**Sensation and Perception**

The starting point for both sensation and perception is a stimulus, a form of energy (such as light or sound waves) that can affect sensory organs (eyes or ears). Sensation is the process that detects stimuli from our body or surroundings. Perception is the process that organizes sensations into meaningful patterns. Visual sensations let you detect letters in a page when you read and perception lets you organize the black marks into letters and words.

*Dalmation picture on Powerpoint slides; until you can make out that the picture is of a Dalmation dog, you’re using sensation—trying to make sense of the black and white dots. Once you see it is a dog, you have perception. From then on, when you see the picture, you can see that it’s a dog.*

**Sensory Thresholds**

How intense must a sound be for a person to hear it? How much change in light intensity must occur for a person to notice it? These questions are the subject of psychophysics, which is the study of the relationship between the physical characteristics of stimuli and the conscious psychological experiences they produce. The minimum amount of stimulation that can be detected 50% of the time is called the absolute threshold. Example: A cup of coffee would require a minimum amount of sugar before you could detect it. You can smell a single drop of perfume in a 3-room apartment.

Detecting a weak signal or stimulus depends not only on its strength but also on our psychological state—our experience, expectations, motivation, and alertness. When we’re walking down a dark street alone at night, your predisposition to report hearing a sound would depend on your estimate of the probability that you’ll be mugged. You’re more alert to danger and more receptive to “danger” signals then. Signal detection theory predicts when we’ll detect weak signals. Researchers distinguish between hits, misses, false alarms, and correct rejections. Hit: a correct report of the presence of the target stimulus. Miss: a failure to report the presence of a target stimulus. False response: an incorrect report of the presence of the target. Correct rejection: the correct report of the absence of a target. Other applications of signal detection theory: detecting blips on a radar screen, detecting bombs on an airport x-ray scanner, and testing out new pain relief techniques.

In addition to perceiving stimuli, we must be able to detect changes in the amount of stimulation we receive. The minimum amount of change in stimulation that can be detected 50% of the time is called the difference threshold. When do you notice when your friend has put on weight? At 5 pounds? 10 pounds? 20 pounds? The difference threshold is also called the just noticeable difference (jnd). A psychologist named Ernst Weber noted that regardless of their magnitude, two stimuli must differ by a constant proportion for their difference to be perceptible. This is known as Weber’s Law. Examples: The jnd for weight is about 2%, meaning that if you held a 50 pound weight, you could feel the addition of 1 lb., but it would take 2 lbs. if you were holding a 100 pound weight. Other examples: Two lights must differ in intensity by 8%. Two tones must differ in frequency by only 0.3%. Weber’s law is also applicable to our life experiences. If your favorite bagel goes up in price by 10 cents, would you notice? Maybe not if you were buying just one bagel, but you’d notice if you were buying a dozen or if you were the owner of a store buying 300 bagels to sell that day.

Example: If you were a salesman and wanted to sell a man a suit and a sweater, which should you show him first? The suit. If he commits to buying the suit, he’ll be less likely to balk at the price of the sweater. Research shows that people will almost always pay more for accessories if they buy them after rather than before a more expensive purchase. If you buy a $25,000 car, you’ll hardly blink an eye if you then have to spend another $500 on XM radio.

**Sensory Adaptation**

Our senses are constantly being bombarded by stimuli we don’t even notice. Why? One reason is that if a stimulus remains constant in intensity, you’ll gradually stop noticing it. This is called sensory adaptation. Examples: Jumping into a pool of cold water and eventually getting used to the temperature; no longer noticing the mildew smell in the in-laws’ house, no longer noticing the trash smell in your kitchen, getting used to sitting on a hard seat. It’s not as easy to adapt to visual stimuli, though, because our eyes constantly flicker and move, thus changing the stimuli slightly. If we could stop our eyes from moving, a constant image on the visual field gradually fades. The disappearance and reappearance of an image occurs in meaningful units. If a person is shown a word, it will disappear, and new words made up of parts of that word will appear and then vanish. Our perceptions are organized by the meanings that our minds impose.

Sensory adaptation allows us to focus only on *informative* changes in our environment without being distracted by the uninformative constant stimulation of clothes, odors, or noises in the environment (like children and barking dogs). NOTE: SOME PEOPLE ARE MORE SENSITIVE THAN OTHERS. Some will go crazy if the seams in their socks don’t line up or if a tag itches. Others don’t notice it. Jeff notices dogs barking; I don’t. \*\*You will never completely adapt to extreme stimuli such as freezing cold or pain because to ignore such stimuli would be harmful (frostbite, death).

**Subliminal Processing**

Can we be affected by stimuli that are below our absolute threshold? In a way, yes, because absolute threshold is the threshold at which we can detect a stimulus 50% of the time. There will be times when we can detect stimuli below that threshold.

Research about subliminal processing:

1. One experiment subliminally flashed either emotionally positive scenes (kittens, a romantic couple) or negative scenes (werewolf, dead body) an instant before subjects viewed slides of people (Krosnick et al., 1992). Although the participants consciously perceived only a flash of light, they gave more positive ratings to people whose photos had been associated with positive scenes.
2. Another study: Ss primed with “rude” or “polite” words. DV was how many people would interrupt an experimenter to turn in a paper. 67% in the rude condition did; 38% in the control condition (no priming); 16% in the polite condition.
3. Word search primed achievement words like succeed and strive. Control Ss got no priming. Experimental group outperformed control group on verbal tasks, even though they weren’t aware of the priming.
4. Bargh & Chartrand—study shows how we can be in a certain mood and not know why. Four groups were in a reaction-time task. Group 1 was primed with a strongly positive attitude (music, friends). Group 2 got mildly positive attitude (clown, parade). Group 3 got mildly negative attitude (Monday, worm) and group 4 got strongly negative attitudes (cancer, cockroach). Then they did mood measures. Mood went up as a direct function of priming.

Mood may be controlled by automatic processes that we’re not aware of. These moods can then influence what we think about something (study 1 about rating people based on mood).

1. A final study looked at patients recovering from surgery. They found that if the doctor said, “How well you recover depends on you” or something positive, the patients recover a lot faster.

What about subliminal persuasion? Can marketers and advertisers manipulate us with “hidden persuasion?” Example: Playing Christmas music may make you buy more. Most people believe that we CAN be subliminally persuaded. Since the 1950s people have believed in subliminal persuasion (brainwashing and hypnotic suggestion captured the public’s imagination after the film *The Manchurian Candidate* came out). The truth is, though, that almost all research psychologists don’t believe in subliminal persuasion. The lab research is a *subtle, fleeting effect.* You can prime a thirsty person with an ad for a coke and thus make the ad more persuasive, but reports that subliminal messages have a powerful, enduring effect on behavior are false. Thus, it’s a waste of money to buy self-help subliminal CDs to help you stop smoking, lose weight, etc. Greenwald et al. (1991) randomly assigned college students to listen daily for 5 weeks to subliminal tapes claiming to improve either self-esteem or memory. On half the tapes, they switched the labels so that the self-esteem group actually got the memory tape and vice-versa. The tapes had NO EFFECT, but the subjects believed that they did. For instance, the group who got the self-esteem tape but thought they were getting the memory tape thought that their memory had improved and vice-versa.

Greenwald has conducted 16 double-blind experiments evaluating subliminal self-help tapes. His results were conclusive: Not one had any therapeutic effect. Any “effect” is due to the placebo effect.

**Vision**

 Psychologists have conducted more research on vision than on all of the other senses combined. Vision lets us sense objects by the light reflected from them into our eyes. Light is the common name for the visible spectrum which is a narrow band of energy within the electromagnetic spectrum. Light varies in wavelength from 380 nanometers to 760 nanometers. The wavelength determines the hue of a color (shorter is violet; longer is red). The height of the waves determines the brightness of a light. A dimmer switch changes the brightness of the light in your living room by altering the height of the waves the light bulb emits. Color we see are usually a mix of various wavelengths and that means they vary in purity. Purity influences perception of richness of colors. CONSIDER PAINT CHIP CHARTS. Effects of wavelength –two totally different charts. Effects of purity - two charts that have darker and lighter versions of same color. Effects of brightness - one chip chart in which some of the color shades seem brighter than others.

Visual Sensation

 Light rays first pass through the transparent protective cornea and then enter the eye through the pupil. The colored iris is actually a muscle that allows the pupil to dilate and contract as needed. After entering through the pupil, the light rays hit the lens, which is a clear structure whose shape adjusts to allow us to focus on objects at varying distances. Light rays leaving the lens are projected on the retina; the image is upside-down and reversed, but the brain corrects this and allows us to see normally. The retina is the light-sensitive inner membrane of the eye that contains the receptor cells for vision. Vision sensations depend on chemicals called photopigments which are chemicals that enable the rods and cones to generate neural impulses. Rods are receptor cells of the retina that play an important role in night vision and peripheral vision. There are about 120 million rods. The 5 million cones are receptor cells of the retina that play an important role in daylight vision and color vision. When light strikes the rods or cones, it breaks down their photopigments. This breakdown begins the process by which neural impulses are eventually sent along the auditory nerves to the brain and then reassembled. These photoreceptors are also important in the processes of dark adaptation and color vision.

 Dark adaptation. When you enter a dark movie theatre, you will have difficulty finding a seat because your photoreceptors have been bleached of their photopigments by the light in the lobby. You are gradually able to see again because your eyes produce more photopigments. You owe your ability to see in dim light to your rods. In the dark, your cones are much less sensitive than your rods, but at first they’re actually MORE sensitive. Cones recover from the bleaching process first and reach their maximum sensitivity in 5-10 minutes. Rods take 7-10 minutes to recover and then overtake the cones. A completely dark-adapted eye is 100,000 times more sensitive than a light-adapted one. Impaired dark adaptation comes with age and accounts for the disproportionate number of night driving accidents that involve older adults. In addition, this illustrates why you shouldn’t drive with your high beams on or try to read a map with the dome light on.

Color vision. Although we can see well without seeing color, color enhances our enjoyment of what we perceive and adds information. Young and Helmholtz presented the first theory of color vision called the trichromatic theory. Young and Helmholtz found that red, green, and blue lights could be mixed into any color, leading them to conclude that the input of three receptors was pooled by the brain. They assumed that the retina has three kinds of receptors (cones) sensitive to red, green, or blue light. The colors we experience depend on the relative degree of stimulation of the cones. There are two ways to mix color.

 An alternative explanation of color vision was put forth by Ewald Hering. The opponent-process theory explains the phenomenon of afterimages. Afterimages are images that persist after the removal of a stimulus. FLAG EXAMPLE on powerpoint. Opponent-process theory assumes that there are red-green, blue-yellow, and black-white opponent processes. Stimulation of one process inhibits the other. This explains why the yellow, black, and green flag came up red white and blue and why we can’t see reddish greens or bluish yellows. The O-p theory also explains color blindness what is the inability to distinguish between certain colors, most often red and green. There’s a color blindness test on Blackboard that you can take to test your color vision. People with normal vision are trichromats--they have all three kinds of photopigments (red, blue, and green). Color blind people are dichromats--they lack one kind of photopigment. The most common kind of color blindness is the inability to distinguish between red and green. The red pigmented cones that people with normal vision have are colored with green in color blind people. This is one of the reasons why the red light is always on the top of a traffic light (unless the light is sideways). People with total color blindness are called monochromats. Today, both the trichromatic theory and opponent-process theory are used to explain color vision. The trichromatic theory explains color processing by the retina and the opponent-process theory explains color processing in the brain.

**Auditory System**

 Like the sense of vision, the sense of audition provides use with information about objects at a distance from us. Sound is produced by vibrations carried by air, water, or other mediums. Because sound requires a medium through with to travel, it cannot occur in a vacuum (e.g. Star Wars movies don’t use realistic sound effects). When the sound waves reach our ears, we hear by perceiving the sound and adding meaning. The basic element of sound is a sound vibration--a successive bunching and spreading of molecules in a sound medium. A series of these bunching and spreading cycles form a sound wave. The height of a sound wave is its amplitude--loudness. The number of sound wave cycles that pass a given point in a second is its frequency--pitch. The number of cycles per second is recorded in hertz (Hz). In addition to pitch and loudness, sounds vary in timbre--quality of sound. The timbre reflects a particular mixture of sound waves. Timbre allows us to identify the source of a sound. The note middle C has a frequency of 256 Hz but sounds different when coming from a piano, a guitar, or if that pitch could be made by fingernails scratching across the black board. Although they may be playing the same note, no two instruments produce exactly the same sounds. Thus, timbre also lets you evaluate the relative quality of sounds.

Auditory Perception

 Your ability to perceive voices, music, and sounds of all kinds depends on pitch perception, loudness perception, timbre perception (already discussed), and sound localization.

 Pitch perception. Remember that pitch is the frequency of sound waves cycles occurring per second. Humans can hear sounds ranging from 20 Hz to 20,000 Hz. Dogs can hear up to about 45.000 Hz which is why we cannot hear dog whistles but dogs can. Hermann von Helmholtz believes that his place theory can account for pitch perception. He believes that sound waves of different frequencies cause different points on the basilar membrane to maximally vibrate (Weiten compares this to a harp). The basilar membrane in the ear is covered in small hairs that vibrate and convert this physical sensation into neural impulses that are sent to the brain. His theory is supported by looking at the deterioration of hair cells that should vibrate when stimulated by high frequencies in older adults who tend to lose their high frequency hearing ability with age.

 However, place theory cannot explain pitch perception below 1,000 Hz because these sound waves don’t make any particular point on the basilar membrane vibrate maximally. Ernest Rutherford came up with frequency theory in an attempt to explain this. His theory assumes that the entire basilar membrane vibrates (much like a drum head) in response to the frequency of sound waves. The neurons of the auditory nerve will fire at the same rate as the basilar membrane. This works fine except for the fact that neurons can fire only up to 1,000 a second so frequency theory can’t account for frequencies above 1,000 Hz.

 A final theory attempts to explain pitch perception between 1,000 Hz and 5,000 Hz. Volley theory states that sound waves in this range induce certain groups of auditory neurons to fire in volleys. Because no single neuron can fire at more than 1,000 Hz, the brain interprets the firing of volleys of particular auditory neurons as representing sound waves of particular frequencies up to 5,000 Hz. So, a frequency of 4,000 Hz might be transmitter by five neurons each firing at 800 Hz.

 There is some overlap among these theories but frequency theory appears to best explain the perception of low-pitched sounds, place theory high-pitched sounds, and volley theory the perception of medium-pitched sounds.

 Loudness Perception. Sounds vary in loudness as well as pitch. The loudness of a sound depends mainly on the amplitude of its sound waves. The unit of sound intensity is the decibel (dB). The threshold of hearing is 0 dB. Exposure to high-decibel sounds promotes hearing loss. Chronic exposure to loud sounds destroys hair cells closest to the opening of the ear which also happen to be responsible for high frequency hearing. Hair cell loss continues throughout our lives (remember that old people have a harder time hearing high frequencies). A study of a sample of audience members at a rock-music concert found that they all displayed a hearing loss immediately after the concert. Three days after the concert, two-thirds of them still showed a hearing loss. Repeated exposure to rock music may produce permanent hearing loss. In certain African tribes, typical 80-year-olds have better hearing than the typical 30-year-old American due to the absence of loud sounds in their surroundings.

 Sound localization. In addition to identifying sounds, we must also be able to locate them. Human beings have an impressive ability to localize sounds. We do this by having two ears. Sounds that travel from places that are not equidistant between our two ears reach on of the ears first. Sounds are also most intense in the ear they reach first because the head partially blocks the reception in the other ear. The brain uses this intensity and arrival time information to help localize sounds. Even sounds that come from places equidistant from our ears can be localized because of the angle at which the sound waves enter the ear. The barn owl has even more impressive sound localization abilities than we do and is able to catch mice by following faint sounds produced by its movements.

**Skin Senses**

 We rely heavily on our senses of touch, temperature, and pain to identify objects, communicate feelings, and protect us from injury. There are a variety of receptors that produce skin sensations but there is no simple one-to-one relationship between specific kinds of receptors and specific skin senses. For example, the cornea of the eye has only one kind of receptor but is sensitive to touch, temperature, and pain. It appears that the pattern of stimulation of the receptors and not the specific kind of receptor determines skin sensations. Our sense of touch is actually a mixture of pressure, warmth, cold, and pain.

Touch

 Touch sensitivity depends on the concentration of receptors, with the most sensitive areas of the skin including the lips, face, tongue, hands, and genitals. The more sensitive the area of skin, the larger its representation on the cortex . The sense of touch is so precise that it can be used as a substitute for vision. The Braille system of reading and writing is a good example.

Temperature

 Sensory receptors actually detect changes in temperature rather than hot or cold objects. If an object is warmer than your skin, you will feel warmth. If an object is cooler than your skin, you will feel cold. Unless the temperature is extremely hot or cold, your skin will quickly adapt to the temperature even though it hasn’t changed. PLACE YOUR HANDS IN HOT (OR COLD) WATER. WAIT UNTIL THEY ADAPT. PLACE HANDS IN LUKEWARM WATER. SHOULD FEEL COLD (OR HOT) NOW.

Pain

 The sense of pain protects us from injury or even death. People born without a sense of pain, or who lose the sense of pain through nerve ending injuries, may cut or burn themselves without realizing it. They usually die by early adulthood because of unchecked infections or from their joints failing due to excess strain. Because intense pain or even moderate chronic pain can be one of the most distressing of all experiences, many researchers are studying the factors that cause pain and possible ways of relieving it. Hyperalgesia is an extreme sensitivity to something that others would find only mildly painful.

 Feeling pain is a property not only of the senses—of the region where we feel it—but of our brain and our expectations as well. Armel & Ramachandran (2003) did a study in which they bent a subject’s finger back slightly on their unseen hands while simultaneously showing the volunteers a fake rubber hand in which the finger was severely twisted by the experimenter. The volunteers felt as if their real finger was being twisted, and they responded with increased skin perspiration.

 Phantom sensations: Example of phantom limb pain in amputees. 7 out of 10 amputees feel pain or movement in nonexistent limbs; they may even try to “use” a nonexistent limb (pick up a coffee cup with their nonexistent hand). Even those born without a limb sometimes perceive sensations from the absent limb. The brain seems to be prewired to receive sensations from all 4 limbs. People who lose other senses have similar phantom sensations. Those who are deaf hear the “sound of silence” that involves tinnitus. Blind people sometimes have phantom visual images and hallucinations. Nerve damage to the taste system can produce odd sensations such as water tasting super-sweet. Some even smell phantom smells, like the smell of rotting food. \*\*Pain-producing brain activity may be triggered with or without sensory input.

 The pain system is not located in a simple neural cord running from a sensing device to a specific “pain” area of the brain. There is also no one type of stimulus that triggers pain as light triggers vision. In fact, at low intensities, the stimuli that produce pain also cause other sensations, including warmth and cold, smoothness or roughness.

The main pain receptors are free nerve endings in the skin. Two kinds of neurons transmit pain impulses. A-delta fibers are large myelinated fibers that carry sharp or pricking pain. C fibers are small unmyelinated fibers that carry dull or burning pain. Sharp pain is felt first. The most influential theory of pain is the gate-control theory. The theory assumes that pain impulses pass through a part of the spinal cord called the *substantia gelatinosa*, which provides a “gate” for pain impulses. The gate either allows pain sensations to pass through to the brain, or it closes it off. Large fibers close the gate, so acute pain is felt only for a short time while chronic pain is felt for a longer time (small fibers can’t close the gate). Stimulation of neurons that convey touch sensations closes the gate by activating large fibers, preventing input from neurons that convey pain sensations. This may explain why rubbing a shin that you have banged against a table will relieve the pain. Also, the closing of the pain gate is stimulated by the secretion of endorphins (the body’s own natural opiates). Finally, neural impulses from the brain can also open or close the gate. Anxiety, relation, or other psychological interpretations of pain (soldier’s ticket to going home in WWII; felt less pain than similarly wounded civilians) lead to a reinterpretation of the pain.

 One way to treat chronic pain is to try to close the pain gate. Massage, electric stimulation, or acupuncture can do this. Also, when we’re distracted from the pain and soothed by the release of endorphins, oru experience of pain may be greatly diminished. Example: Not noticing a sports injury until after the game. People who carry a gene that boosts the availability of the body’s natural painkillers (endorphins) are less bothered by pain, and their brains are less responsive to it.

 When others are enduring pain, people perceive their own pain more and endure it less. When feeling empathy for another’s pain, the person’s own brain activity may partly mirror the other’s brain in pain (men experiencing the “pain” of childbirth). There’s also more to our *memories* of pain than the pain we experienced. In experiments and after medical procedures, people overlook a pain’s duration. Their memory snapshots instead record its peak intensity and how much pain they felt at the end. Medical personnel do better to taper down a painful medical procedure, even if it means extending the pain for a minute, than to abruptly cut it off at a more intensely painful moment.

 Other techniques: relaxation (Lamaze), distraction (giving a burn patient a 3-D virtual reality world through computers), and even scenery (surgery patients who have a room with a view of trees require less pain medication than those with a view of a brick wall) all help minimize the experience of pain. Diverting the brain’s attention to pain may work.

Substance P—a neurotransmitter found in the brain and spinal cord that has been implicated in some inflammatory pain conditions such as fibromyalgia. Believed to be involved in the integration of pain, anxiety, and stress. Substance P has been shown to exist in higher levels in people with fibromalgia. The theory is that when found in higher levels Substance P as a neurotransmitter increases how we perceive pain. The higher the level of Substance P the more efficient our system is at pain transmission, it is that transmission which makes little pains feel horrible to fibromyalgia sufferers. Serotonin seems to be directly related to the control of substance P, which is why SSRIs work for some fibromyalgia patients to “turn down” the volume of their pain. Interestingly, something called capsaicin (found in chili peppers) depletes or interferes with substance P. Capsaicin is an irritant to humans and produces a burning sensation. It’s available over-the-counter in some pain-relieving gels (e.g., Sombra, Zestra). People with arthritis, diabetic neuropathy, and nerve pain may benefit from it. You’re supposed to use it 3-4 times daily, and there will be a burning sensation for 2-4 weeks initially. It takes 1-4 weeks to notice an improvement.

**Chemical Senses**

 The chemical senses include smell and taste.

Smell

 Odors are so important to us that people in this country spend millions of dollars on perfumes, colognes, and deodorants to make themselves more socially appealing. If necessary, we could even rely on our sense of smell to identify people like Helen Keller did. Even our moods can be altered by concentrations of odors in the air that we are unaware of. In addition, odors may evoke memories. The smell of chocolate chip cookies may remind you of your grandmother or a particular smell of cologne may remind you of your dad. The sensory system for smell is called the olfactory system.

 The receptors for smell are olfactory cilia. Scents enter the nose as chemicals and are transformed into neural impulses. The impulses travel up the olfactory nerve to the frontal lobes of the brain. Smell is the only sense not processed in the thalamus before being processed in other brain centers. In fact, the limbic system receives many of the neural impulses which may account for the strong emotional effects of certain odors.

 Our olfactory senses are restricted in terms of the range of stimuli that can be detected. We can only smell fragrances with molecules of a specific weight—between 15 to 300. Alcohol is within this range, but sugar is not.

 *Aromatherapy:* Since the 1970s, practitioners in the field of aromatherapy claim that they can successfully treat a wide range of psychological and physical ailments by means of specific fragrances. E.g., Lavendar, vanilla, cedar: relaxation; lemon, peppermint, basil: alertness. Does it work? Yes and no. Baron et al. found that any fragrance people find pleasant enhances their mood slightly, and this in turn influences their cognition and behavior. The particular fragrance doesn’t seem to matter; it’s just whether people find it pleasant or not. Another study by Baron showed that lemon does improve alertness in simulated driving tasks, though.

Taste

 The gustatory system allows us to protect ourselves from harm by ingesting poisons and enhance our enjoyment of life by savoring foods and beverages. Taste depends on thousands of taste buds which line the grooves between the bumps on your tongue. The taste buds contain receptor cells that send neural impulses when stimulated by molecules dissolved in saliva. Taste sensitivity varies with taste bud density. The more taste buds you have, the more intensely you’ll taste something. When you burn your tongue, some of your taste buds die and will be quickly replaced (die and are replaced every few days anyway). As you age, replacement of the taste buds slows so older people are able to eat spicier foods and may find food less flavorful.

 Researchers agree that there are four basic tastes: sweet, sour, salty, and bitter. Different areas of the tongue are maximally sensitive to each of the basic tastes. The front of the tongue is most sensitive to sweet and salty, the sides more sensitive to salty and sour, and the back most sensitive to bitter. All other tastes are combinations of these basic tastes and appear to depend on the pattern of stimulation of the taste receptors.

 Recent evidence suggests that there may be additional taste buds, including one called umami, which is evoked by the amino acid glutamate, found in meats, meat broths, and MSG. It’s a “savory” flavor. There may be another basic taste: fattiness. Research since 2001 suggests that people and animals can still detect fat when textural cues and smells are controlled. This may be why people don’t find fat-free foods as appealing as fatty ones. Particular tastes are more than just taste bud sensations. They also depend on texture, smell, temperature, and the pressure it exerts on our mouths. Don’t confuse taste with flavor. Taste depends merely on sensations from your mouth while flavor relies on both taste and smell. If you closed your eyes and held your nose, you would be unable to detect a difference between a piece of apple and a piece of potato.

*Interesting facts about taste:*

1. Children between ages 2 and 6 are typically fussy eaters and don’t like to try new meats or bitter-tasting vegetables. This is an evolutionary survival mechanism because such foods were often dangerous sources of food poisoning, especially for children.
2. Smoking and alcohol decrease the number of taste buds you have and your sensitivities to taste.
3. Our emotional responses to food are hard-wired. Newborns who taste something bitter or sweet have the same facial reactions as adults do.
4. People without tongues can still taste—through receptors in the back and on the roof of the mouth.
5. If you lose taste sensation from one side of your tongue, you probably won’t notice because the other side will become supersensitive. Also, the brain doesn’t localize taste well. Although the middle of the tongue has few taste buds, we perceive taste as coming from the entire tongue.
6. We can neither smell nor taste most nutrients (protein, starch, and food vitamins). We can taste sugar, though. We do quickly learn a liking or aversion to the taste and smell of other food components that prove nutritious or sickening.

Kinesthesia and Vestibular Sense

 Two other senses that are often ignored are our kinesthetic and vestibular senses. The kinesthetic sense gives us information about the location of our body parts with respect to each other and allows us to perform movements. (Drunk people have impaired kinesthesia.) Try this: Put both arms down by your sides. One at a time, touch each of your index fingers to your nose. Most people can do this, but it’s easier when you have visual cues. Vision enhances our kinesthetic sense.

 The vestibular sense keeps us in balance. The sensory organs for the vestibular sense are located in the inner ear, and they provide information about the body’s position by tracking changes in linear movement. It’s designed to detect *changes* in motion rather than constant motion. We also receive vestibular information from other senses, such as vision. If the information from the visual sense contradicts that of the vestibular sense, it can produce queasiness (getting off a roller coaster).

# Perception

**Form Perception**

 Perception researchers have traditionally believed that we “construct” our perceptions based on unconscious inferences we make from our sensations. These inferences are based on our experience with objects in the physical environment. Much of the work done in this area was done by Gestalt psychologists, e.g. Max Wertheimer, Kurt Koffka, and Wolfgang Kohler. Gestalt psychologists favored top-down processing over bottom-up processing. (COW EXAMPLE on Powerpoint…similar to Dalmation slide). Top-down advocates stress that the mind is active in the act of perception and that your expectancies affect what you see in an ambiguous picture. Advocates of bottom-up processing assume that the mind constructs perceptions mechanically from raw sensations. Gestaltists discovered several principles that guide the way in which sensations are molded into perception. Remember that Gestalt psychology is a school marked by the belief that the whole is greater than the sum of its parts. They believe that perceptions cannot be understood by analyzing a scene into elements. Instead, you must look at the relation of elements to one another.

 Figure/ground. To perceive forms (meaningful shapes or patterns), we must distinguish a figure (an object) from its ground (its surroundings). Sometimes, it’s not obvious what is figure and what is ground. How do we decide what is a figure? We tend to look for some type of boundaries. If a visual field contains a sharp and distinct change in brightness, color, or texture, we perceive an edge. If the edge forms a boundary, we will probably perceive space enclosed by the boundary as a figure. Most figures are defined by a boundary but the presence of a boundary is not necessary for perception of form (we’ll make boundaries if necessary). Sometimes the organization of elements results in perception of illusory contours--lines or boundaries that do not exist. Thus, we may see a figure with no real, distinct boundaries.

**Four Gestalt Rules for Grouping Stimuli**

 Proximity. The principle of proximity states that stimuli that are close together tend to be perceived as parts of the same form.

 Similarity. The principle of similarity states that stimuli that are similar to one another tend to be perceived as parts of the same form.

 Closure. The principle of closure states that we tend to fill in minor gaps in forms that we perceive.

 Continuity/Simplicity. The principle of continuity states that we tend to group stimuli into forms that follow continuous lines or patterns or in the simplest way possible. Depth

 If we lived in a two-dimensional world, form perception would be sufficient. But, because we live in a three-dimensional world, we must have some way to judge the distance of objects. This is provided by depth perception. We perceive depth using a variety of binocular and monocular cues.

 Binocular cues. These cues require the interaction of both eyes. Because of this, people who are blind in one eye have slightly impaired depth perception. Only animals with two eyes on the front of their head can make use of binocular cues.

*Convergence* - the degree to which the eyes turn inward to focus on an object. Your eyes move so that they can both look at a visual scene. If the object is close to your face, your eyes turn inward. If it is farther away, the eyes face nearly straight ahead. If you hold your forefinger in front of your face and move it inward, you should notice a change in muscle tension. Your brain translates the degree of muscle tension into an estimate of your distance from the object on which you are focusing.

*Retinal disparity* - Hold up a finger at arm’s length and another midway between your face and the first finger. Look at one and you’ll see a double image of the other. Whenever the eyes are pointed toward a particular point, the images of objects at different distances will fall on different portions of the retina of each eye. The amount of disparity produced by the images of each object on the two retinas provides an important clue about its distance from us. The closer objects are, the further apart on the retina. 3-D movies are shot by two cameras from slightly different angles. When you wear the special glasses, each eye sees a slightly different view of the scene and this creates an impression of depth

 Monocular cues. While binocular cues require two eyes, monocular cues require only one. Even a person who is blind in one eye can perceive some depth because of the following cues.

Interposition - if one object is placed between us and another object, it obscures our view of the more distant object so we know which one is closer.

Familiarity with size - if we know how large a car is, we can judge its distance by how small it appears (e.g. plane looking down at horizon)

Perspective - tendency for parallel lines that recede from us to converge at single point.

Changes in texture - coarser looks closer. In cities, parts of landscape less distinct because of haze.

Visual Illusions

 Visual illusions are misperceptions of physi cal reality usually caused by the misapplication of visual cues. Since ancient times, people have been mystified by the moon illusion. This occurs when the moon appears larger when on the horizon than when overhead (harvest moon). Examples: [Powerpoint slides]

 Müller-Lyer. Two vertical lines do not appear to be vertical

 Poggendorff. Two diagonal elements lie on the same straight line.

 Ponzo. Two horizontal lines are the same length.