Review of Key Concepts and Terms (Unit 1B)

Sensation and Perception

Important but NOT TESTABLE vs. New this year(24-25), TESTABLE; add to your notes

Psychologists study sensation and perception to explain how and why externally gathered sensations and perceptions impact behaviors and mental processes. Using input from several anatomical structures, the sensations we perceive process and interpret information about the environment around us and our place within it. This results in perceptions that influence how we think and behave. In this way, sensation and perception provide a bridge between the biological and cognitive perspectives, offering aspects of both for explaining how we think and behave.

Topic 3.1: Principles of Sensation

Learning Target 3.A

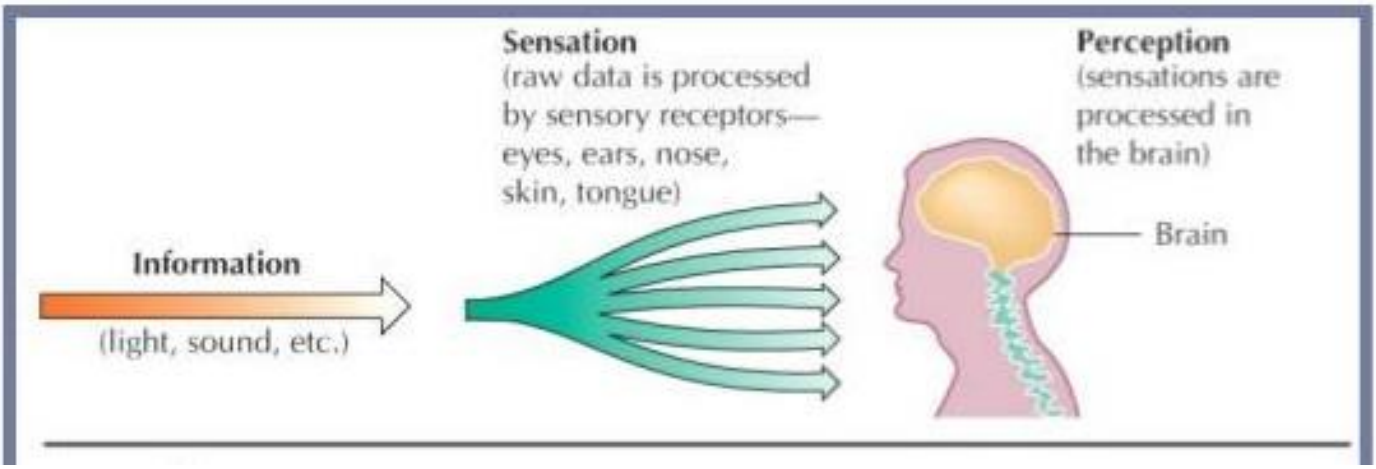
Describe general principles of organizing and integrating sensation to promote stable awareness of the external world.

Sensation: The process by which we receive physical energy from the environment and encode it into neural signals.

The brain receives input from the sensory organs.

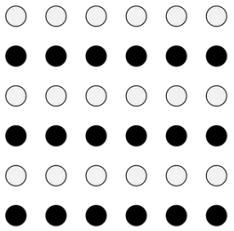
Perception: The process of organizing and interpreting sensory information, enabling us to recognize meaningful objects and events.

The brain makes sense out of the input from sensory organs.

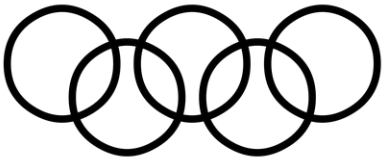


Gestalt: A movement/school of thought in psychology founded in Germany in 1912, seeking to explain perceptions in terms of gestalts (or an organized whole) rather than by analyzing their constituents (or individual parts). When trying to make sense of the world around us, Gestalt psychology suggests that we do not simply focus on every small component. Instead, our minds tend to perceive objects as part of a greater whole and as elements of more complex systems.

- ***Gestalt Laws of Perceptual Organization***: Provide a set of principles for understanding some of the ways in which perception works. It's important to note that sometimes these principles can lead to incorrect perceptions of the world.
    - **SIMILARITY:** *Similar things tend to appear grouped together (both visual and auditory stimuli).* **Example:** You see the groupings of colored circles a rows rather than just a collection of dots



    - **PRAGNANZ ("Good Figure" or Simplicity):** *Objects in the environment are seen in a way that makes them appear as similar as possible.* **Example:** You see the image as overlapping circles rather than an assortment of curved, connected lines

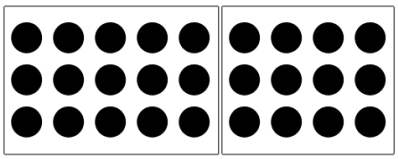


    - **PROXIMITY:** *Things that are near each other seem to be grouped together.* **Example:** The circles on the left appear to be part of one grouping while those on the right appear to be part of another. Because objects are close to each other, we group them together.

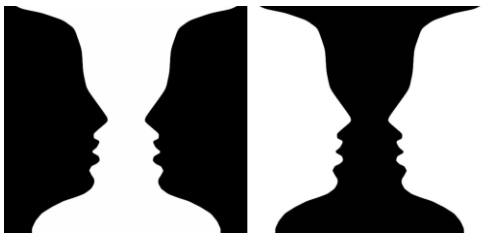
    - **CONTINUITY:** *Points that are connected by straight or curving lines are seen in a way that follows the smoothest path.* **Example:** Rather than seeing separate lines and angles, lines are seen as belonging together.

    - **CLOSURE:** *Things are grouped together if they seem to complete some entity. We fill in gaps to create a complete, whole object.* **Example:** You probably see the shapes of a circle and rectangle because your brain fills in the missing gaps in order to create a meaningful image.

    - **COMMON REGION / GROUPING:** *Elements that are groups together within the same region of space tend to be grouped together.* **Example:** The rectangles/boundaries around the two different groupings makes them appear as if they are two separate groups.



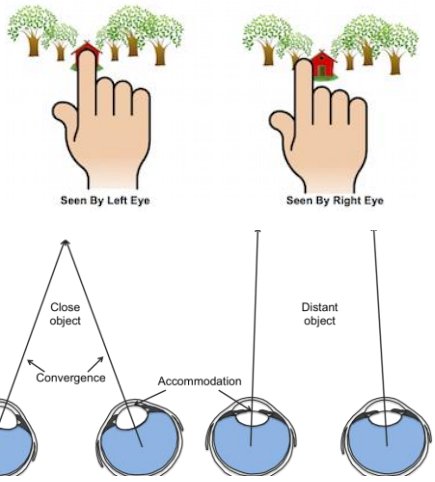
- **FIGURE-GROUND:** *The organization of the visual field into objects (the **figures**) that stand out from their surroundings (the **ground**).* **Example:** Depending on whether you see the black or white as the figure, you may see either two faces in the profile (meaning you perceive the dark color as the figure) or a vase in the center (meaning you see the white color as the figure).



Depth Perception: The ability to see objects in three dimensions although the images that strike the retina are two-dimensional; allows us to judge distance.

- **Visual Cliff:** A laboratory device for testing depth perception in infants and young animals. Used by Eleanor Gibson and Richard Walk to determine whether crawling infants could perceive depth

- **BINOCULAR CUES** (we use BOTH of our eyes) that help us to judge distance:



  - **RETINAL DISPARITY:** Each eye sees a slightly different image because they are about 6 cm apart (on average). Your brain puts the two images it receives together into a single three-dimensional image.
  - **CONVERGENCE:** When looking at a close-up object, your eyes angle inwards towards each other (you become slightly cross-eyed). The extra effort used by the muscles on the outside of each eye gives a clue to the brain about how far away the object is. If you hold your finger 20 cm in front of your eyes, your muscles need to work a lot harder than when your finger is 50 cm away.
  - These binocular cues are most effective for objects up to 6 m away. After this, the amount of eye separation does not give a great enough difference in images to be useful.

- **MONOCULAR CUES** (depth perception that requires only ONE eye; more limited but still possible) that help use judge distance:
  - **LINEAR PERSPECTIVE:** Parallel lines appear to converge at a vanishing point on the horizon. The closer the lines are, the greater the distance
  - **INTERPOSITION:** The partial blocking of one object by another object, leaving the viewer with the perspective that the blocking object is closer.
  - **RELATIVE SIZE:** If two objects are roughly the same size, the object that looks the largest will be judged as being the closest to the observer.
  - **RELATIVE HEIGHT:** We perceive objects higher in our field of vision as farther away.

- **RELATIVE CLARITY:** Clear objects appear closer than blurry or fuzzy objects. The further something is from us, the less detail it conveys.

- **LIGHT AND SHADOW:** Nearby objects reflect more light to our eyes than distant ones. If there are two identical objects, the dimmer one seems farther away. Shading (shadows) also produces a sense of depth because our brains assume that light comes from above.

- **TEXTURE GRADIENT:** When you're looking at an object that extends into the distance, such as a grassy field, the texture becomes less and less apparent the farther it goes into the distance. As you look out over a scene, the objects in the foreground have a much more apparent texture.

- **MOTION PARALLAX:** Objects closer to use appear to move faster than those farther away. When you're riding in a car, for example, the nearby telephone poles rush by much faster than the trees in the distance. This visual clue allows you to perceive the fast moving objects in the foreground as closer than the slower moving objects off in the distance.

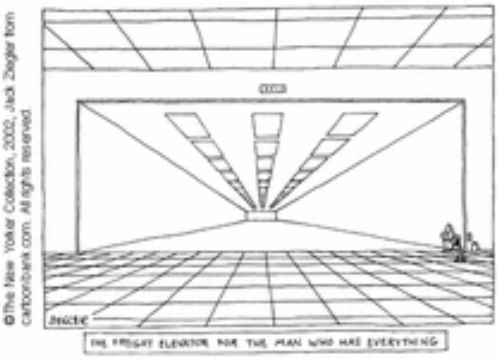
Image courtesy Shaun P. Vecera, Ph.D., adapted from stimuli that appeared in Vecera et al., 2002

Relative height We perceive objects higher in our field of vision as farther away. Because we perceive the lower part of a figure-ground illustration as closer, we perceive it as figure (Vecera et al., 2002). Invert the illustration above and the black becomes ground, like a night sky.

Relative size If we assume two objects are similar in size, *most* people perceive the one that casts the smaller retinal image as farther away.

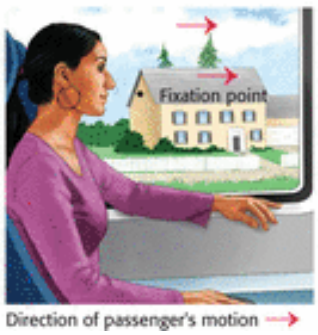
Banque d'Images, ADAGP/Art Resource, NY

Interposition If one object partially blocks our view of another, we perceive it as closer. The depth cues provided by interposition make this an impossible scene.

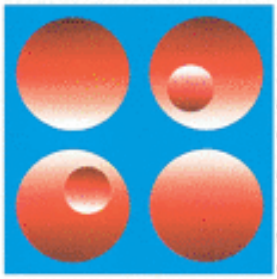


Linear perspective Parallel lines, such as railroad tracks, appear to converge with distance. The more they converge, the greater their perceived distance.

Light and shadow Nearby objects reflect more light to our eyes. Thus, given two identical objects, the dimmer one seems farther away. Shading, too, produces a sense of depth consistent with our assumption that light comes from above. Invert the illustration below and the hollow in the bottom row will become a hill.



Relative motion As we move, objects that are actually stable may appear to move. If while riding on a bus you fix your gaze on some object—say, a house—the objects beyond the fixation point appear to move with you; objects in front of the fixation point appear to move backward. The farther those objects are from the fixation point, the faster they seem to move.



From "Perceiving Shape from Shading" by Vilayanur S. Ramachandran. Copyright © 1988 by Scientific American, Inc. All rights reserved.

MOTION PERCEPTION

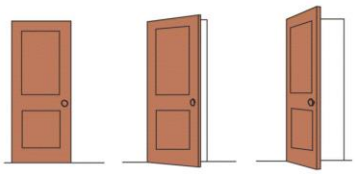
- The human visual system can process up to 10-12 images per second and still perceive the images as individual pictures.
- **PHI PHENOMENON (Stroboscopic Movement):** An illusion of movement created when two or more adjacent lights blink on and off in quick succession, like Christmas lights.

  - Stroboscopic Motion: 24 still pictures flashing within one second create the illusion of motion **(example: flip books and cartoons)**
  - Phi Phenomenon: Lights blinking next to each will create the illusion of motion **(neon or scrolling signs)**


- **RELATIVE MOTION:** As we move, objects that are actually stable may appear to move. If while riding in a train you fix your gaze on some object (the fixation point), objects closer than the fixation point appear to be moving backward. The nearer an object is the faster it seems to move. Objects behind the fixation point appear to be moving with you: The farther away the object is from the fixation point, the more slowly it appears to move.

PERCEPTUAL CONSTANCY

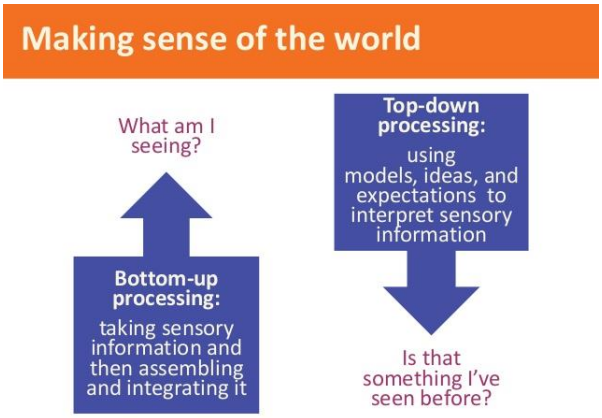
- Our ability and need to perceive objects as unchanging even as changes may occur in distance, point of view, and illumination. Our brain makes adjustments and interpretations without our awareness to perceive the objects as the same, because otherwise our world view would not make sense.
  - **Color Constancy**: perception that the color of an object remains the same even if lighting conditions change
  - **Size Constancy**: tendency for the brain to perceive objects as the same apparent size regardless of their distance from us
  - **Shape Constancy**: when our viewing angle changes or an object rotates and we still perceive the object as staying the same shape; EXAMPLE: the doors to the right become more trapezoidal but we still perceive a rectangle



  - **Lightness Constancy**: when our perception of the whiteness, blackness, and grayness of objects remains constant no matter how much the illumination has changed (we see a constant proportion of lightness)

Top-Down Processing: Information processing guided by our thoughts or higher-level mental processes - we move from the general concept to the specific example.

- We look at the whole picture, try to find patterns in it to make meaning, and then examine the details. We use background knowledge to fill in the gaps.
- Deductive Reasoning is the approach to logical thinking that follows this same concept



Bottom-Up Processing (also known as **Feature Analysis):** Information processing that starts by noticing individual elements and then zooms out to appreciate the whole picture.

- ***COMPARISON:*** Top-down processing begin in the mind with previous knowledge while bottom-up processing begins with sensory inputs and works up to mentally organizing them into a whole
- Inductive Reasoning is the approach to logical thinking that follows this same concept

Learning Target 3.B

Discuss basic principles of sensory transduction, including absolute threshold, difference threshold, signal detection, and sensory adaptation.

Transduction: The conversion of one form of energy into another. In sensation, this is the transformation of sights, sounds, and smells into neural impulses our brain can interpret.

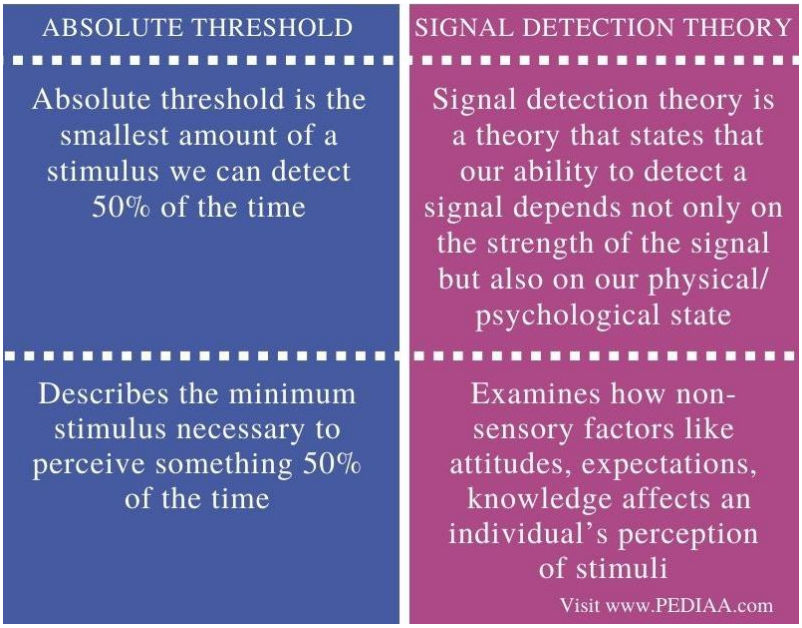
- We process between one and ten million bits of information through our senses every SECOND.
- Another set of systems selects, analyzes, and condenses that information to form patterns or perceptions
- Psychophysics: the study of the relationship between stimuli and out responses to them

- **ABSOLUTE THRESHOLD:** The minimum stimulation needed to detect a particular stimulus 50% of the time. Our lowest levels of awareness of faint stimuli with no competing stimuli present. Below are the absolute thresholds for humans…

SENSE	*STIMULUS*	*RECEPTORS*	*THRESHOLD*
Vision	Electromagnetic Energy	Rods & Cones in the retina	A candle flame viewed from a distance of about 30 miles on a dark night
Hearing	Sound Waves	Hair cells of the inner ear	The ticking of a watch from about 20 feet away in a quiet room
Smell	Chemical substances in the air	Receptor cells in the nose	About one drop of perfume diffused throughout a small house
Taste	Chemical substances in saliva	Taste buds on the tongue	About 1 teaspoon of sugar dissolved in 2 gallons of water
Touch	Pressure on the skin	Nerve endings in the skin	The wing of a fly falling on a cheek from a distance of about 0.4 inches

- **DIFFERENCE THRESHOLD (Just Noticeable Difference or JND):** The minimum difference between two stimuli required for detection 50% of the time
    - **Weber's law:** the principle that, to be perceived as different, two stimuli must differ by a constant percentage (rather than a constant amount).
    - ***COMPARISON:*** While the difference threshold involves the ability to detect differences in stimulation levels, the absolute threshold refers to the smallest detectable level of stimulation. EXAMPLE:
        - EXAMPLE: The absolute threshold for sound, for example, would be the *lowest volume level* that a person could detect. The just noticeable difference would be the smallest *change in volume* that a person could sense.
    - **SUBLIMINAL PERCEPTION:** Perception of a stimulus below the threshold for conscious perception. Although advertisers like to claim it works (and movies have been made about it), there is currently no research to support claims that subliminal advertising or subliminal therapy can elicit behavior change.

- **SIGNAL DETECTION THEORY:** Your ability or likelihood to detect some stimulus is affected by the intensity of the stimulus (e.g., how loud a noise is) and your physical and psychological state (e.g., how alert you are).
    - Assumes that detection depends partly on a person's experience, expectations, motivation, and alertness.
    - EXAMPLE: When you walk to your car that is parked in an empty parking lot late at night all by yourself, you might be much more aware of noises because the situation is somewhat threatening (you are primed and listening carefully to hear anything and everything). In this case, you may hear some slight noises that you might otherwise not hear if you were in a different situation that was not as threatening.



- **SENSORY ADAPTATION:** Diminished sensitivity as a consequence of constant stimulation.
    - EXAMPLE: When you go into a dark room or outside at night, your eyes eventually adjust to the darkness because your pupils enlarge to let in more light. Likewise, when you are in bright light, your eyes adjust by the narrowing of your pupils. This is another form of sensory adaptation.
    - EXAMPLE: When you jump into a cold swimming pool or first get into a hot tub, the water may feel unpleasantly cold or much too hot, but eventually, your body adjusts to the temperature and it feels only mildly cool or perfectly pleasant and even, eventually, too cold.

Learning Target 3.C

Identify the research contributions of major historical figures in sensation and perception.

GUSTAV FECHNER

- German philosopher and psychologist
- Fechner founded the field of psychophysics and is considered to be the founder of modern experimental psychology
- Discovered the Fechner Color Effect which is the observation of different colors when black and white patterns are moving at a high speed
- The first to study synesthesia, a condition in which the stimulation of one sensory system leads to the involuntary response by another sensory system (examples are people who are able to 'hear' color)

DAVID HUBEL and TORSTEN WIESEL

- Two Harvard University researchers who received the Nobel Prize in Physiology or Medicine for their discoveries about information processing in the visual system. By recording impulses from individual brain cells of cats and monkeys, Hubel and Wiesel demonstrated that specialized cells in the mammalian brain respond to complex visual features of the environment.

ERNST WEBER

- Weber's Law is related to the Just Noticeable Difference (also known as the difference threshold), which is the minimum difference in stimulation that a person can detect 50 percent of the time. But Ernst Weber noted that for people to really perceive a difference, the stimuli must differ by a constant "proportion" not a constant "amount".

Topic 3.2: Principles of Perception

Learning Target 3.D

Discuss how experience and culture can influence perceptual processes.

Perceptual Set: A mental predisposition to perceive or notice some aspects of the available sensory data and ignore others; influences nearly everything we perceive; related to “top-down processing”.

- A number of variables, or factors, influence perceptual set which in turn influences perception. The way you see the world is heavily influenced by...
    - **Expectations**
        - If we expect people to behave in certain ways in certain situations, these expectations can influence how we perceive these people and their roles.
    - **Emotion**
        - If we are angry, we might be more likely to perceive hostility in others
    - **Motivation**
        - If we are rooting for our favorite sports team, we might be motivated to view members of the opposing team as overly aggressive, weak, or incompetent.

Do you see a musician or a girl's face?

Schema: Mental filters or maps that organize our information about the world *(also associated with Piaget and Development)*

- Can be useful because they allow us to take shortcuts in interpreting the vast amount of information that is available in our environment
- Can bias the way new information is interpreted, stored, and recalled; we may focus only on things that confirm our pre-existing beliefs and ideas; can contribute to stereotypes
- Different types of schema:
    - **Object schemas** focus on what an inanimate object is and how it works.
    - **Person schemas** are focused on specific individuals. For example, your schema for your friend might include information about her appearance, her behaviors, her personality, and her preferences.
    - **Social schemas** include general knowledge about how people behave in certain social situations.
    - **Self-schemas** are focused on your knowledge about yourself. This can include both what you know about your current self as well as ideas about your idealized or future self.
    - **Event schemas** are focused on patterns of behavior that should be followed for certain events. This acts much like a script informing you of what you should do, how you should act, and what you should say in a particular situation.
    -

Context Effects: Describes the influence of environmental factors (context) on one's perception of a stimulus.

- Used significantly in marketing/advertising - an event/object is more favorably perceived and remembered when the surrounding environment is comfortable and appealing
- The context with which we are experiencing a stimuli will influence our perception of it

Cultural Effects: Not all cultures perceive the same stimuli in the same way

- Many studies have shown Asian and Western cultures to differ in the judgment of relative and absolute sizing of objects as well as the recollection of focal objects vs background of pictures and videos (Chioa et al., 2010). People raised in Asian cultures recall background context and relative size more accurately. On the other hand, people raised in Western culture are able to more accurately perceive the absolute size of objects and remember the focal objects of images more accurately.

Learning Target 3.E

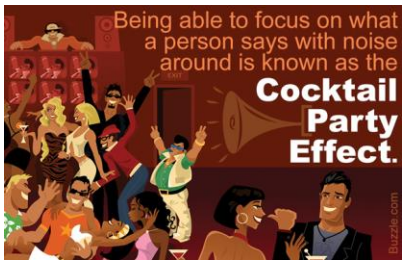
Discuss the role of attention in behavior.

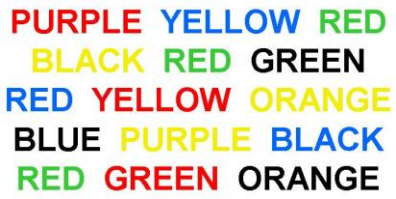
Divided Attention: Focusing on two or more tasks or stimuli

- While we can perform some simple motor skills simultaneously (walking and chewing gum), for more cognitively complex tasks, we can focus on only one thing at a time
- Relates specifically to multitasking. Research in neuroscience tells us that the brain doesn't really do tasks simultaneously, as we thought (hoped) it might. In fact, we just switch tasks quickly. Each time we move from hearing music, to writing a text, or talking to someone, there is a stop/start process that goes on in the brain.

Selective Attention: The process of directing our awareness to relevant stimuli while ignoring irrelevant stimuli in the environment

- There is a limit to how much information can be processed at a given time, and selective attention allows use to tune out insignificant details and focus on what's important
    - EXAMPLE: **The Cocktail Party Effect**
        - The ability to focus your hearing on one specific thing even though noise is all around you. Your brain helps you selectively focus on the person you are talking to and 'mutes' the other conversation, music, and general noise around you.
    - EXAMPLE: **The Stroop Effect**
        - Our brains recognize the color of the word first, which interferes with our ability to read the word aloud. Selective attention is required in order to correctly identify the color of the word.





Inattentional Blindness: Failing to see visible objects when our attention is directed elsewhere.

- Magicians take advantage of inattentional blindness to successfully complete perform magic tricks
- Study by Simmon & Chabris (1999) showed that half of the observers failed to see a clearly visible gorilla pass through a ball passing game

- **Change Blindness:** A type of inattentional blindness; the inability to see changes in our environment when our attention is directed elsewhere

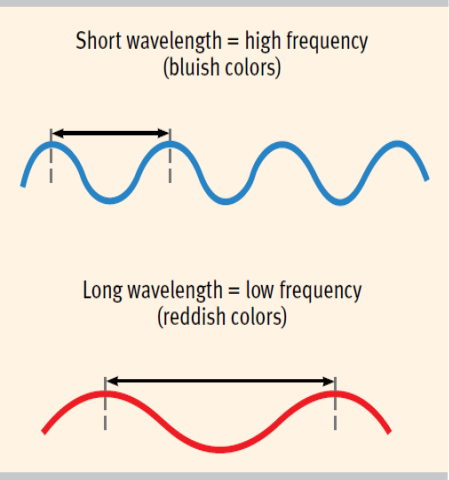
Topic 3.3: Visual Anatomy

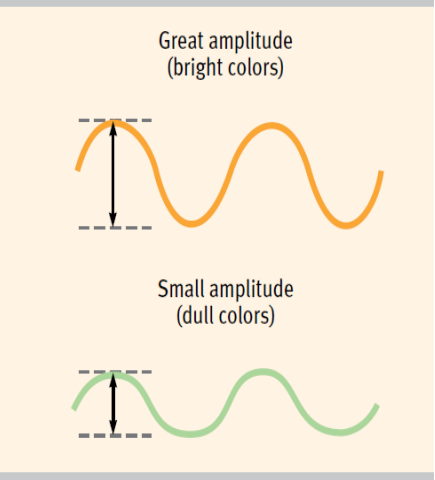
Learning Target 3.F

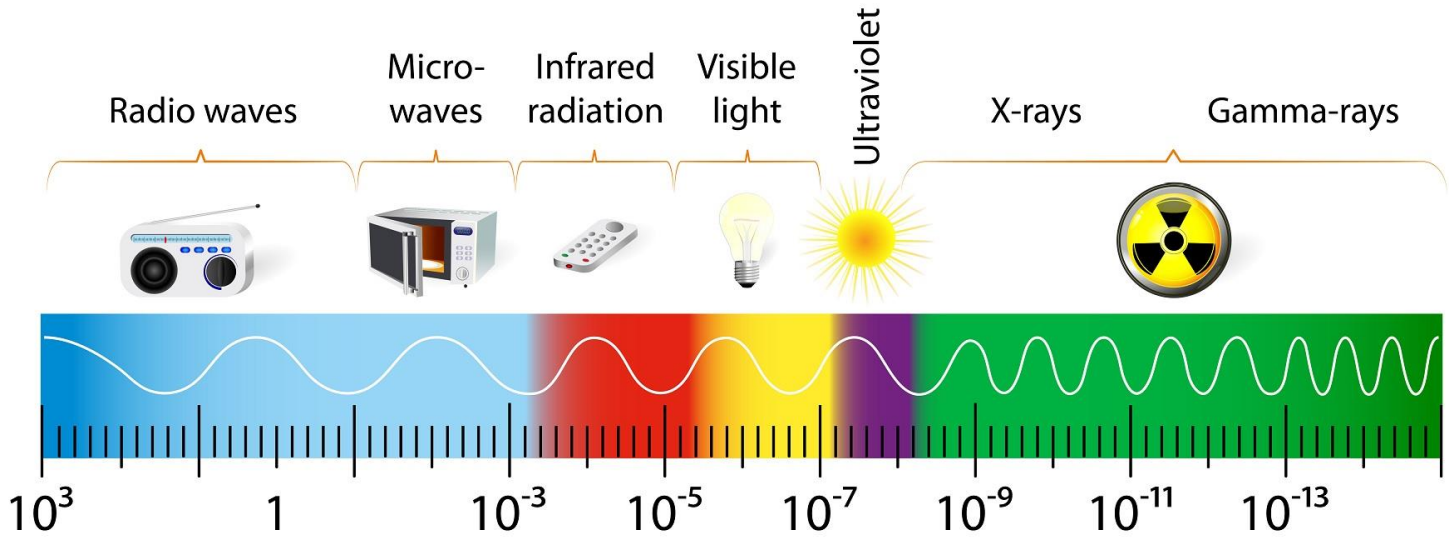
Describe the vision process, including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the senses.

Wavelength: the distance from the peak of one light or sound wave to the next peak. Wavelengths in light waves determine the **hue** (color) and wavelengths in sound waves determine the **pitch** (sound).

Amplitude: the wave's height. It is measured from the peak of the wave to the trough of the wave. Amplitude measures the **intensity** of the wave. In light it determines the brightness of the color and in sound it determines the volume.



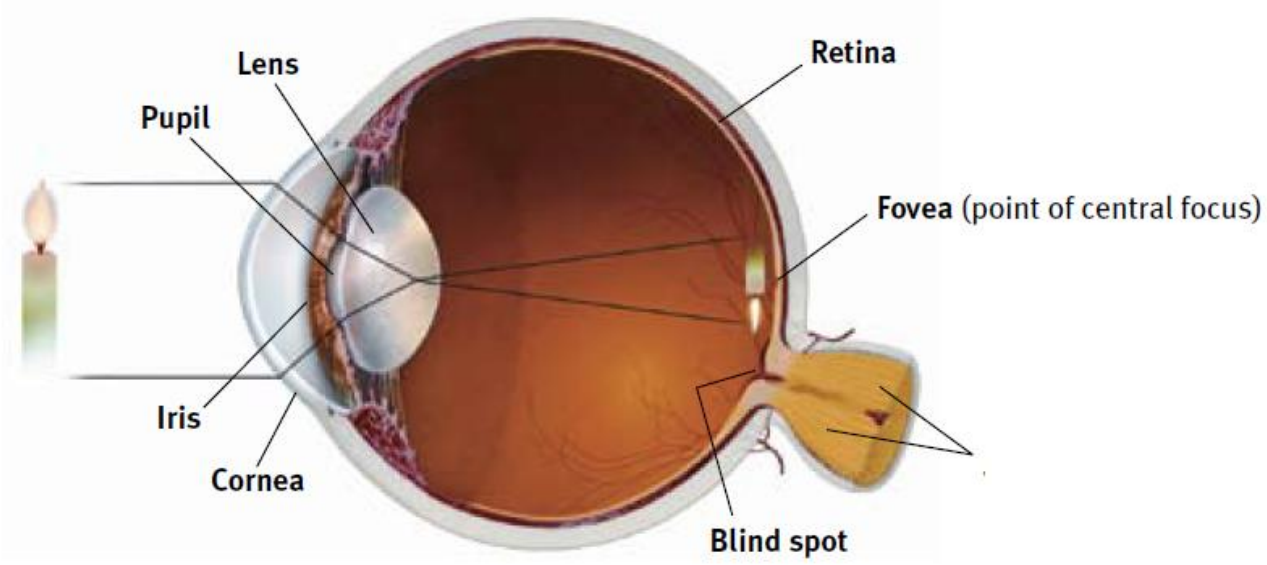




Vision: the sense of sight.

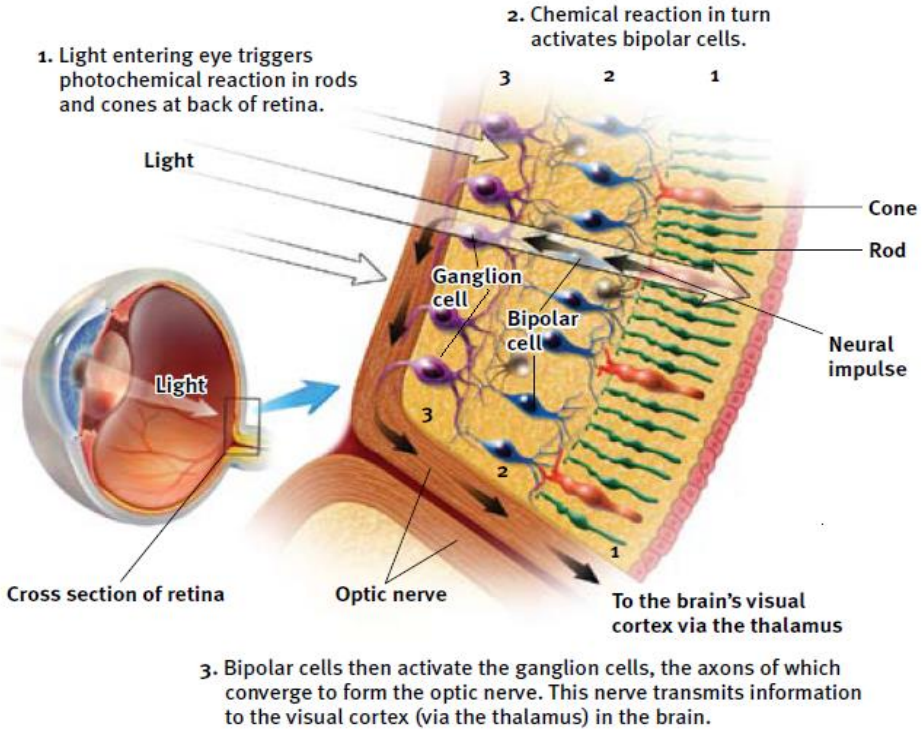
- **Pupil:** the adjustable opening in the center of the eye through which light enters.
- **Iris:** the ring of muscle tissue that forms the colored portion of the eye and that controls the size of the pupil opening.
- **Lens:** the transparent structure behind the pupil that changes shape to help focus images on the retina. This process of the lens changing shape is called **accommodation.**

- **Retina:** the light-sensitive inner surface of the eye that contains the receptor rods and cones plus layers of neurons that begin the processing of transduction for vision.
- **Rods:** retinal receptors that detect black, white, and shades of gray that are necessary for peripheral and twilight vision when cones don't respond. The human eye has around 120 million rods.
- **Cones:** retinal receptors that are concentrated near the center of the retina that detect colors and details and that function in the daylight or in well-lit conditions. The human eye has around 6 million cones.
- **Fovea:** the central focal point in the retina, around which the eye's cones cluster.
- **Bipolar cells:** specialized neurons that connect the rods and cones w/the ganglion cells.
- **Ganglion cells:** specialized neurons that connect to the bipolar cells. The bundled axons of the ganglion cells form the optic nerve.
- **Optic nerve:** the nerve that carries neural impulses from the eye to the brain.
- **Blind spot:** the point at which the optic nerve leaves the eye, creating a "blind' spot because there are no receptor cells located there.

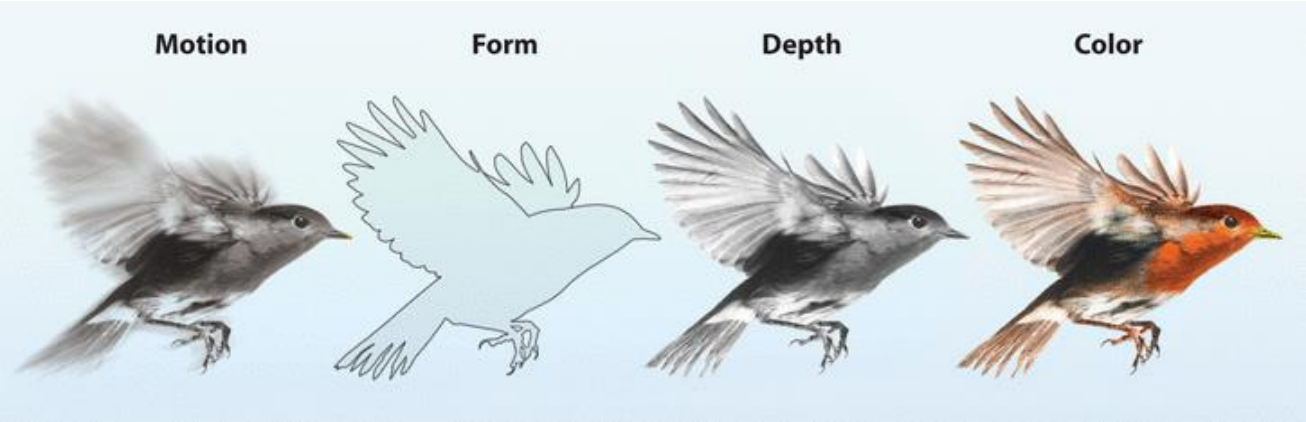


See also: monochromatism, dichromatism

The process of transduction:



Feature Detectors: nerve cells in the brain that respond to specific features of the stimulus, such as shape, angle, or movement. The brain delegates the work of processing motion, form, depth, and color to different areas and then integrates them into the perceived image.



Parallel processing: the brain's natural mode of information processing many things at once, such as color, motion, form, and depth.

Young-Helmholtz trichromatic (three-color) theory: the theory that the retina contains three different color receptors (red, green, and blue) which, when stimulated in combination can produce the perception of any color.

Opponent-process theory: the theory that opposing retinal processes (red-green, yellow-blue, white-black) enable color vision. This explains the **afterimage effect** (staring at a yellow, green, and black flag and when looking away, you see red, white, and blue).

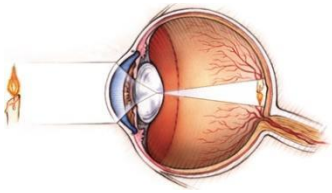
Learning Target 3.G

Explain common sensory conditions - Visual Impairments

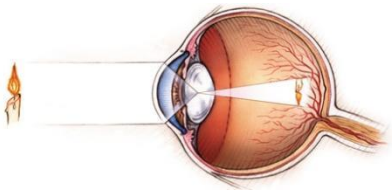
Acuity: sharpness of vision.

Nearsightedness / Myopia: a condition in which nearby objects are seen clearly but distant objects are blurred because light rays reflecting from them converge in front of the retina.

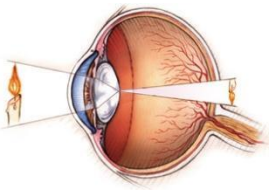
Farsightedness / Hyperopia: a condition in which distant objects are seen clearly but nearby objects are blurred because light rays reflecting from them strike the retina before converging.



Normal



Nearsighted

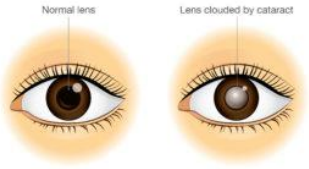


Farsighted

Prosopagnosia / Face Blindness: a neurological condition characterized by the inability to recognize the faces of familiar people and learn to recognize new ones

Agnosopsia / Blind Sight: a perceptual phenomenon that occurs when people who have blindness due to damage to the primary visual cortex but the actual visual system (the eyes) are undamaged. When this happens in a person they can sometimes respond to visual stimuli that they can 'see' with their eyes but their primary visual cortex cannot translate to the brain.

Cataracts: a clouding of the eye's lens which results in vision difficulties. The symptoms include seeing faded colors, blurry figures, double, halos and surrounding light. Also, those with this condition may have difficulties with bright lights, darkness, reading, and recognizing faces. Cataracts are generally attributed to aging but it may also be caused by radiation, trauma, or genetic factors.



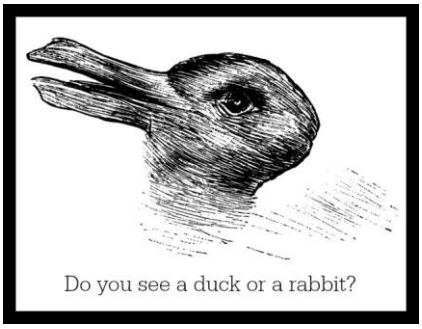
Topic 3.4: Visual Perception

Learning Target 3.H

Explain the role of top-down processing in producing vulnerability to illusion.

Our brain constructs our perceptions.

Perception is not merely a projection of the world onto our brain. Rather, our sensations are disassembled into information bits that our brain, using bottom-up and top-down processing, then reassembles into its own function model of the external world. During this process, our assumptions can lead us astray. (Myers, AP Psychology 2nd Edition)



Top-Down Processing: we form perceptions (or focus our attention) by starting with the larger concept or idea (it can even be the concept or idea of an object) and then working our way down to the finer details of that concept or idea.

Illusion: a sensory distortion that can fool a person's senses (inaccurate perceptions). Illusions can involve any of the senses, but visual (optical) illusions are the best understood by science. Illusions occur when a situation distorts a person's capacity for depth and motion perception and perceptual constancy.

Topic 3.5: Auditory Sensation and Perception

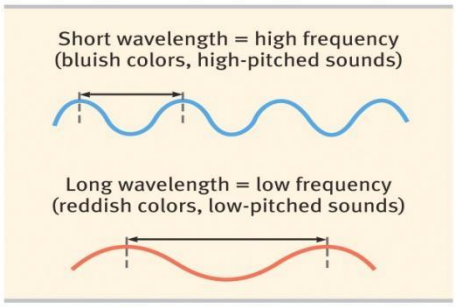
Learning Target 3.I

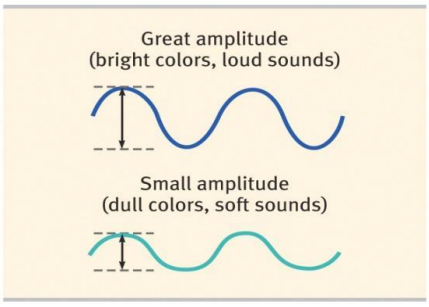
Describe the hearing process, including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the senses.

Frequency: the number of complete wavelengths that pass a point in a given time. Frequency determines the **pitch**.

Pitch: a tone's highness or lowness. The shorter the waves, the higher the pitch; the longer the waves, the lower the pitch.

Amplitude: the strength of a wave. This is measured from peak to trough. The taller the wave, the louder the sound; the shorter the wave, the softer the sound.

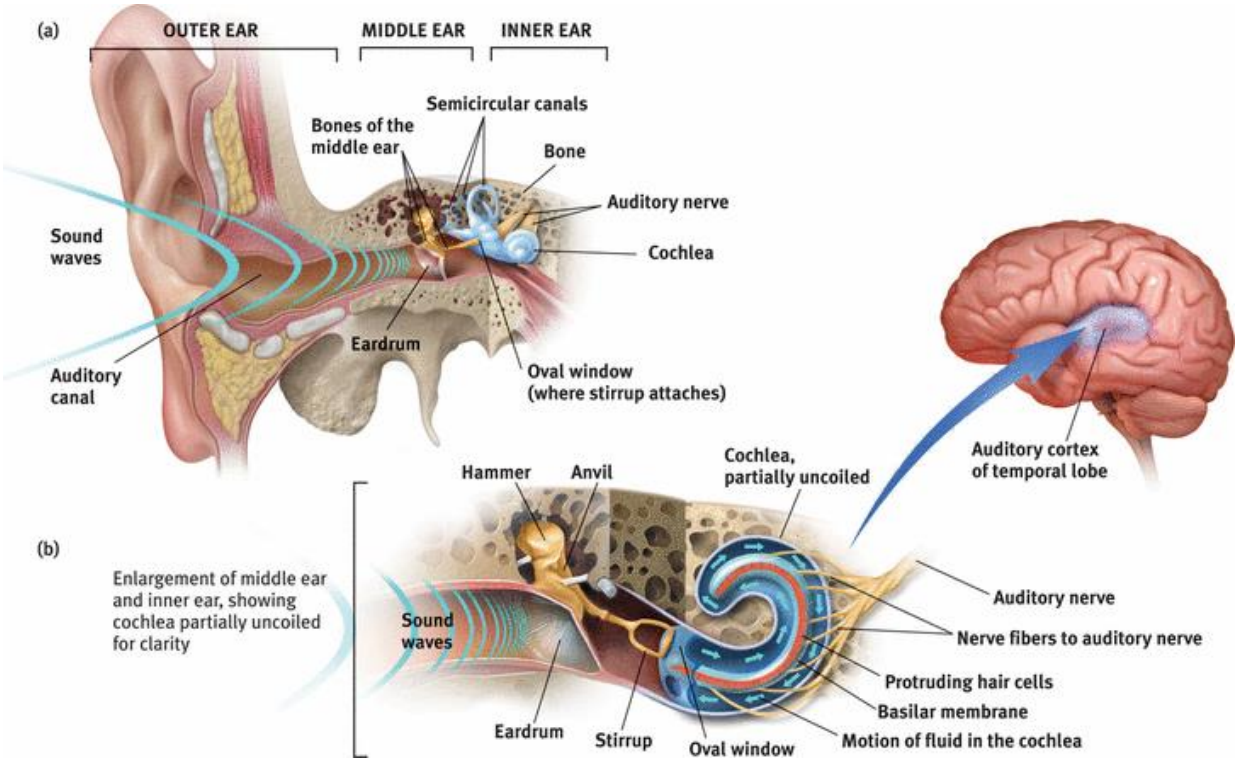




Timbre: the sound of a tone. It allows you to distinguish between two similar sounds. Ex. Hearing the difference between a flute and a piccolo.

Audition: the sense of hearing.

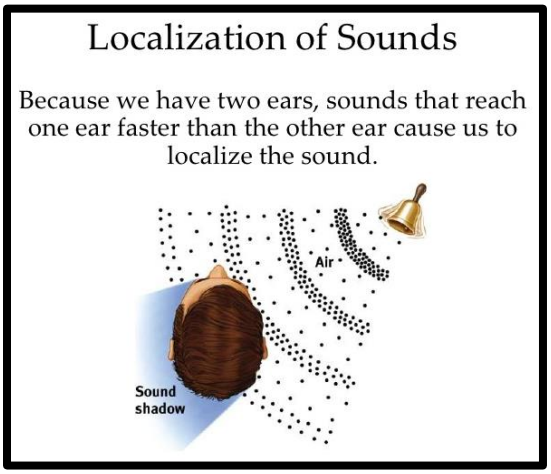
- **Outer ear:** the part of the ear that traps sound waves and channels them through the auditory canal to the eardrum.
- **Pinna:** the fleshy outside part of the ear.
- **Auditory canal:** the canal in the outer part of the ear down which sound waves travel. At the end of the auditory canal is the eardrum.
- **Eardrum:** the tight membrane that vibrates when sound waves hit it.
- **Middle ear:** the part of the ear that transmits the eardrum's vibrations through a piston made of three tiny bones (hammer, anvil, and stirrup) to the cochlea.
- **Inner ear:** the innermost part of the ear that contains the cochlea, semicircular canals, and vestibular sacs (important for balance). This is where transduction happens for sound.
- **Basilar membrane:** A membrane inside the cochlea which vibrates in response to sound and whose vibrations lead to activity in the auditory pathways.
- **Auditory nerve:** the nerve that sends neural messages (via the thalamus) to the temporal lobe's auditory cortex.



Place theory: links pitch we hear with the place where the cochlea's membrane is stimulated. This theory can explain how we high-pitched sounds, but now how we hear low-pitch sounds because the neural signals generated by low-pitched sounds are not so neatly localized on the basilar membrane.

Frequency theory: states that the rate of nerve impulses traveling up the auditory nerve matches the frequency of a tone, thus enabling us to sense its pitch.

Volley principle: neural cells alternate firing. By firing in rapid succession, they can achieve a combined frequency.



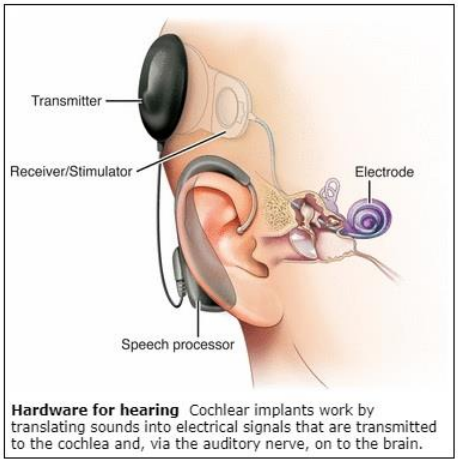
Learning Target 3.G (REPEAT)

Explain common sensory conditions - Hearing Impairments

Conduction hearing loss: hearing loss caused by damage to the mechanical system, such as the three bones, that conducts sound waves to the cochlea. A hearing aid may help amplify sounds for someone who has conduction hearing loss.

Sensorineural hearing loss: hearing loss caused by damage of the cochlea's receptor cells or to the auditory nerves. It is also called **nerve deafness.** This can be caused by disease, but are more often the culprits of biological changes linked heredity, aging, and prolonged exposure to ear-splitting noise or music.

- **Cochlear implant:** a device for converting sounds into electrical signals and stimulating the auditory nerve through electrodes threaded into the cochlea.



Hardware for hearing Cochlear implants work by translating sounds into electrical signals that are transmitted to the cochlea and, via the auditory nerve, on to the brain.

*** McGurk Effect:** a perceptual phenomenon which demonstrates an interaction between hearing and vision in speech perception. This effect may be experienced when a video of one phoneme's production is dubbed with a sound-recording of a different phoneme being spoken. Often, the perceived phoneme is a third, intermediate phoneme. For example, a visual /ga/ combined with an audio /ba/ is often heard as /da/.

Topic 3.6: Chemical Senses

Learning Target 3.J

Describe taste and smell processes, including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the senses.

Gustation: the sense of taste. There are 5 basic tastes: sweet, salty, sour, bitter, and umami (taste of meat; savory).

Papillae: structures on the tongue in which the taste buds are located.

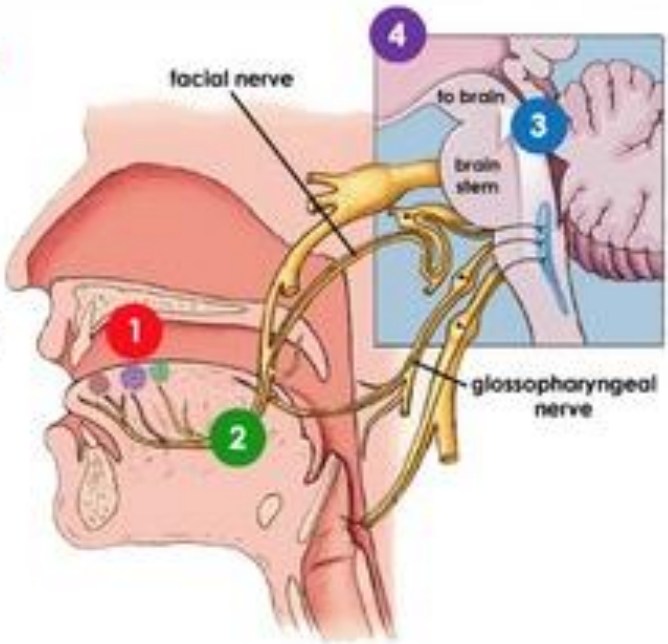
Sensory Interaction: the principle that one sense may influence another, as when the smell of food influences its taste.

Table 21.1 The Survival Functions of Basic Tastes

Taste	Indicates
Sweet	Energy source
Salty	Sodium essential to physiological processes
Sour	Potentially toxic acid
Bitter	Potential poisons
Umami	Proteins to grow and repair tissue

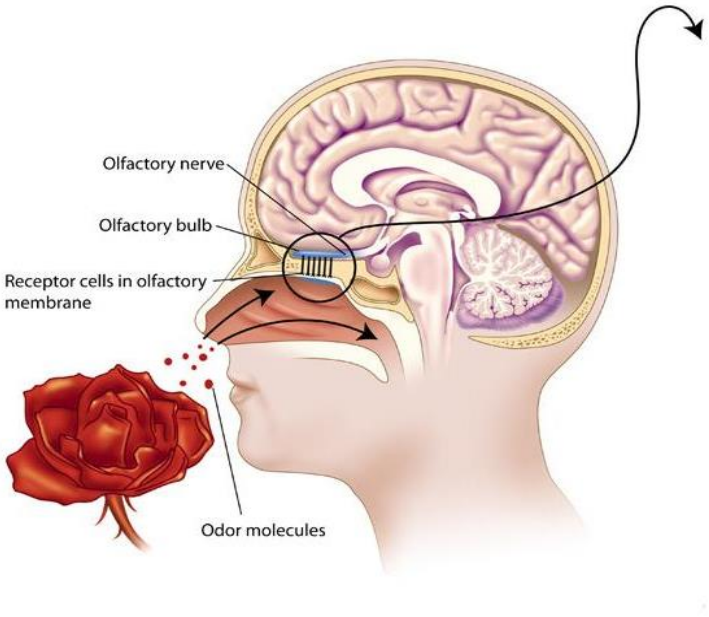
(Adapted from Cowart, 2005.)

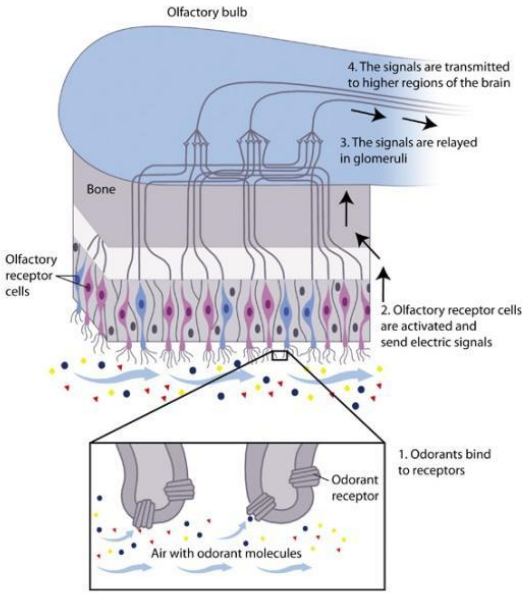
1. Molecules enter taste pores of taste buds and stimulate taste cells.
2. Nerve impulse travels via the facial nerve or glossopharyngeal nerve to the brain.
3. Nerve impulse reaches the thalamus, where it is re-routed to the temporal lobe of the cerebral cortex.
4. The taste stimuli is processed by the gustatory cortex.



See also: oleogustus (taste)

Olfaction: the sense of smell. ***Remember: an old factory smells bad.**





- **Odorants:** a chemical compound that has smell.
- **Olfactory bulb:** the place in the nasal cavity where transduction occurs for smell. ***Remember that smell does not go to the thalamus. It goes directly to the amygdala and then the hippocampus. Bad smells make people angry and smells make strong memories.**

  See also: pheromones

Topic 3.7: Body Senses

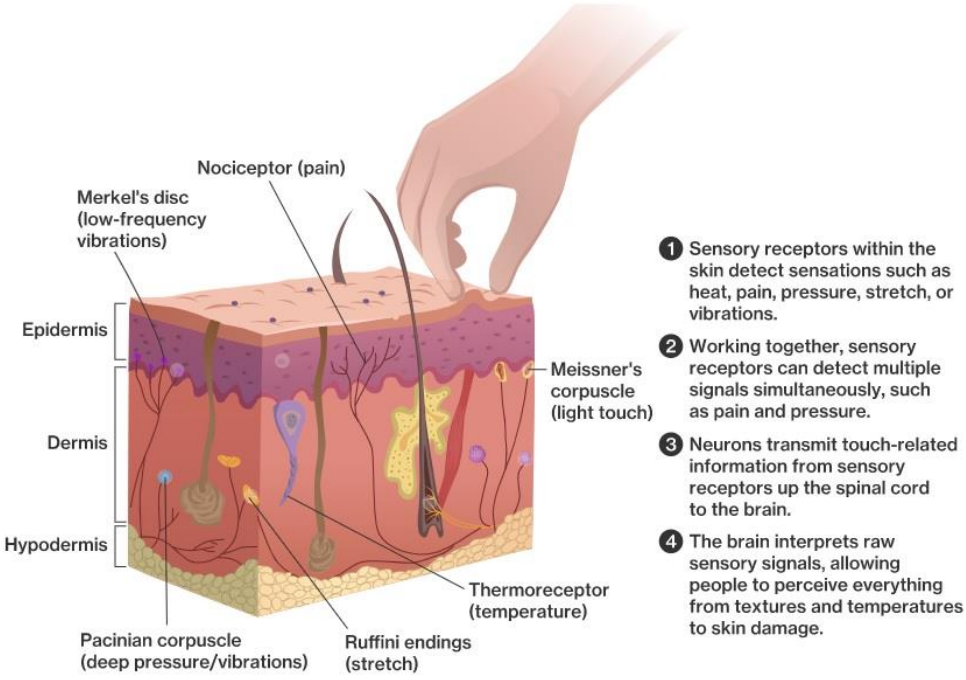
Learning Target 3.K

Describe sensory processes, including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the body senses.

Touch and Pain:

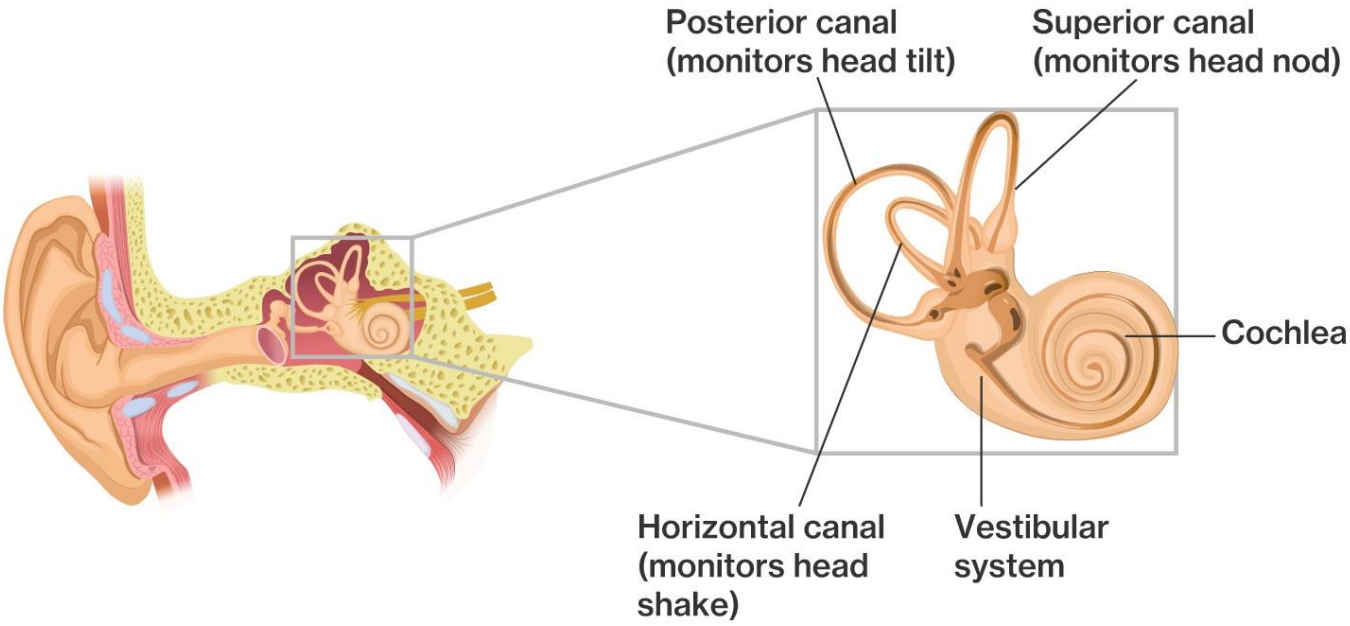
- **Epidermis:** the outside layer of skin.
- **Dermis:** the inside layer of skin.
- **Gate-control theory:** the theory that the spinal cord contains a neurological "gate" that blocks pain signals or allows them to pass on to the brain. The "gate" is opened by the activity of pain signals traveling up small nerve fibers and is closed by activity in larger fibers or by information coming from the brain.
- **Phantom limb sensations:** feeling sensations or movement in limbs that have been removed.
- **Tinnitus:** a phantom auditory sensation in which people hear ringing in the ears.
- **Nociceptors:** sensory receptors that detect hurtful temperatures, pressure, or chemicals.
- **Endorphins:** the body's natural painkillers.

Don't worry too much about the details. Focus more on the process on the right side of the diagram.



Body Position and Movement:

- **Vestibular sense:** the sense of body movements and position, including the sense of balance
    - Uses feedback from head movements to help maintain balance and spatial orientation. Changes in head position move fluid within the vestibular canals of the inner ear to activate hair cells. Information is sent primarily to the cerebellum, the region of the brain that coordinates movement.
    - Dizziness, nausea, and vertigo may result from problems with the vestibular system. Additionally, motion sickness may occur when information the brain receives from the visual system and vestibular system do not match.
- **Kinesthesis:** the system for sensing the position and movement of individual body parts.
- **Proprioceptors:** sensors that are located in the skin, joints, muscles, and tendons for kinesthesis.


Posterior canal
(monitors head tilt)
Superior canal
(monitors head nod)
Cochlea
Horizontal canal
(monitors head
shake)
Vestibular
system

Summarizing the Senses

Sensory System	Source	Receptors
Vision	Light waves striking the eye	Rods and cones in the retina
Hearing	Sound waves striking the outer ear	Cochlear hair cells in the inner ear
Touch	Pressure, warmth, cold on the skin	Skin receptors detect pressure, warmth, cold, and pain
Taste	Chemical molecules in the mouth	Basic tongue receptors for sweet, sour, salty, bitter, and umami
Smell	Chemical molecules breathed in through the nose	Millions of receptors at top of nasal cavity
Position/movement of body parts—kinesthesis	Any change in position of a body part, interacting with vision	Kinesthetic sensors in joints, tendons, and muscles
Position/movement of head—vestibular sense	Movement of fluids in the inner ear caused by head/body movement	Hairlike receptors in the semi-circular canals and vestibular sacs

Sensory Phenomenon

- **SENSORY INTERACTION**
  - Involves one sense **affecting** another.
    - The perception of **flavor** as the combination of smell and taste as well as temperature and texture
- **SYNESTHESIA**
  - Stimulation of one sensory system generates **unexplained** sensations in another sensory system. Research shows ≈ 1 in 2,000 have regular experiences, and 1 in 300 have some
  - Being able to **hear** colors and **taste** shapes