Unit 2 : Sensation and Perception

Standard

- SSPBF4: The student will describe how the physical world is translated into a psychological experience.
- A. Describe the basic structures of the eye and ear, the associated neural pathways, and the process of sensory transduction.
- B. Recognize causes which can lead to hearing and vision deficits; include environmental causes, aging, genetics, diet, disease, and trauma.
- C. Describe the major theories associated with visual and auditory sensation and perception; include opponent process theory, trichromatic theory of vision, frequency theory, volley theory, and place theory of hearing.
- D. Analyze different perceptual illusions and describe why illusions are important for our understanding of perception.
- E. Compare top-down and bottom-up processing.

Sensation & Perception

How do we construct our representations of the external world?

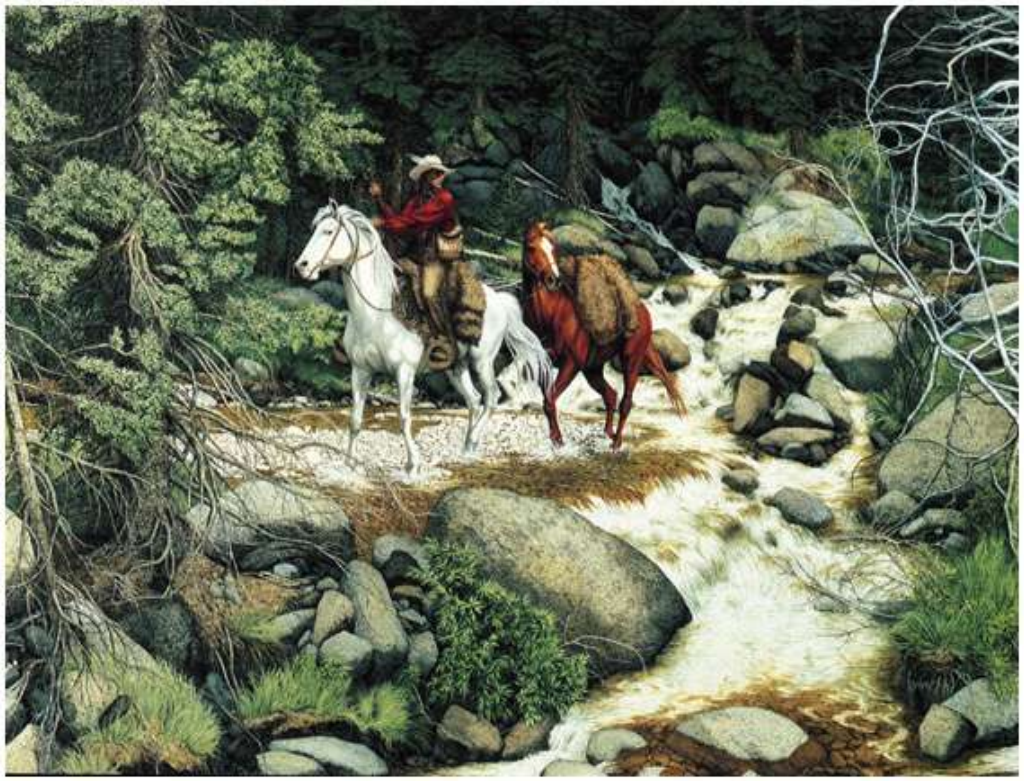
To represent the world, we must detect physical energy (a stimulus) from the environment and convert it into neural signals. This is a process called sensation.

When we select, organize, and interpret our sensations, the process is called perception.


Double-Double
BURGER

Making Sense of Complexity

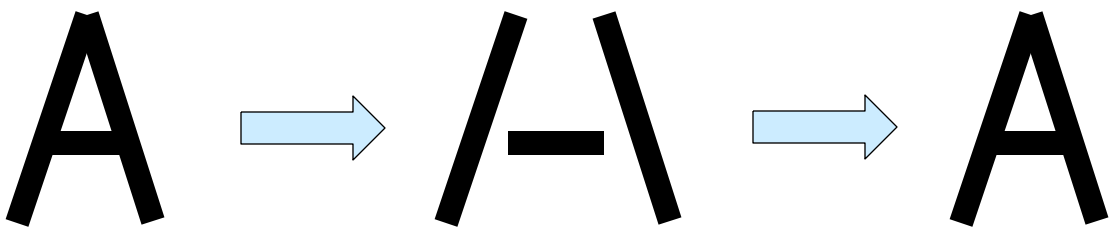
Our sensory and perceptual processes work together to help us sort out complex images.



"The Forest Has Eyes," Bev Doolittle

Bottom-up Processing (externally driven)

Analysis of the stimulus begins with the sense receptors and works up to the level of the brain and mind.



Letter “A” is really a black blotch broken down into features by the brain that we perceive as an “A.”

Top-Down Processing (internally driven)

Information processing guided by higher-level mental processes as we construct perceptions, drawing on our experience and expectations.

Eonverye taht can raed tihs rsaie yuor hnad..

- fi yuo cna raed tihs, yuo hvae a sgtrane mnid too
- Cna yuo raed tihs? Olny 55 plepoe out of 100 can.
- i cdnuolt blveiee taht l cluod aulaclty uesdnatnrd waht l was rdanieg. The phaonmneal pweor of the hmuan mnid, aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it dseno't mtaetr in waht oerdr the ltteres in a wrod are, the olny iproamtnt tihng is taht the frsit and lsat ltteer be in the rghit pclae.. The rset can be a taotl mses and you can sitll raed it whotuit a pboerlm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe. Azanmig huh? yaeh and l awlyas tghuhot slpeling was ipmorantt!

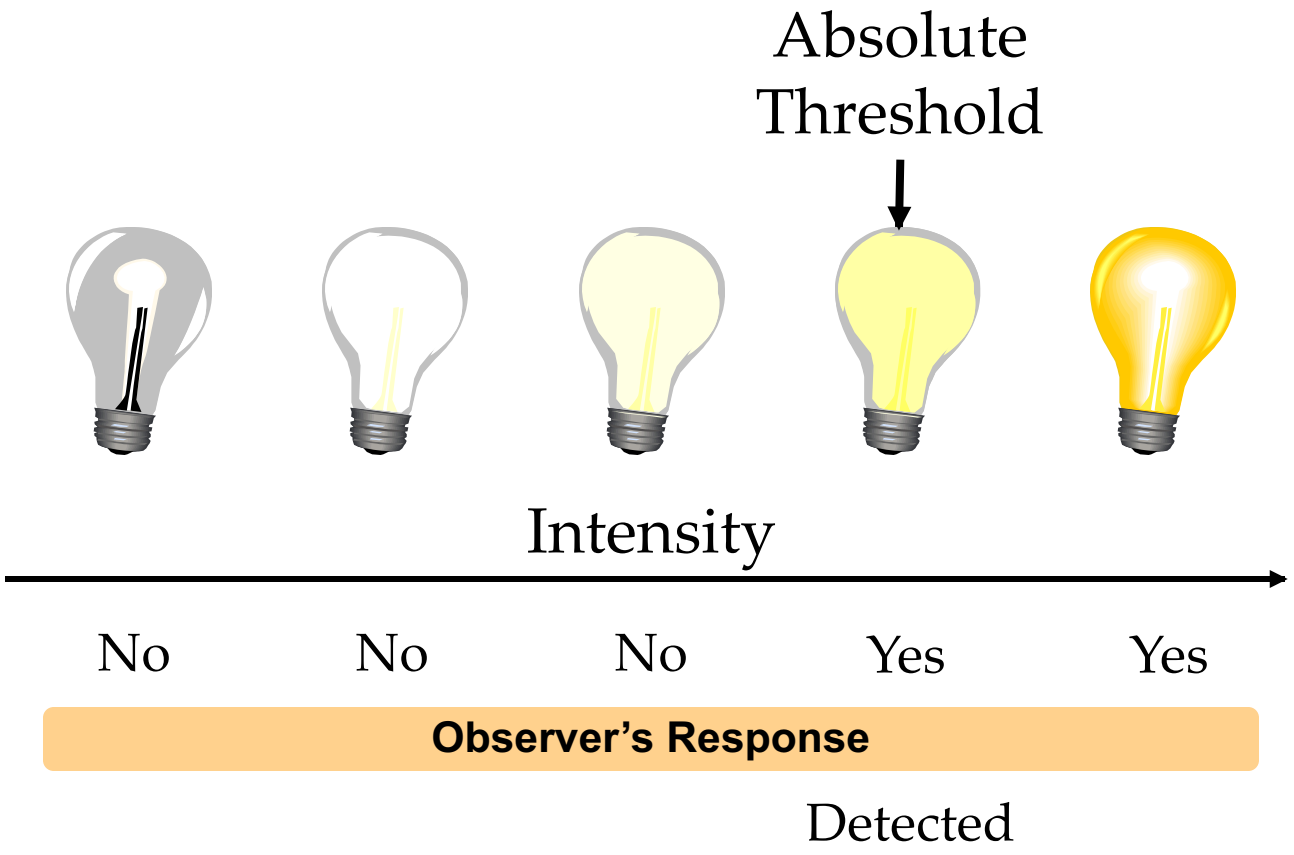
Pair Learning

- Working with a partner… come up with your own examples for top-down and bottom-up processes

Transduction

In sensation, the transformation of stimulus energy (sights, sounds, smells) into neural impulses.

Detection



Tell when you (the observer) detect the light.

Absolute Threshold

- is the level of stimulus that produces a positive response of detection 50% of the time

- Ex. Vision-seeing a candle flame 30 miles away on a clear night
- Ex. Auditory-hearing a watch ticking 20 feet away

Difference Threshold

- Minimum amount of difference a person can detect between two stimuli
- **Weber's law**- the larger or stronger a stimulus, the larger the change required to notice anything has happened to it

Sensory Adaptation

Diminished sensitivity as a consequence of constant stimulation.

Put a band aid on your arm and after awhile you don't sense it.

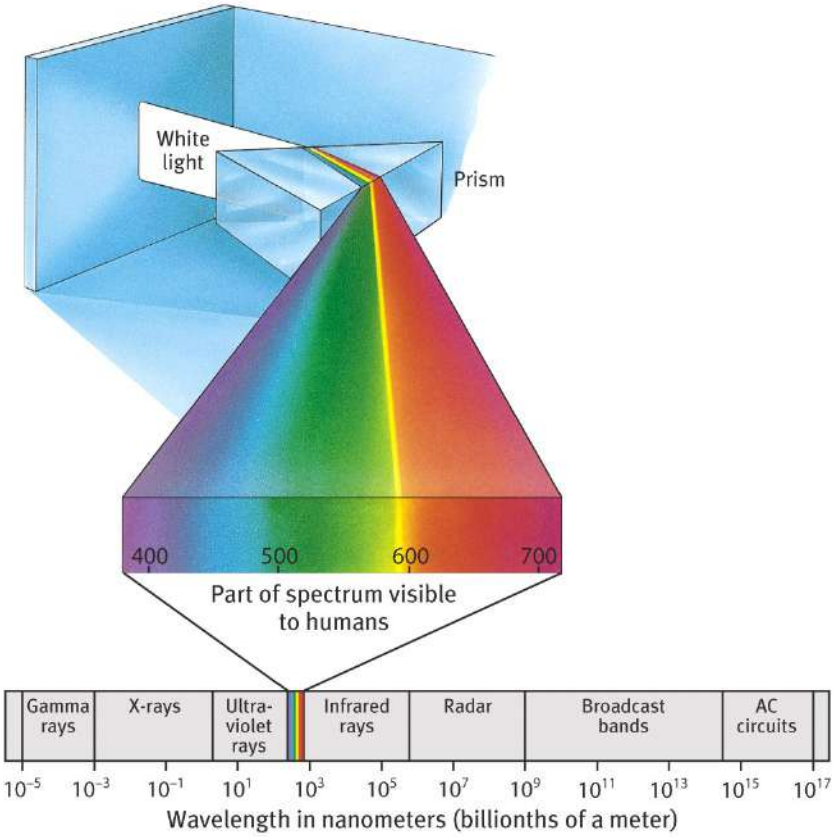
Synesthesia

- Synesthesia is a kind of crossing of sensory signals in which the stimulation of one sense evokes another;
  - purple may smell like kiwi
  - a spoonful of mango sorbet makes the wall turn lime green, rippled with cherry-red stripes.
  - estimate that roughly 1 in 2,000 people has the condition
  - Psychologists believe synesthesia is caused by genetic mutations that create dense neural connections between areas of the brain that process sensory information
  - https://www.youtube.com/watch?v=a3DbScY8Ais

Vision

Vision

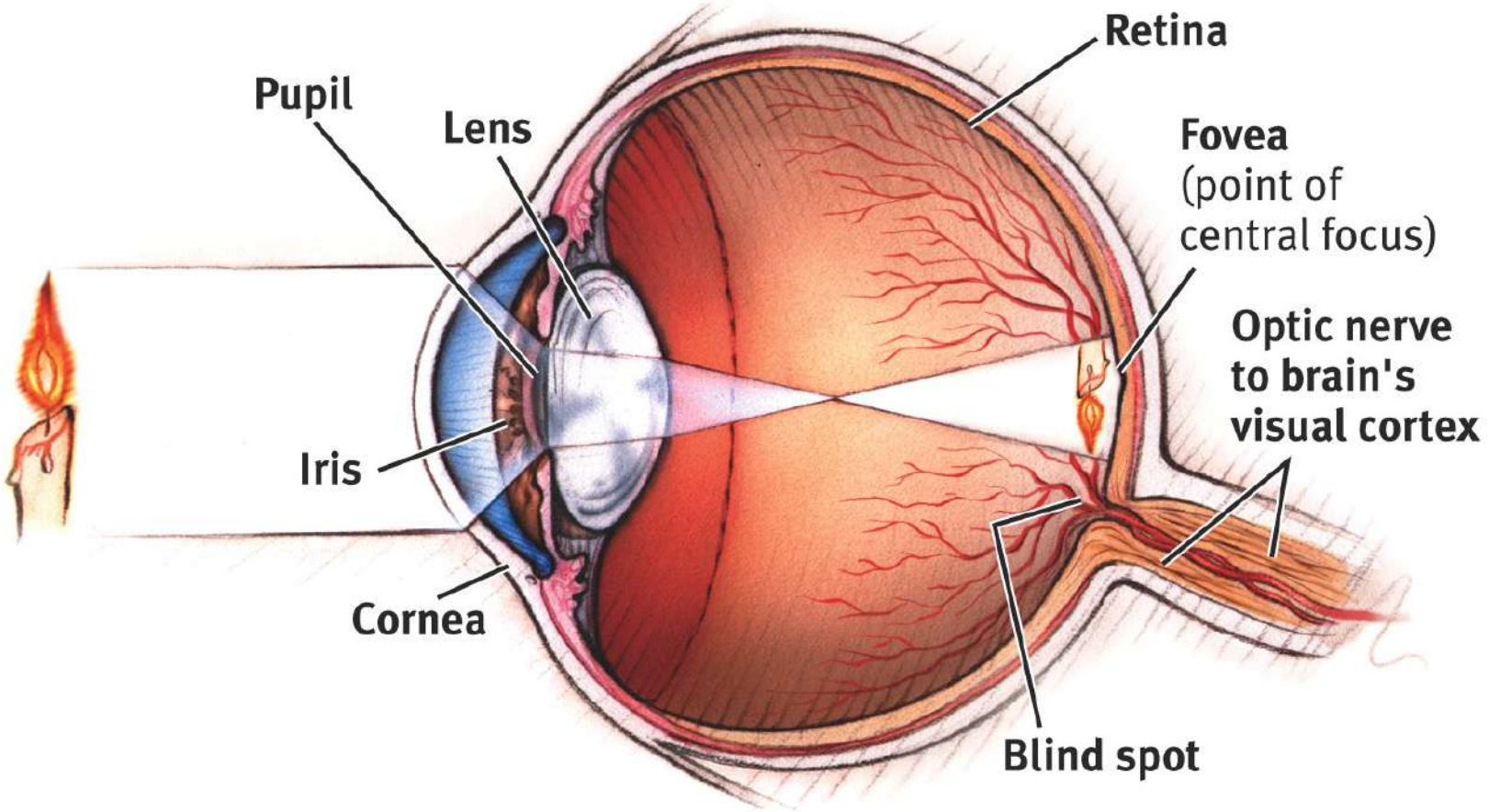
- Begins with light entering the eye
  - Human photoreceptors in the eye are sensitive to wavelengths of light energy called the visible spectrum which ranges from red to violet



Light Characteristics

1. Wavelength (hue/color)
2. Intensity (brightness)
3. Saturation (purity)

The Eye


Retina
Pupil
Lens
Fovea
(point of
central focus)
Optic nerve
to brain's
visual cortex
Iris
Cornea
Blind spot

Parts of the eye

1. Cornea: Transparent tissue where light enters the eye.
2. Pupil: Opening in the iris that regulates the amount of light that enters the eye.
3. Iris: Muscle that expands and contracts to change the size of the opening (pupil) for light.
4. Lens: Focuses the light rays on the retina.
5. Retina: Contains sensory receptors that process visual information and sends it to the brain.

Ammons, Shannon
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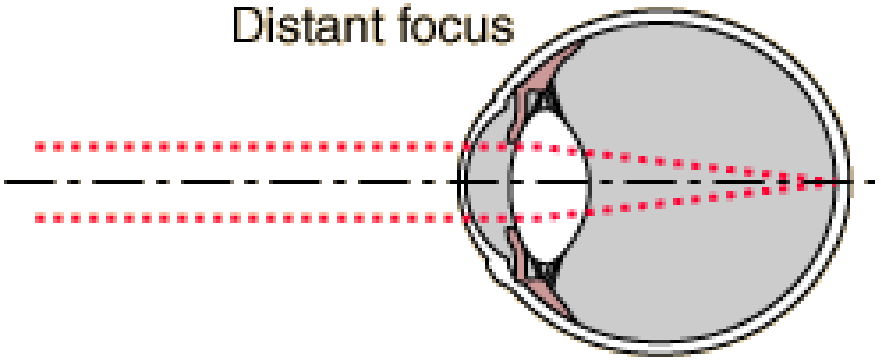
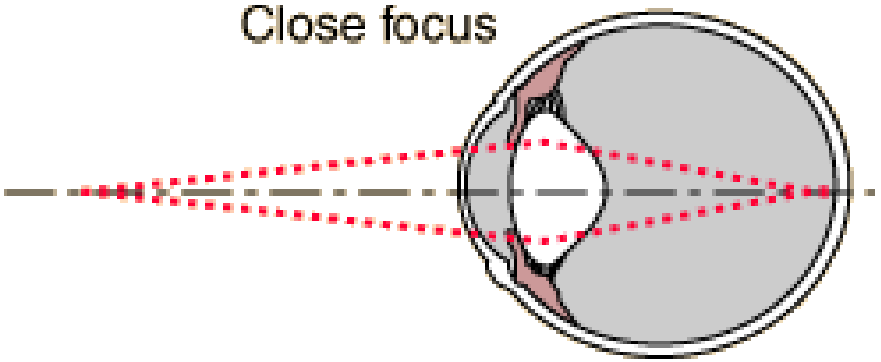
The Lens

Lens: Transparent structure behind the pupil that changes shape to focus images on the retina.

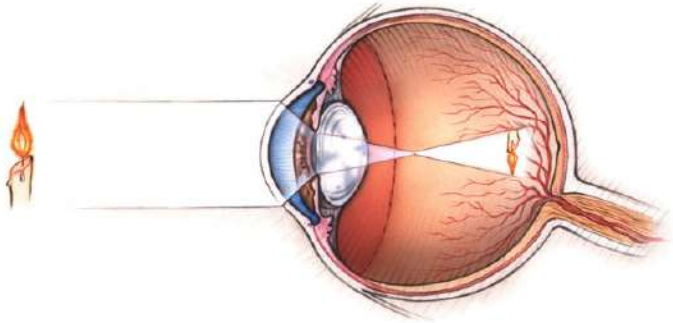


Accommodation: The process by which the eye's lens changes shape to help focus near or far objects on the retina.



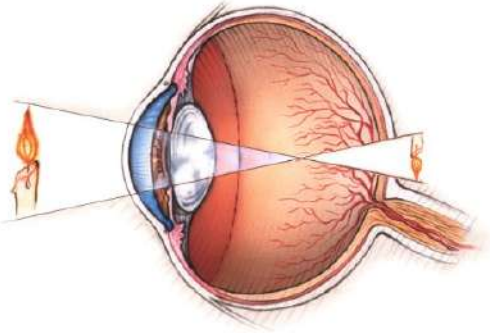
The Lens

Nearsightedness: A condition in which nearby objects are seen more clearly than distant objects.



Nearsighted vision

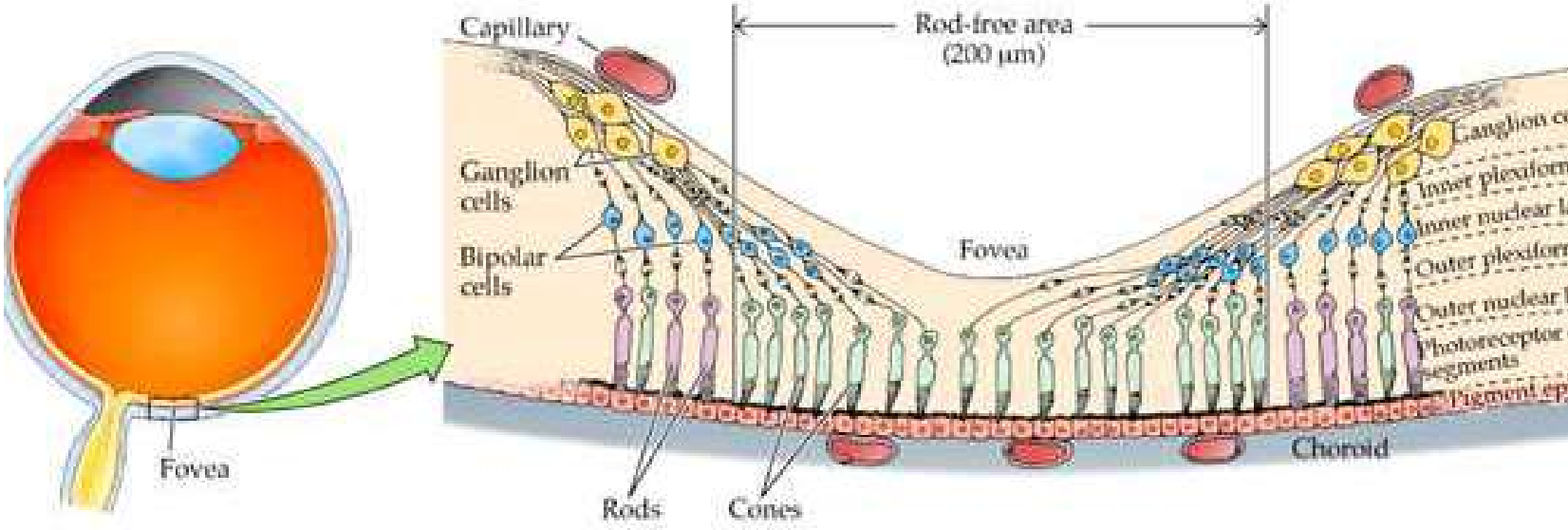
Farsightedness: A condition in which faraway objects are seen more clearly than near objects.



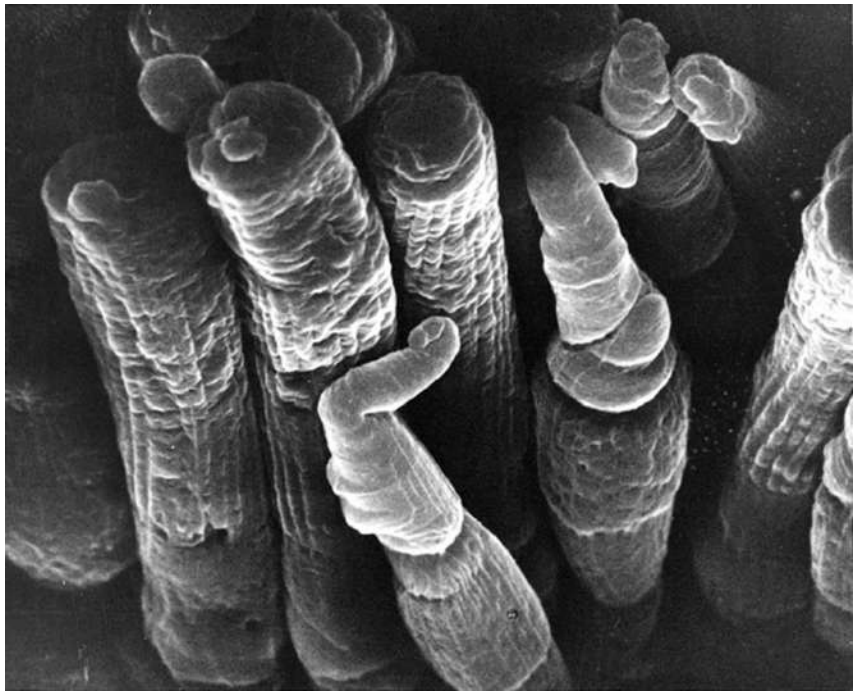
Farsighted vision

Optic Nerve, Blind Spot & Fovea

Optic nerve: Carries neural impulses from the eye to the brain. Blind Spot: Point where the optic nerve leaves the eye because there are no receptor cells located there. This creates a blind spot. Fovea: Central point in the retina around which the eye's cones cluster.



Photoreceptors



E.R. Lewis, Y.Y. Zeevi, F.S Werblin, 1969

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
Detail sensitive?	Yes	No

Color Vision

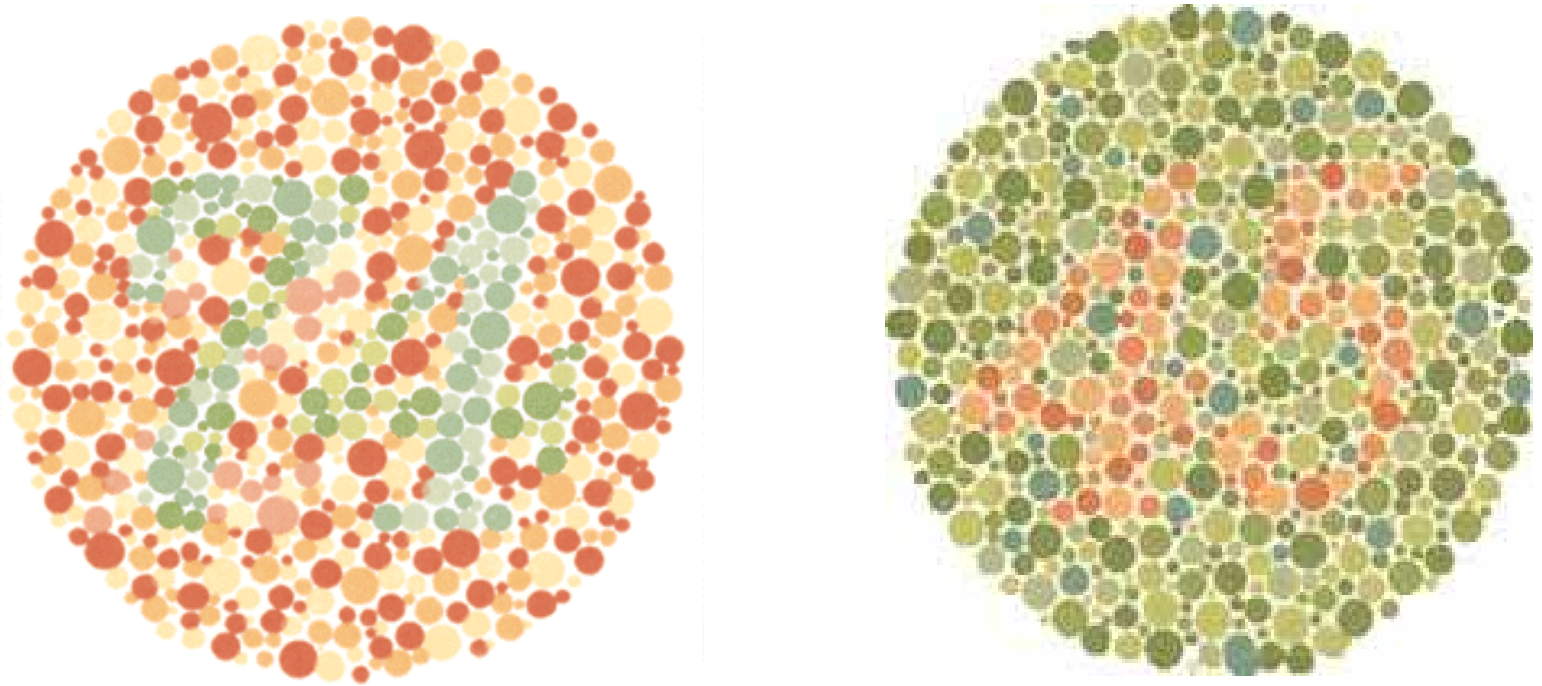
- Color of any object is determined by wavelength the object reflects
  - If no one sees a tomato is it red? No. it is everything but red because it rejects red wavelengths/Color is our mental construct-color resides not in the object but in our brain.
  - White object reflects all wavelenghts
  - Black object absorbs all color
  - Difference threshold for color is so low we can detect 7 million color variations

Trichromatic Theory of Color

- Young-Helmholtz Trichromatic Theory-
  - Retina has three color receptors
  - Cones in retina sensitive to three reflected wavelenghts
    - Red (long wavelenghts)
    - Green (medium wavelenghts)
    - Blue (short wavelenghts)
  - Combination of the three create other colors
  - Color Blindness: have normal blue sensory cones but either have limited red or green

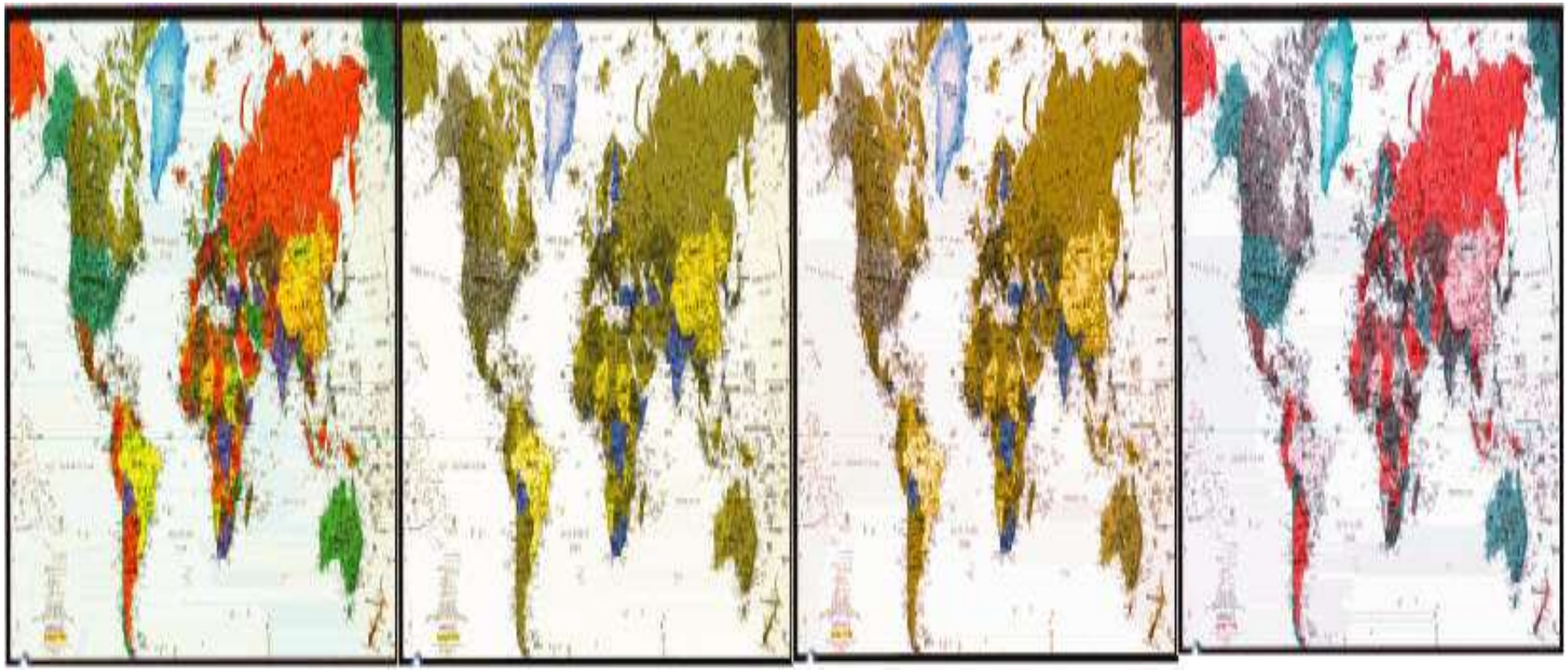
Color Blindness

Genetic disorder in which people are blind to green or red colors. This supports the Trichromatic theory.



Ishihara Test

What do Colorblind people see?




Colorblind HomePage
by
Dr. Torrean L. Waggoner
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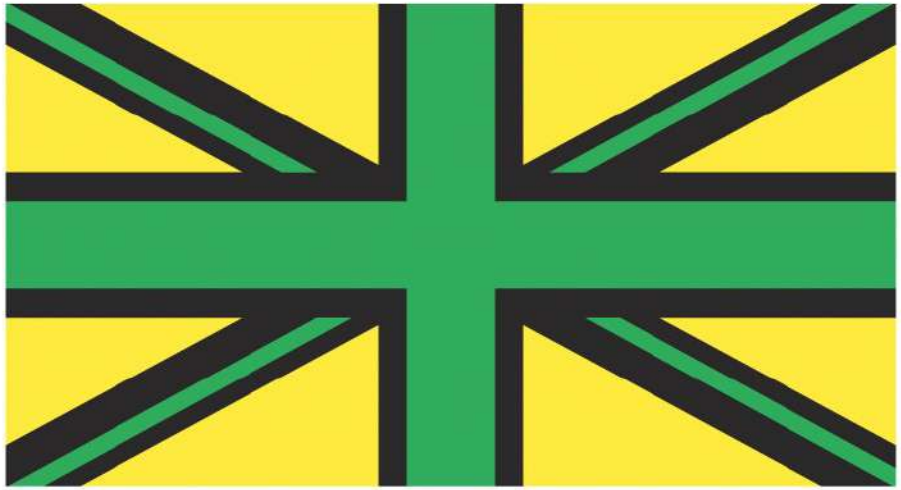
Opponent Colors



Gaze at the middle of the flag for about 30 Seconds. When it disappears, stare at the dot and report whether or not you see Britain's flag.

Audition

The Stimulus Input: Sound Waves

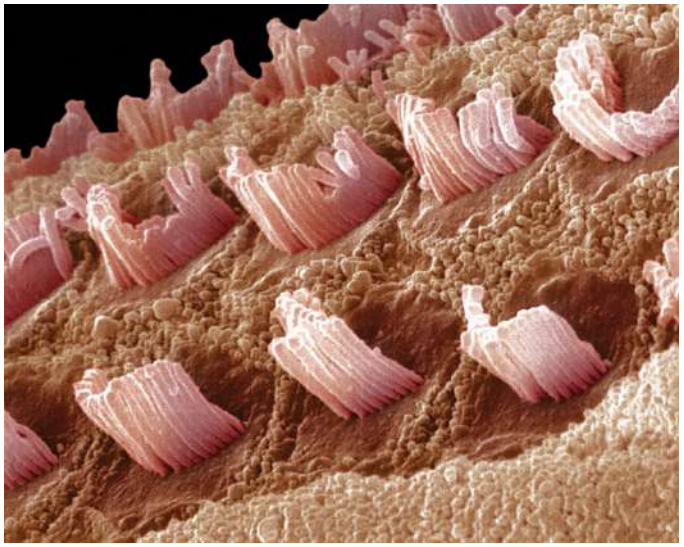
Sound waves are composed of compression and rarefaction of air molecules.

Acoustical transduction: Conversion of sound waves into neural impulses in the hair cells of the inner ear.

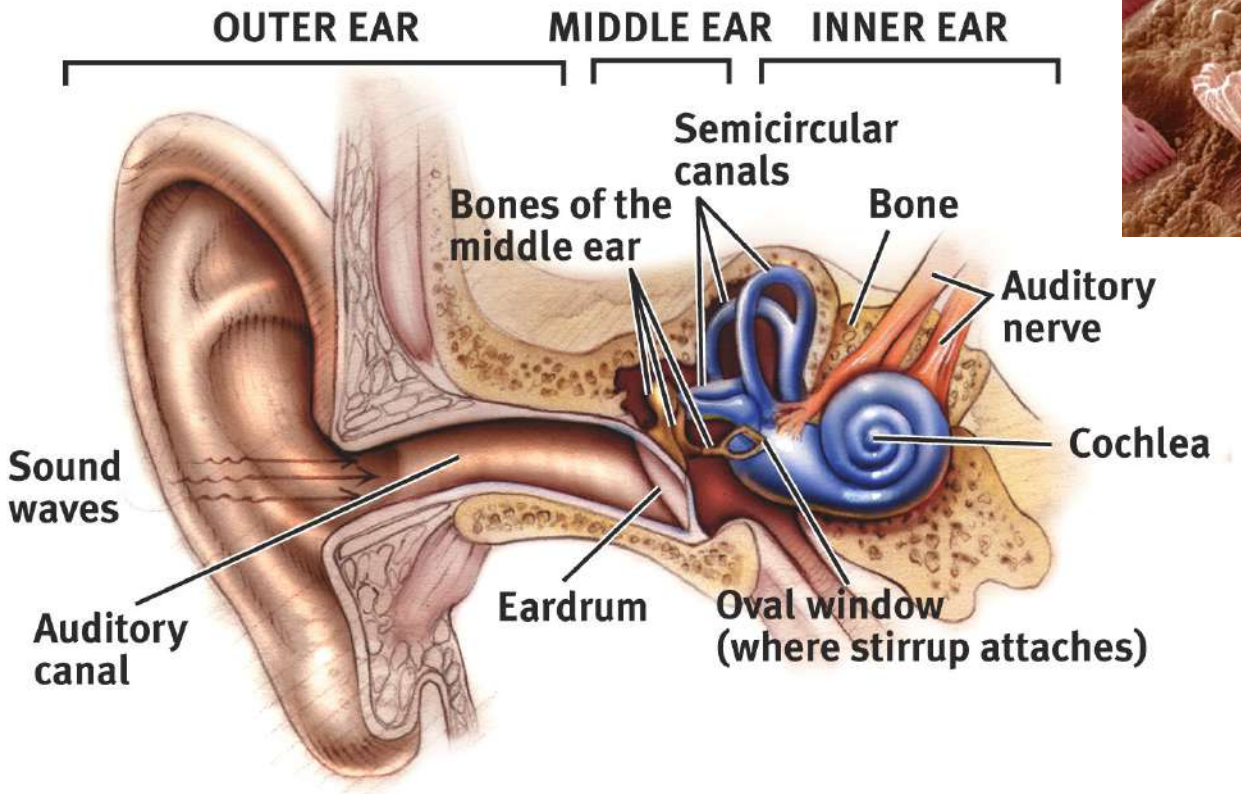
Sound Characteristics

1. Frequency (pitch)
2. Intensity (loudness)
3. Quality (timbre)

The Ear



Dr. Fred Hossler/ Visuals Unlimited



The Ear

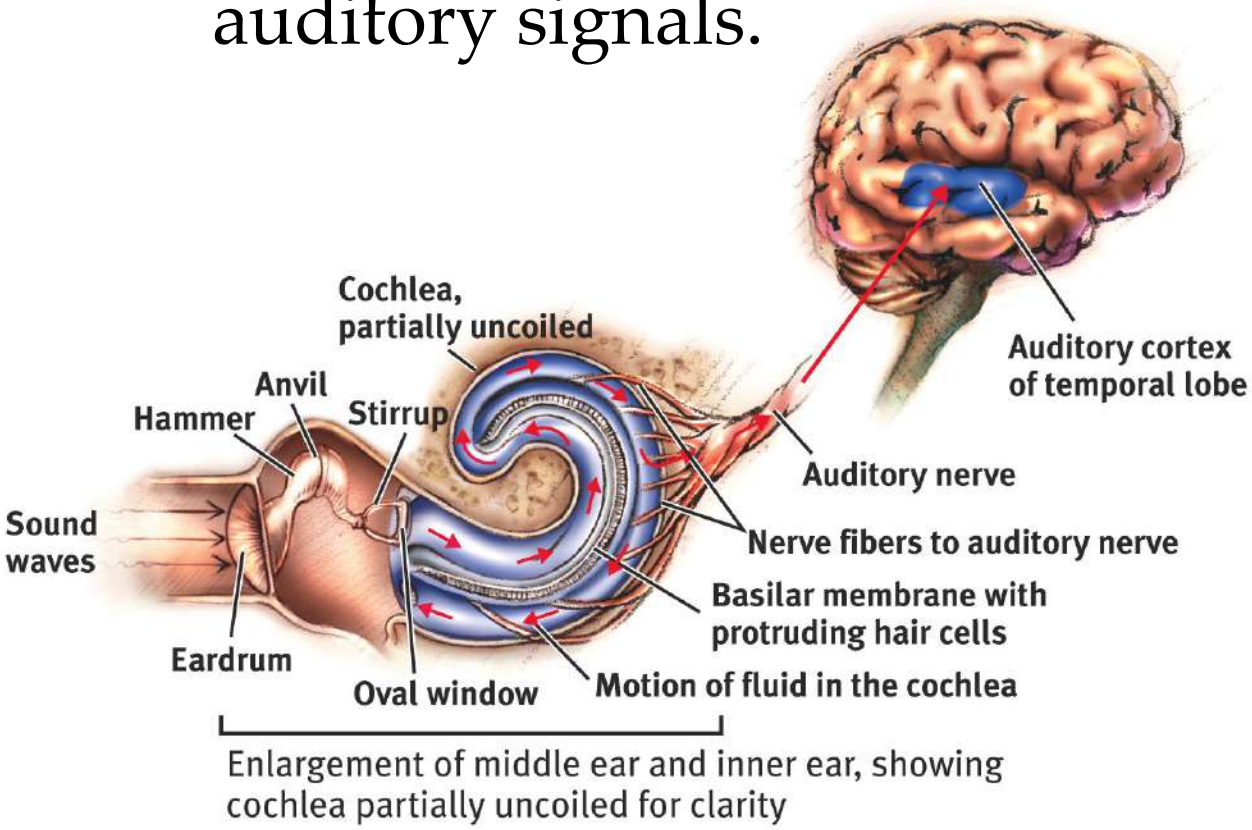
Outer Ear: Pinna. Collects sounds.

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, containing the cochlea, semicircular canals, and vestibular sacs.

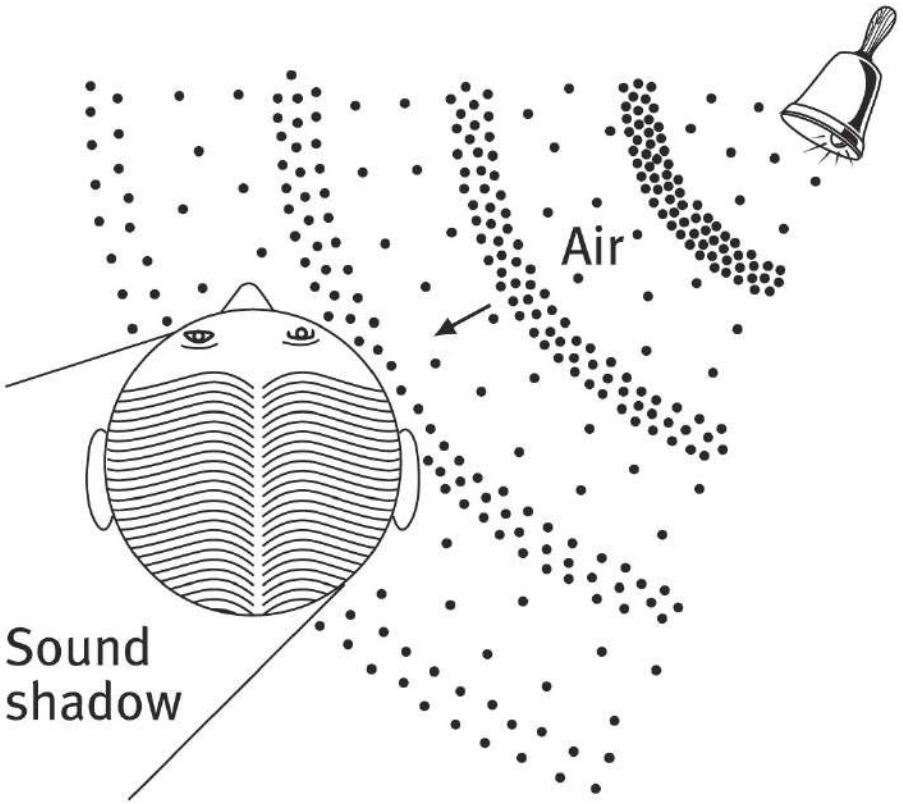
Cochlea

Cochlea: Coiled, bony, fluid-filled tube in the inner ear that transforms sound vibrations to auditory signals.



Localization of Sounds

Because we have two ears, sounds that reach one ear faster than the other ear cause us to localize the sound.



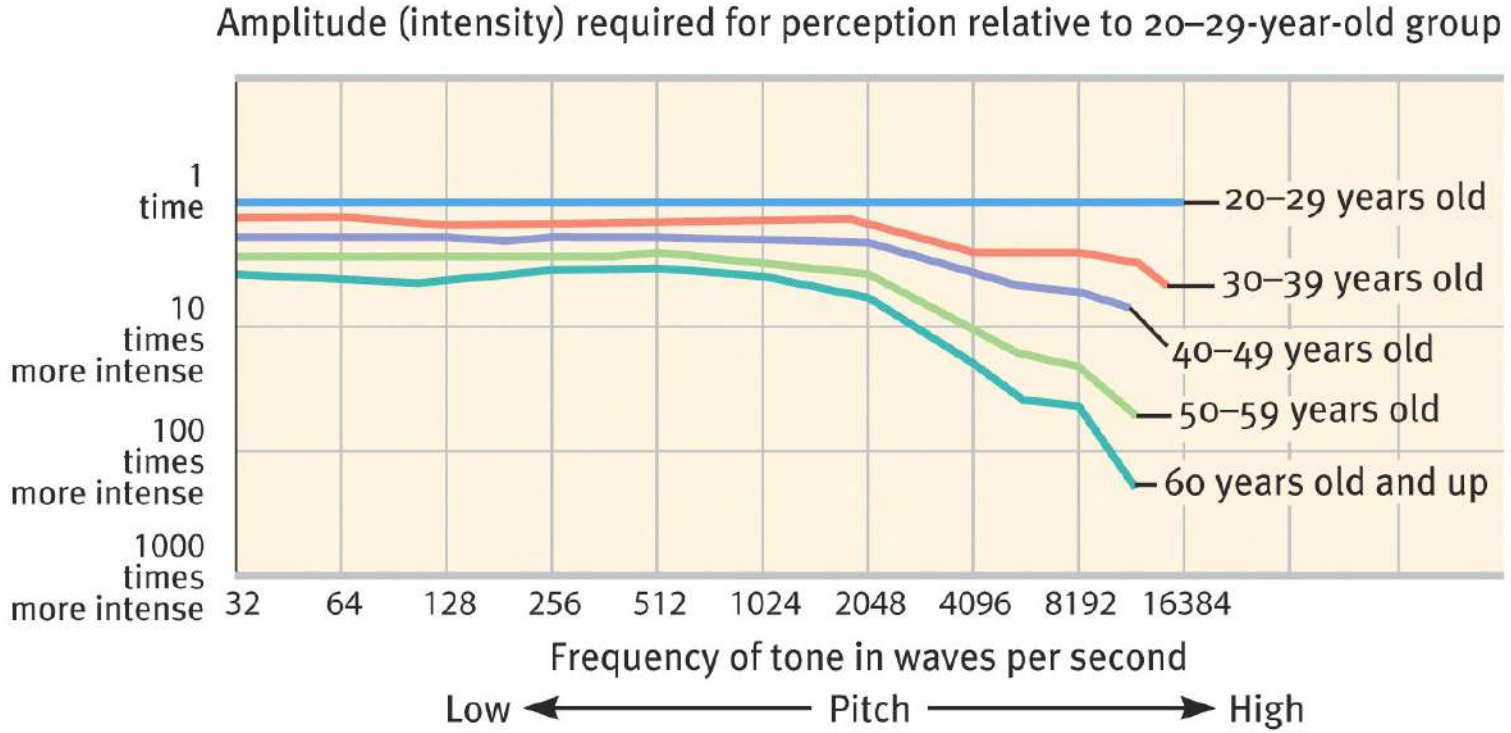
Hearing Loss

Conduction Hearing Loss: Hearing loss caused by damage to the mechanical system that conducts sound waves to the cochlea. Can be helped with a hearing aid.

Sensorineural Hearing Loss: Hearing loss caused by damage to the cochlea's receptor cells or to the auditory nerve, also called nerve deafness. Can be helped with cochlear implant.

Hearing Deficits

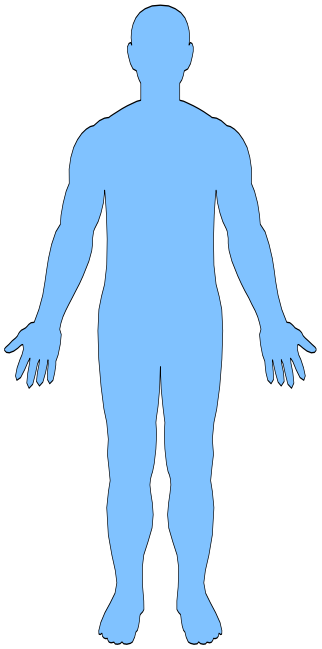
Older people tend to hear low frequencies well but suffer hearing loss when listening for high frequencies.



Other Important Senses

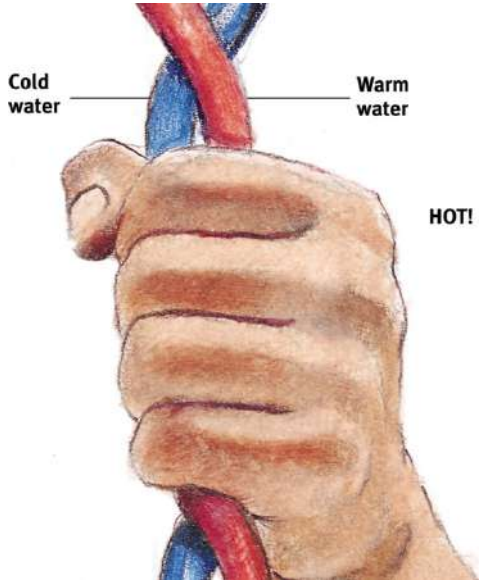
The sense of touch is a mix of four distinct skin senses—pressure, warmth, cold, and pain.

Bruce Ayers/ Stone/ Getty Images

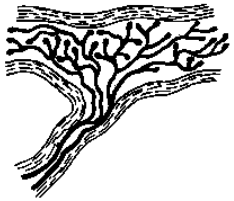


Skin Senses

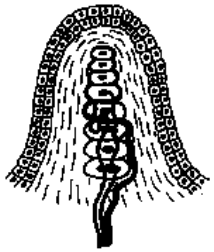
Only pressure has identifiable receptors. All other skin sensations are variations of pressure, warmth, cold and pain.



Burning hot

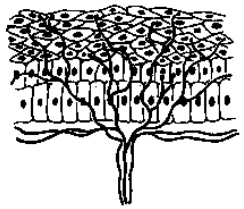


Pressure



Vibration

Vibration



Cold, warmth and pain

Touch

- Definition
  - Senses (pressure, warmth, cold, pain)- essential information about physical interactions with objects in the environment.
- Skin- largest and heaviest organ
- Sense receptors- unevenly distributed throughout the body (hands, face, and lips more densely packed.

Congenital insensitivity to pain (CIP), also known as **congenital analgesia**

Pain tells the body that something has gone wrong. Usually pain results from damage to the skin and other tissues. A rare disease exists in which the afflicted person feels no pain.

AP Photo/ Stephen Morton

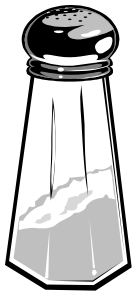
Ashley Blocker (right) feels neither pain nor extreme hot or cold.

Taste

Traditionally, taste sensations consisted of sweet, salty, sour, and bitter tastes. Recently, receptors for a fifth taste have been discovered called *"Umami"*.

Sweet

Sour



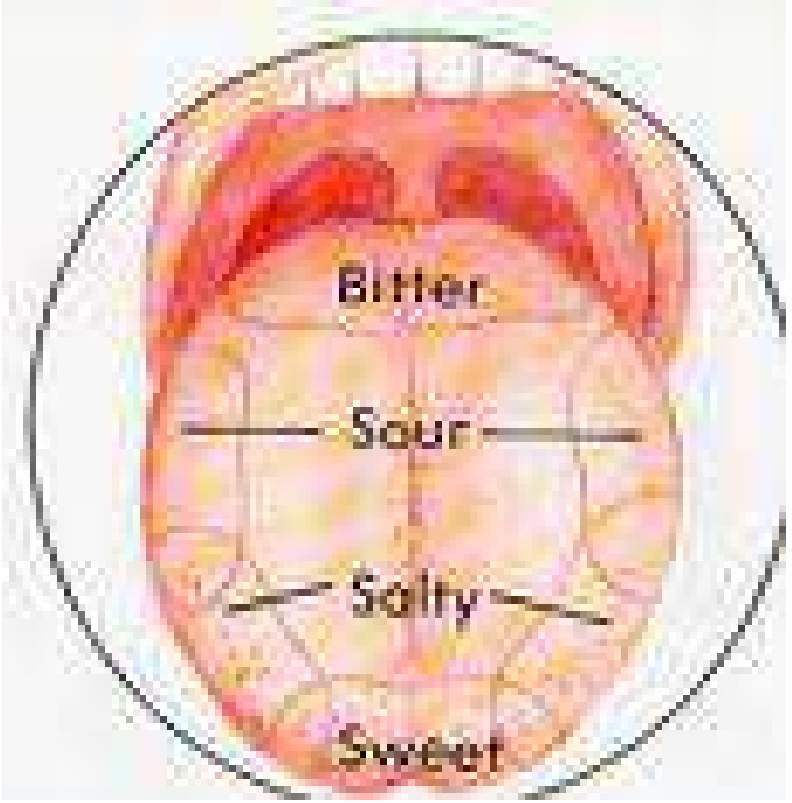
Salty

Bitter

Umami (Fresh Chicken)

4 Primary Taste Qualities

- Sweet, salty, sour, bitter
  - Activation of different receptors
  - Brush teeth and drink oj-tastes bitter/chemical in toothpaste intensifies bitter receptors and inhibits sweet receptors



How We Taste

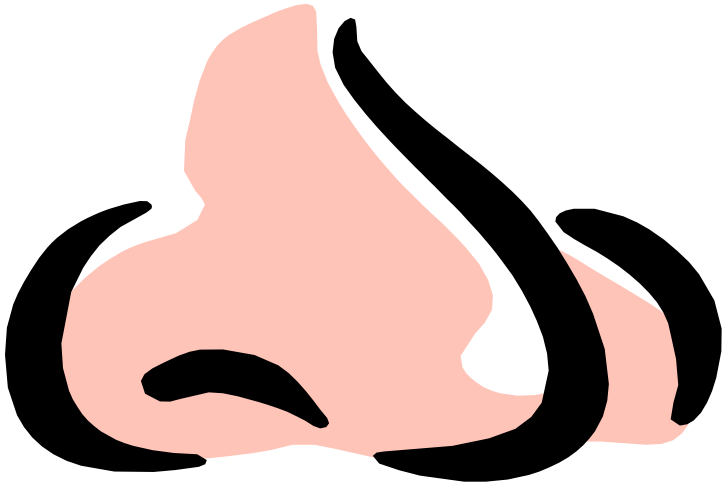
- Specialized receptors in the taste buds
- Located on tongue, mouth, and throat (reproduce every week or two)
- Receptors send neural messages to thalamus and directs info to the cortex

How we taste

- Number of taste buds decrease with age
- Smoking and alcohol accelerate the decline of tastebuds
- Texture, temperature, and appearance also important to taste- Ex.: Liquid diet- blended pizza- tastes different
- Emotional response to taste- Sweet or bitter on newborn tongue same reaction face as adults.

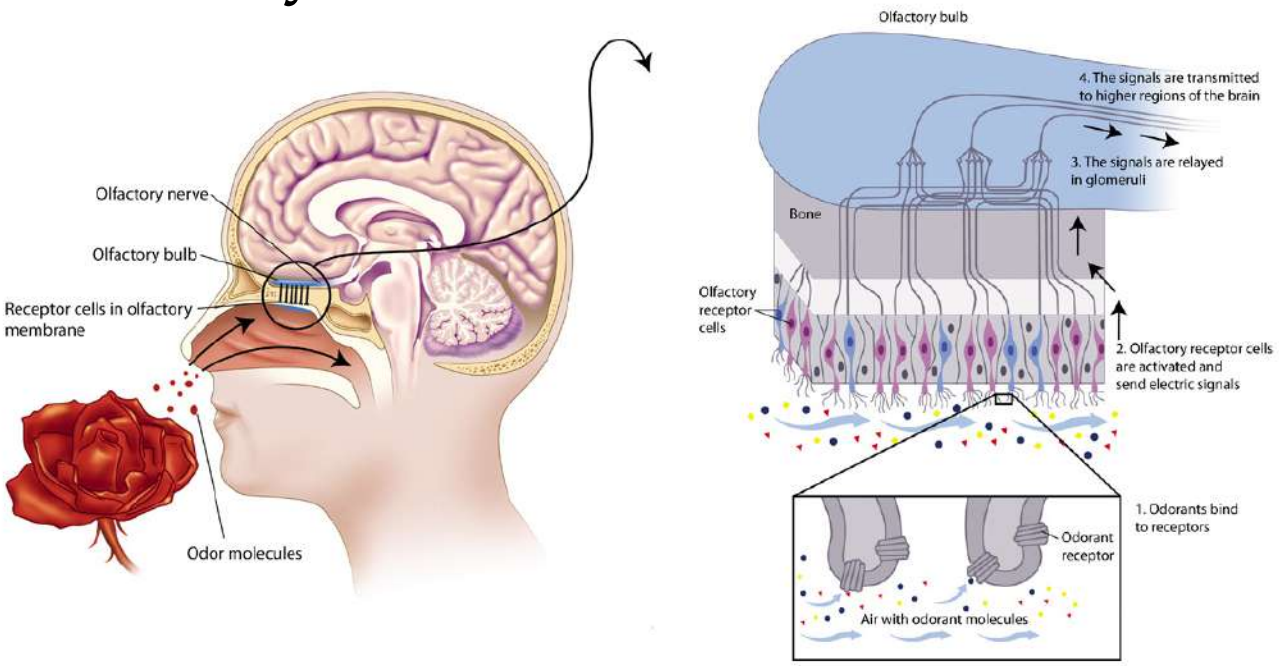
Sense of Smell and Taste (olfaction and gustation)

- These are chemical senses. Sensory receptors are specialized to different types of chemical substances.



Smell

Like taste, smell is a chemical sense. Odorants enter the nasal cavity to stimulate 5 million receptors to sense smell. Unlike taste, there are many different forms of smell.



How We Smell

- Stimulation of airborne molecules (vapors) to specialized olfactory receptor cells high in the nasal cavity.
- Neural message travels down the axon of the olfactory nerve. Specialized odors are identified by the brain.
- Women tend to be more sensitive to smell than men
- Ability to detect odor peaks in early adulthood and then declines.

How we smell

- We each have identifiable chemical signals (exception- identical twins)
- Pheromones- chemical signal used by animals to communicate territorial boundaries and sexual receptiveness
  - Humans don't have
- Odors can provoke memories and feelings
  - Link between olfactory nerve and limbic system
  - Recognize long forgotten odors
  - Memory relating to smell
  - Pleasant scents boost self confidence and mood

Sensory Interaction

When one sense affects another sense, sensory interaction takes place. So, the taste of strawberry interacts with its smell and its texture on the tongue to produce flavor.