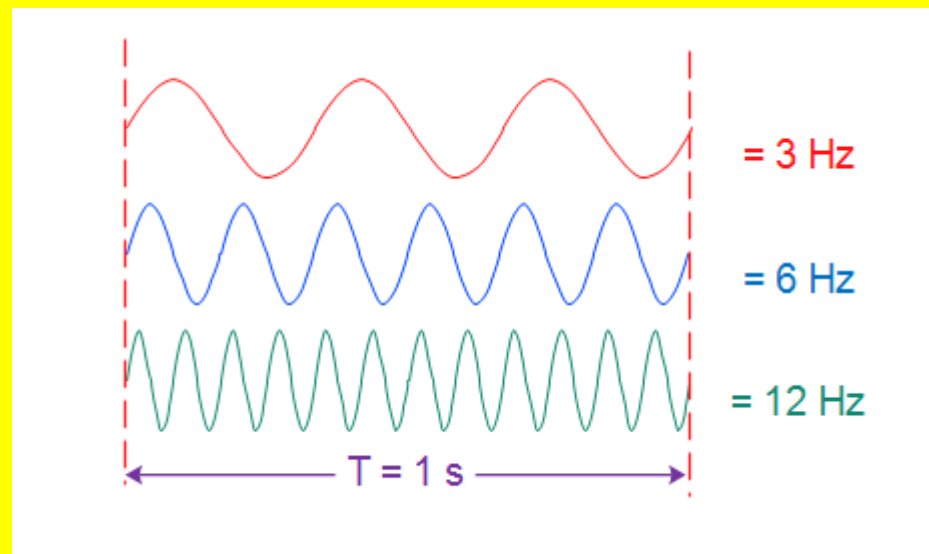
**Wavelength** – the length of a wave from one peak to the next



# Waves: Amplitude and Wavelength

**Frequency** - the number of waves that pass a given point in a given time period and is often expressed in terms of hertz (Hz), or cycles per second

Low Frequency?  
High Frequency?





# What is Sound? The Influence of Sound Waves on Hearing

## Three aspects of sound:

### Pitch

- Quality of sound
- Perception of sounds frequency

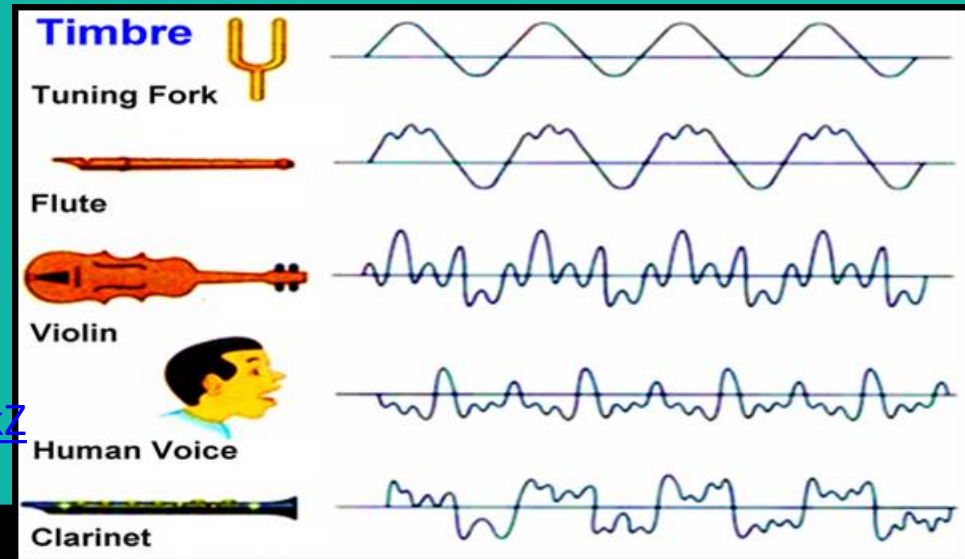
### Volume

- Determined by the amplitude (height) of the wave

### Timbre

- relates to the purity of the wavelengths
- Tone quality

<https://www.youtube.com/watch?v=5tGEDgkZIC8>



# What is Light? Aspects of Light

<https://www.youtube.com/watch?v=pvC9MQvqHMQ>

## Brightness

- high or how low the wave actually is (amplitude).
- The higher the wave, the brighter the light will be. Low waves are dimmer.

## Color

- or hue, is determined by the *length* of the wave

## Saturation

- Describes the intensity of purity
- Describes how “much” is absorbed



# Structure of the Eye

## Cornea

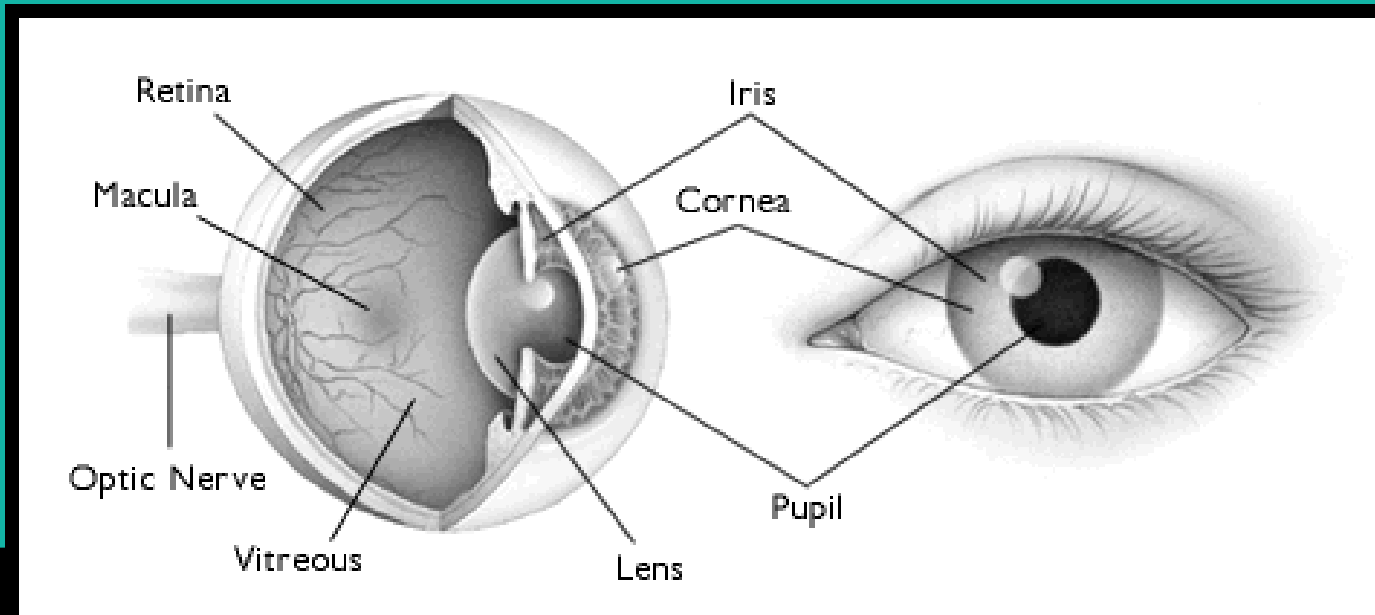
the transparent layer forming the front of the eye

## Pupil

the dark circular opening in the center of the iris of the eye, varying in size to regulate the amount of light reaching the retina

## Iris

can change the size of the pupil, letting more or less light into the eye; helps focus the image (shine light\iris larger; pupil get smaller protect retina



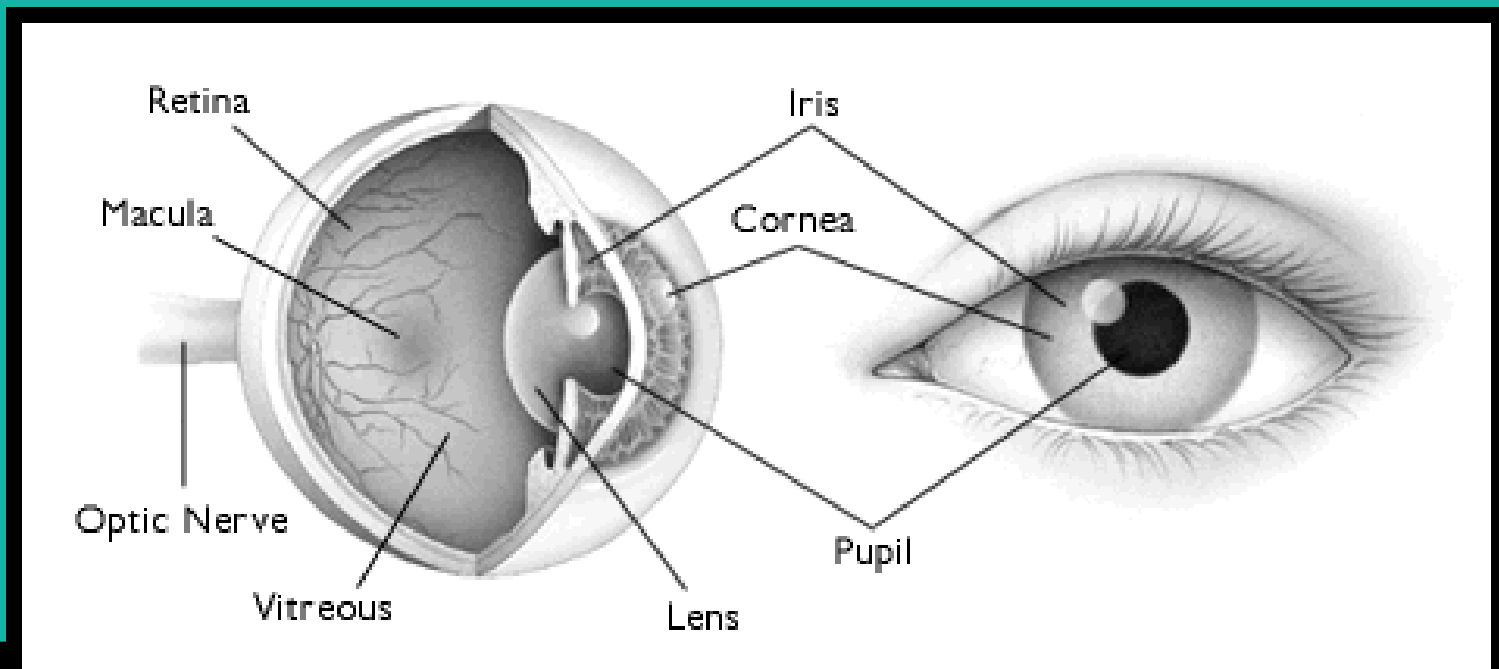
# Structure of the Eye

## Lens

clear structure behind the iris, suspended by muscles; finishes the focusing process begun by the cornea

## Retina

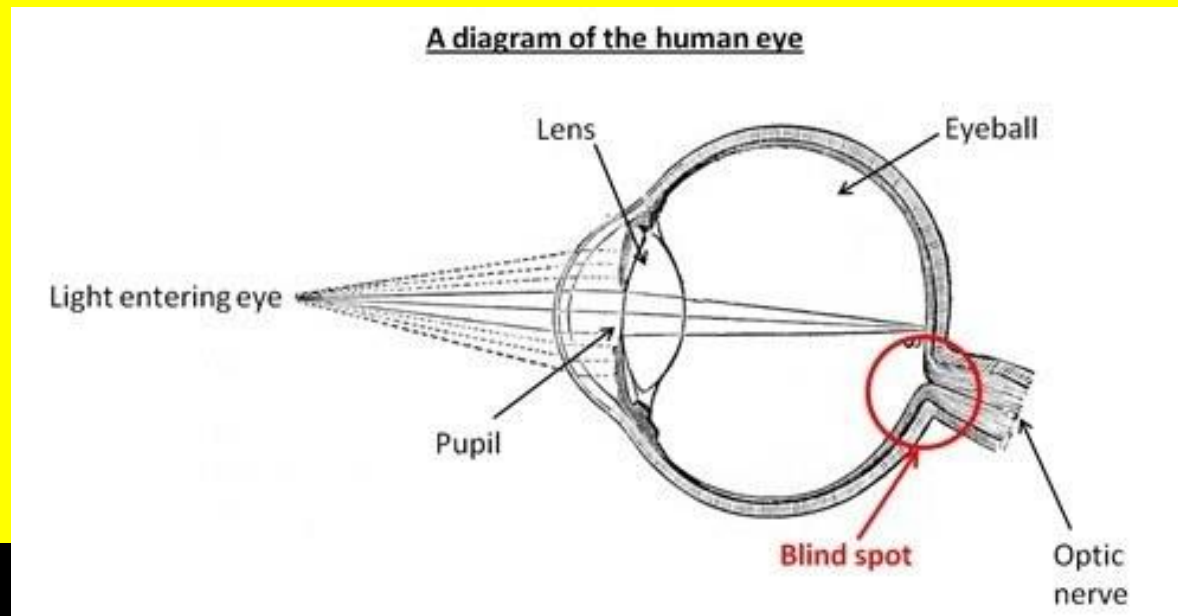
Light sensitive area of the eye



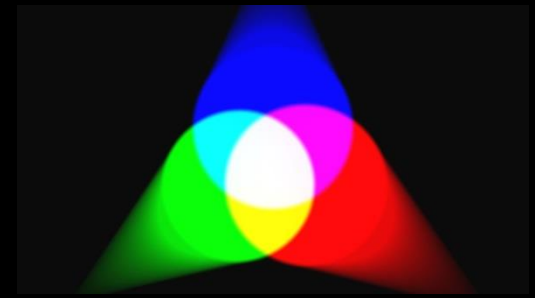
# Retina, Rods, and Cones

## Blind spot

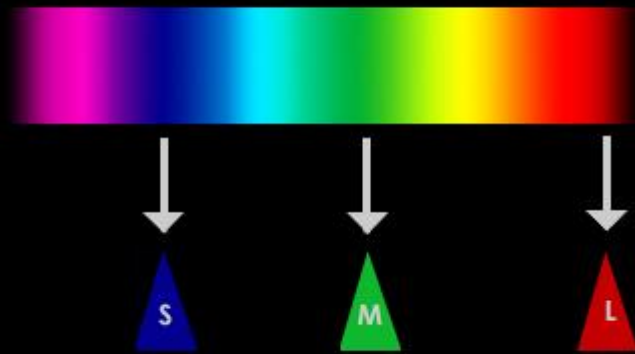
- small portion of the visual field of each eye
- within the retina
- there are no photoreceptors (i.e., rods or cones) in the optic disk, and, therefore, there is no image detection in this area.



# Color Vision



Trichromatic Theory



## Trichromatic theory

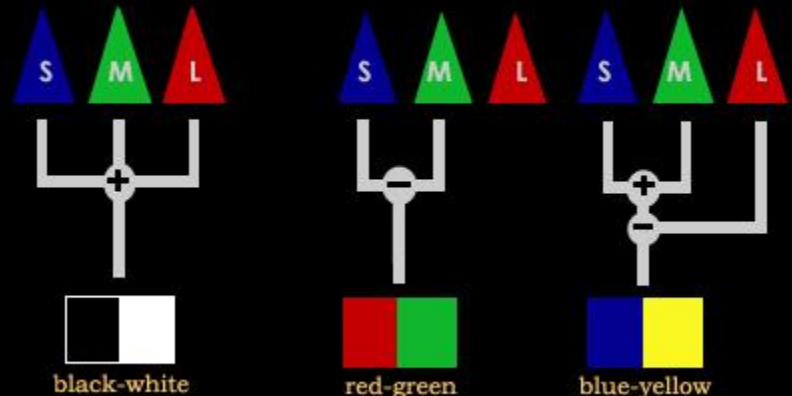
- theory of color vision
- types of cones: red, blue, and green (primary colors of light);
- the combination of cones and the rate at which they fire determine the color

## Opponent-process theory

theory of color vision that proposes four primary colors with cones arranged in pairs: (3 receptors) black and white, red and green, blue and yellow

• • • • •

Opponent-Process Theory



Achromatic System

Chromatic System

# DEPTH PERCEPTION



**Depth perception is the ability to perceive the world in three dimensions**

**Visual ability → distance**



# Pictorial depth cues



# Perceiving the world in three dimensions



# VISUAL ADAPTION

## Dark adaptation

the recovery of the eye's sensitivity to visual stimuli in darkness after exposure to bright lights (low intensities)

Night blindness



## Light adaptation

the recovery of the eye's sensitivity to visual stimuli in light after exposure to darkness

# Nearsightedness vs. Farsightedness



## Nearsightedness (myopia)

able to see objects clearly up close, but unable to focus on items further away

## Farsightedness (hyperopia)

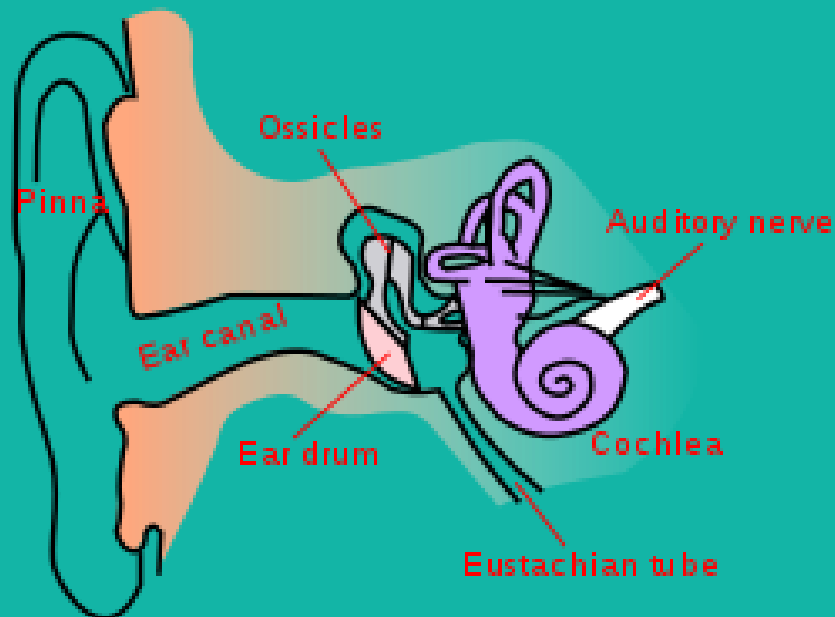
items far away are clear, but activities like reading and knitting are difficult, because nearby objects appear fuzzy or unfocused

# STRUCTURE

Of the Ear



- ▶ **Pinna** – visible part of the ear that protrudes from our heads
- ▶ **Auditory canal** - short tunnel that runs from the pinna to the eardrum



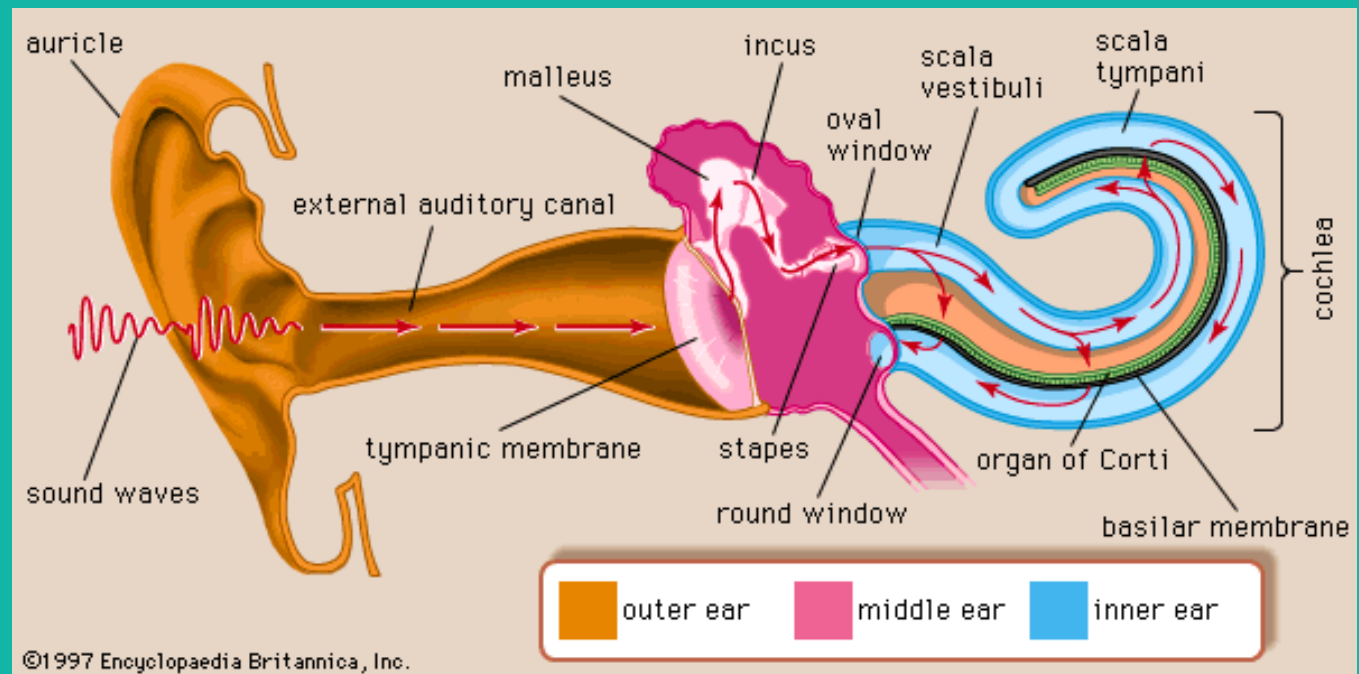
# STRUCTURE

Of the Ear



- ▶ **Tympanic membrane/Eardrum** - thin section of skin that tightly covers the opening into the middle part of the ear, just like a drum skin covers the opening in a drum
  - When sound waves hit the eardrum, it vibrates and causes three tiny bones in the middle ear to vibrate.

- Hammer
- Anvil
- Stirrup



# STRUCTURE

Of the Ear  
CONTINUED



## Cochlea

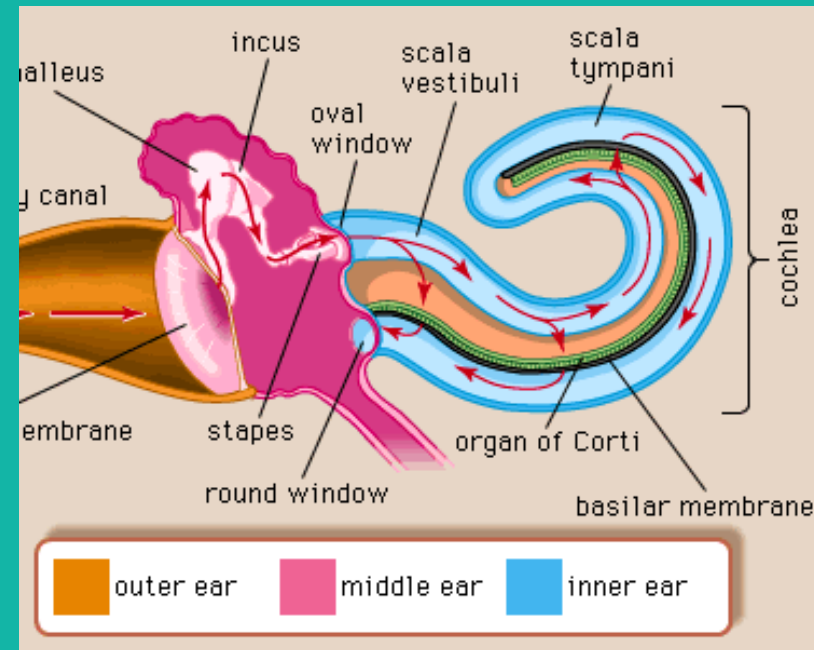
snail-shaped structure of the inner ear that is filled with fluid

## Basilar (bas-i-ler) membrane

a thin strip of tissue within the cochlea

## Organ of Corti (cor-tee)

rests in the basilar membrane; contains receptor cells for sense of hearing





## Types of Hearing Loss

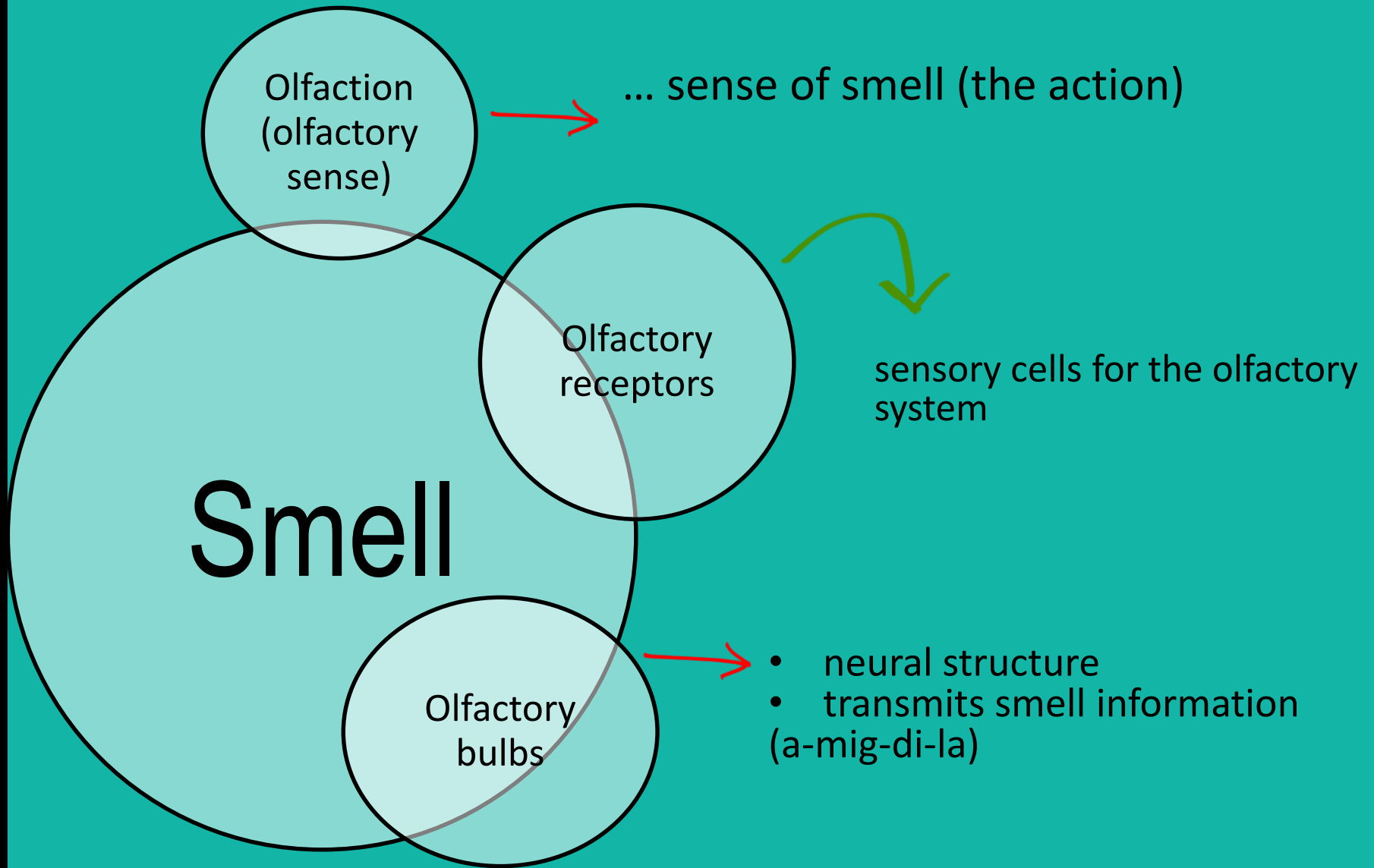
**Deafness** (or hearing loss) can involve a partial or complete inability to hear

**Congenital deafness** - hearing loss from birth

**Conductive hearing loss** - occurs from damage to the eardrum or the bones of the middle ear

**Sensorineural hearing loss** - occurs when the hearing problem is associated with a failure to transmit neural signals from the cochlea to the brain (viral infection i.e. meningitis)

Ordinary hearing aids are designed to assist with conductive hearing loss, whereas **cochlear implants** can be used to restore some hearing for people with nerve hearing impairment.



What happens if the Olfactory Bulbs are damaged?

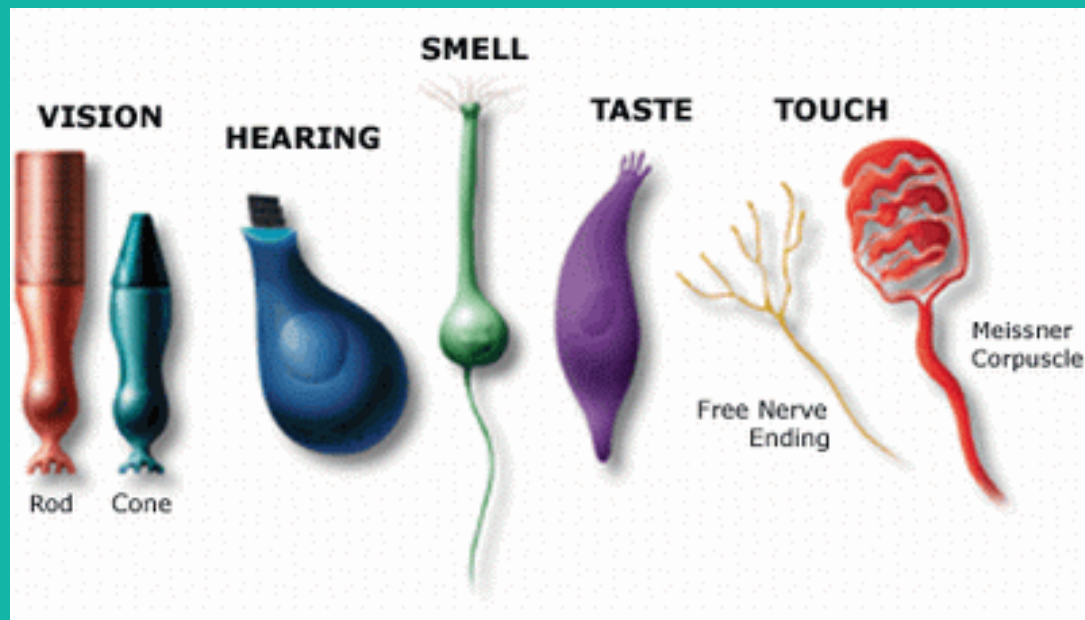
# Somesthetic senses

## Somesthetic senses

the body senses consisting of the skin senses, the vestibular sense, and the kinesthetic sense

Soma – body

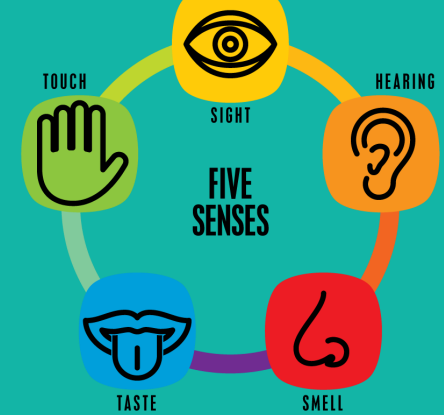
Esthetic – feeling





# Somesthetic senses

CONTINUED



## 1. Skin senses


- the sensations of touch, pressure, temperature, and pain
- Sensory receptors in the skin

## 2. Vestibular senses


- the sensations of movement, balance, and body posture

sensory conflict theory - an explanation of motion sickness in which the information from the eyes conflicts with the information from the vestibular senses, resulting in dizziness, nausea, and other physical discomforts (motion sickness)

### Vestibular Sense

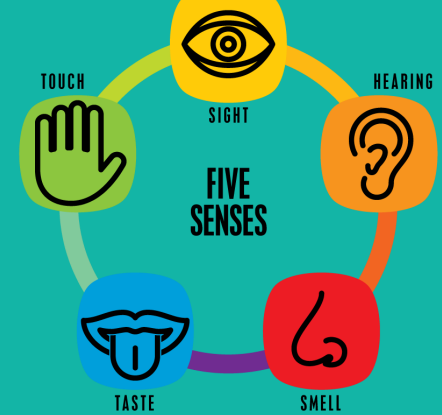


- **Vestibular Sense** - Enables you to sense your body position and balance
- Located in our **semicircular canals** in our ears.
- **Example:** Spinning around in a chair, you lose your vestibular sense



# Somesthetic senses

CONTINUED



## 3. Kinesthetic sense (kinesthesia)

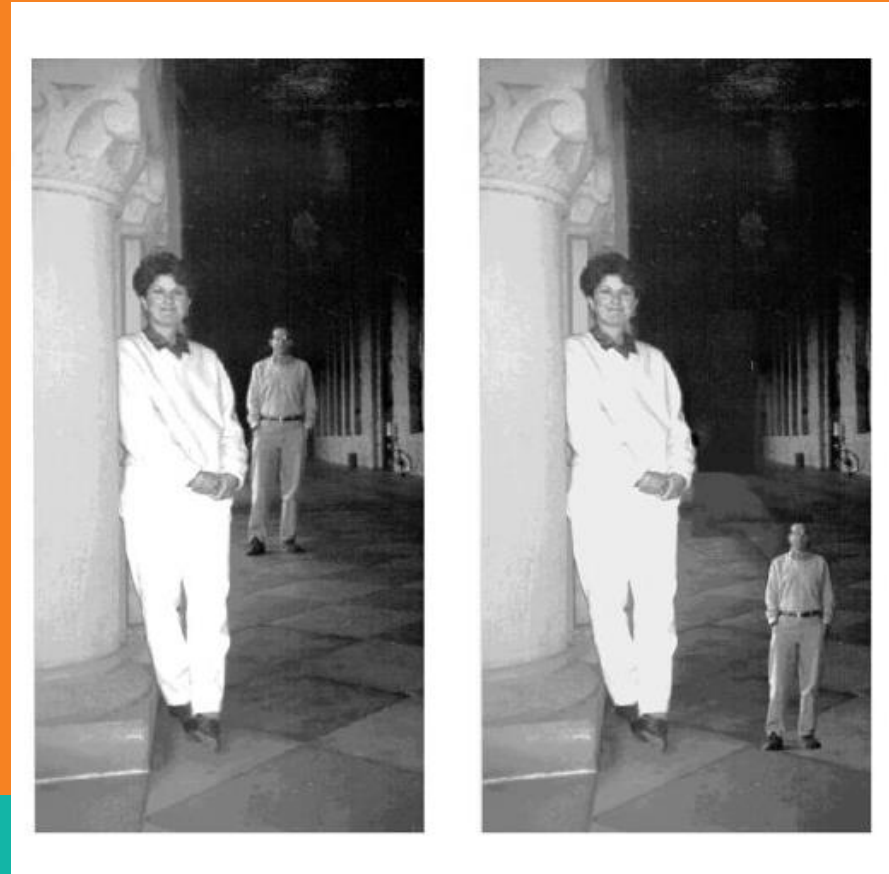
- tells us where our body parts are
- perception of the body's movement through space
- system for sensing the position and movement of individual body parts
  - Movement
  - Posture
  - Orientation



# Perception and Constancies



**Size constancy** - the tendency to interpret an object as always being the same actual size, regardless of its distance

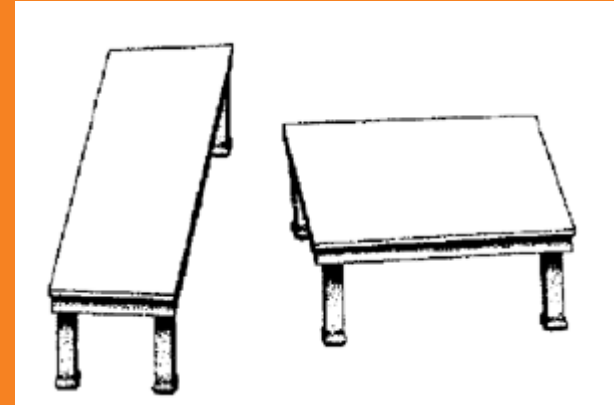


# Perception and Constancies



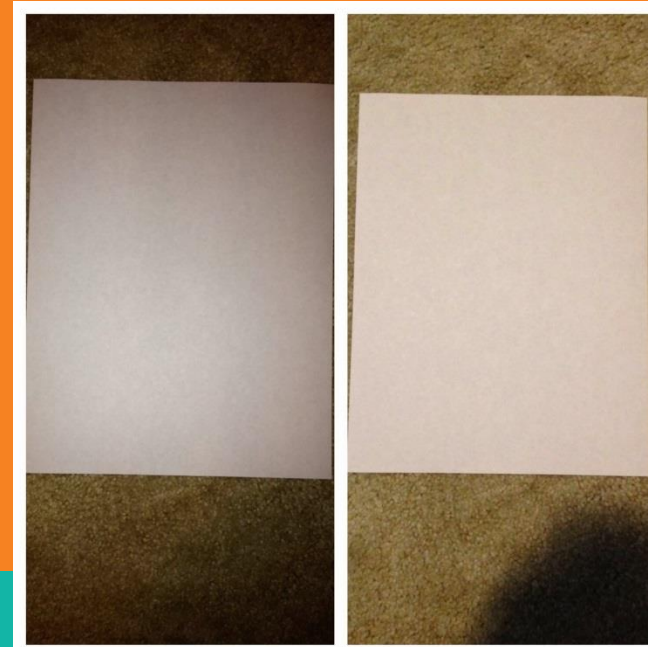
## Shape constancy

- the tendency to perceive the shape of a rigid object as constant despite differences in the viewing angle



## Brightness constancy

- the tendency for a visual object to be perceived as having the same brightness under widely different conditions of illumination



# Gestalt Principles

**GESTALT**

*noun* \ gə-'stält

understanding the whole,  
not merely the sum of  
its parts.

## Gesalt Psychology

- School of thought
- Looks at human mind and behavior
- Attempts to understand the laws of how we perceive things in the world
- Mind perceives objects of a greater whole
- Views objects in its simplest forms

## Figure-ground Relationship

- Perceptual grouping
- “Identifying a figure from the background”

**FIGURE 3.16 Figure-Ground Illusion**  
What do you see when you look at this picture? Is it a wine goblet? Or two faces looking at each other? This is an example in which the figure and the ground seem to “switch” each time you look at the picture.

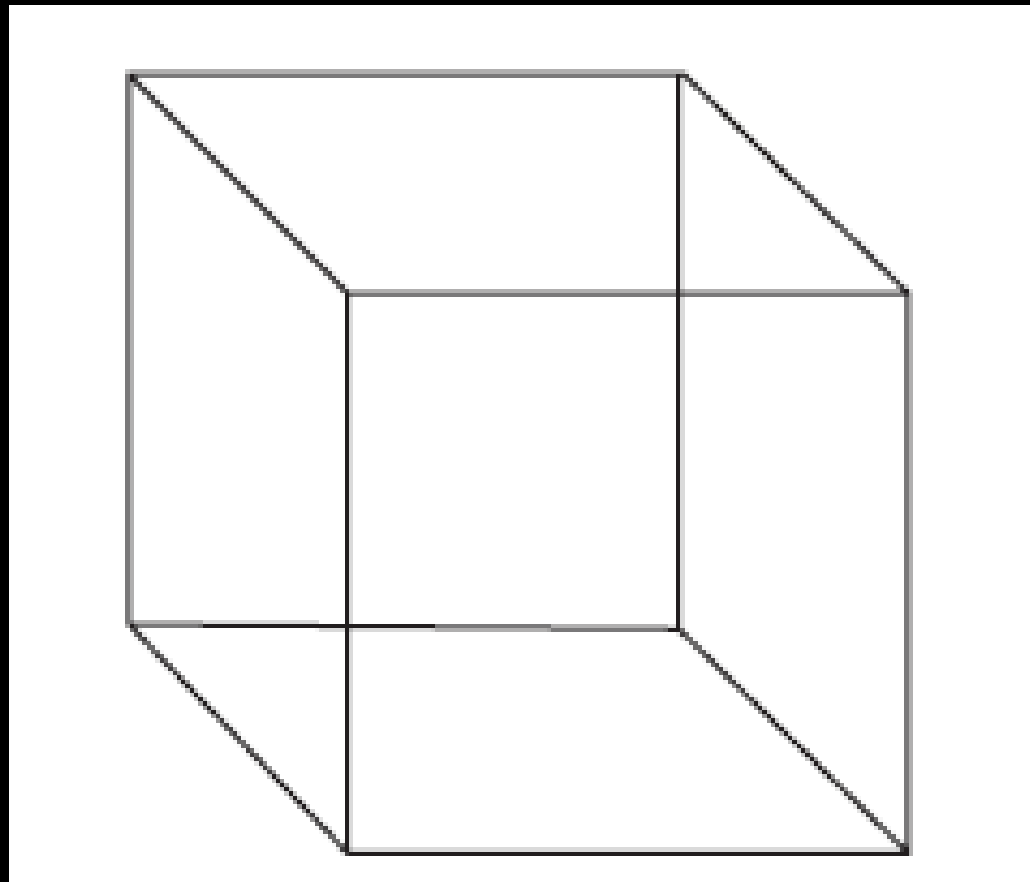
## **Gestalt Principles of Perception**



**FIGURE 3.15 The Necker Cube**

This is an example of a reversible figure. It can also be described as an ambiguous figure, since it is not clear which pattern should predominate.

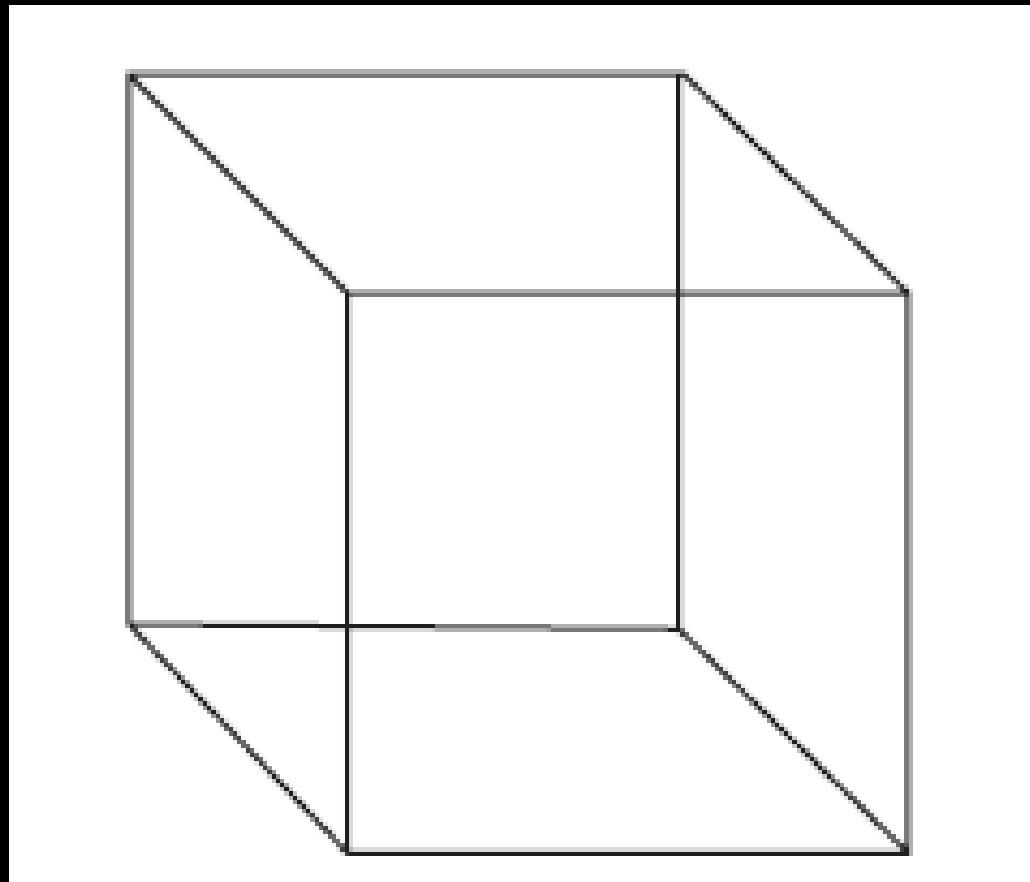
**Gestalt Principles  
of Perception**



**FIGURE 3.15 The Necker Cube**

This is an example of a reversible figure. It can also be described as an ambiguous figure, since it is not clear which pattern should predominate.

**Gestalt Principles  
of Perception**





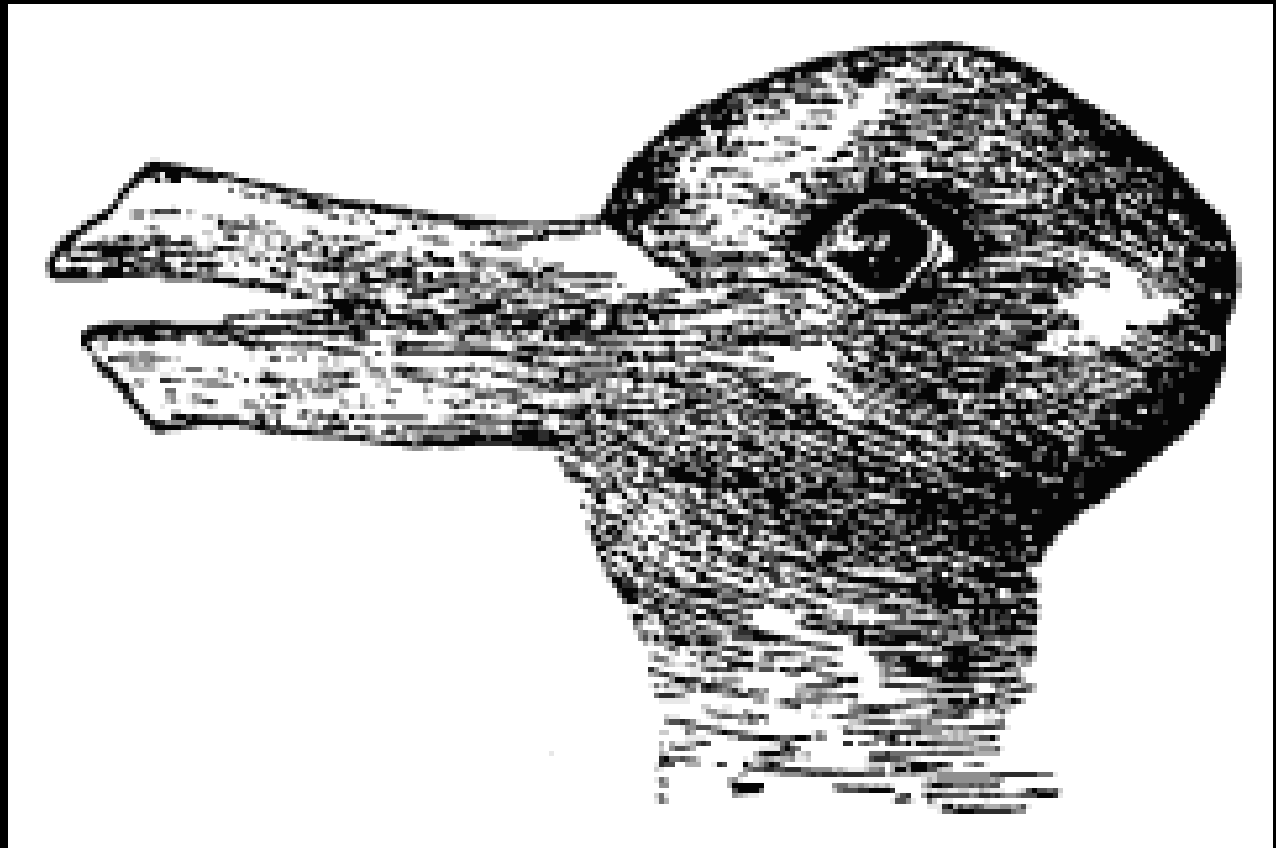
## Gestalt Principles of Perception

Do you see  
an old lady  
or a young  
lady?



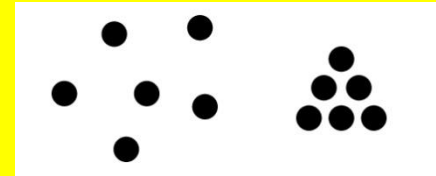
## Gestalt Principles of Perception

Do you see a  
rabbit or a  
duck?

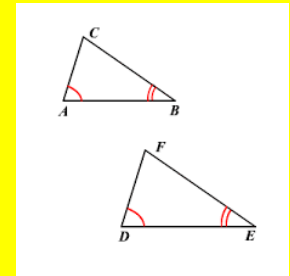


# Other Gestalt Principles

- **Proximity** – nearness, time, space, and relationship



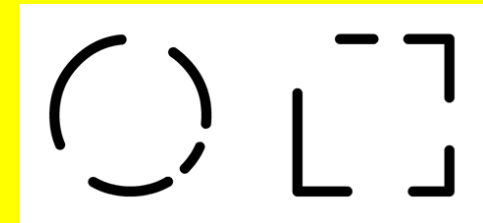
- **Similarity** - the tendency to perceive things that look similar to each other as being part of the same group



- **Continuity** – unbroken, continuous existence



- **Closure** - the tendency to complete figures that are incomplete



# Beyond Ordinary Sense



## Parapsychology

the study of ESP, ghosts, and other subjects that do not normally fall into the realm of ordinary psychology.

**Extrasensory Perception (ESP)** - claim of perception that occurs without the use of normal sensory channels such as sight, hearing, touch, taste, or smell

**Telepathy** - claimed ability to read another person's thoughts, or mind reading

E.g., John guessed the card that Ted was holding without physically seeing it.

# Beyond Ordinary Sense



**Clairvoyance** - supposed ability to “see” things that are not actually present

E.g., While in two different rooms, Kara saw her twin sister, Sara, cut her finger at the very moment it happened.

**Precognition** - supposed ability to know something in advance of its occurrence or to predict a future event

E.g., Joshua told his friend, Paula, to watch out for the red car. Two minutes later, Paula barely escaped being hit by a red car while crossing the street.