

Table 1: Sensing the World: Some Basic Principles

Sensation: the process by which our sensory receptors and nervous system receive and represent stimulus energies from our environment

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

Bottom-up processing: analysis that begins with the sense receptors and works up to the brain's integration of sensory information

Top-down processing: information processing guided by higher level mental processes, as when we construct perceptions drawing on our experience and expectations

Psychophysics: the study of relationships between the physical characteristics of stimuli, such as their intensity, and our psychological experience of them

Absolute threshold: the minimum stimulation needed to detect a particular stimulus 50 percent of the time

-Applies to both seeing and hearing (figure 5.1)

Signal detection theory: a theory predicting how and when we detect the presence of a faint stimulus ("signal") amid background stimulation ("noise"). Assumes that there is no single absolute threshold and that detection depends partly on a person's experience, expectations, motivation, and level of fatigue.

Subliminal: below one's absolute threshold for conscious awareness

-Controversy erupted over subliminal messages in Coca Cola ads.

Difference threshold: the minimum difference between two stimuli required for detection 50 percent of the time. We experience the difference threshold as a just noticeable difference

-Increases with the magnitude of the stimulus. If you add 10 grams to a 100 gram weight, you will detect the difference; add 10 grams to a 1 kilogram weight and you will not, because the difference threshold has increased

Weber's law: the principle that, to be perceived as different, two stimuli must differ by a constant minimum percentage (Rather than a constant amount)

-For the average person to perceive their differences, two lights must differ in intensity by 8 percent. The two objects must differ in weight by 2 percent. And two tones must differ in frequency by only 0.3 percent.

Sensory adaptation: diminished sensitivity as a consequence of constant stimulation

-Move a wrist watch up an inch up your arm and you will only feel it for a second. After constant exposure to a stimulus, our nerve cells fire less frequently.

Transduction: conversion of one form of energy into another. In sensation, the transforming of stimulus energies into neural impulses.

-Your eyes receive light energy and transducer the energy into neural messages that the brain then processes into what you consciously see.

The stimulus input: Light energy

Electromagnetic Spectrum: ranges from gamma rays as short as the diameter of an atom to radio waves over a mile long.

-The narrow band of wavelengths visible to the human eye extends from the shorter waves of blue-violet to the longer waves of red light.

Wavelength: the distance from the peak of one light or sound wave to the peak of the next. Electromagnetic wavelengths vary from the short blips of cosmic rays to the long pulses of radio transmission

Hue: the dimension of color that is determined by the wavelength of light; what we know as the color names blue, green, and so forth.

Intensity: the amount of energy in a light or sound wave, which we perceive as brightness or loudness, as determined by the wave's amplitude.

-determined by a wave's amplitude, or height

Table 2:**The Eye**

Light rays reflected from the candle pass through the cornea, pupil, and lens. The curvature and thickness of the lens change to bring either nearby or distant objects into focus on the retina. Light rays travel in straight lines. So rays from the top of the candle strike the bottom of the retina and those from the left side of the candle strike the right side of the retina. The candle's retinal image is thus up side down and reversed.

Acuity, or sharpness of vision, can be affected by small distortions in the shape of the eye. In nearsightedness, the misshapen eyeball focuses the light rays from distant objects in front of the retina. If you're nearsighted, you have difficulty seeing distant objects.

Farsightedness is the opposite of nearsightedness. If you're farsighted, you can't see nearby objects.

Rods are retinal receptors that detect white, black, and grey. Cones are receptor cells that are concentrated near the center of the retina and function in daylight or well-lit conditions. The rods are more sensitive to light than are the color sensitive cones, which is why the world looks colorless at night.

The fovea is the retina's area of central focus. The fovea contains only cones. Many cones have their own bipolar cells to help relay their individual messages to the cortex, which devotes a large amount of its area to impulses from the fovea. This allows you to see fine detail.

Table 4: Visual Information Processing

In the cortex, individual neurons called feature detectors, respond to specific features of a visual stimulus, and their information is pooled for interpretation by higher level brain cells. Sub-dimensions of vision (color, movement, depth, and form) are processed separately and simultaneously which shows the brain's capacity for parallel processing. The visual pathway represents the retinal stimulation, but the brain's representation incorporates our interests and expectations.

Color Vision

The Young-Helmholtz Trichromatic theory suggests that the retina contains three types of cones. Each one is sensitive to different wavelengths and perceives the three primary colors. Also an opponent-process theory says the cones are paired into opponent colors, this explains the phenomenon of after vision. Color constancy under different illuminations shows how our brains construct our experience color.

Table 5: Audition: A sense of hearing

Audition is another name for hearing and is highly adaptive. We hear sounds according to the range of the human voice. Sound waves are what the ear interprets. They vary in wavelength, and accordingly, in pitch. The strength, or amplitude of sound waves determines their loudness. Waves also vary in length, and therefore in frequency. The visible outer ear channels sound waves to the ear drum. The middle ear drum transmits the ear drums vibrations through a piston made of three tiny bones: the hammer, anvil, and stirrup, to a snail shaped tube in the inner ear called the cochlea. This causes the fluid inside the cochlea to vibrate. This causes ripples in the basilar membrane, which is lined with hair cells. The basilar membrane bends these hair cells like grass in the wind. This movement triggers impulses in nerve fibers, which form the auditory nerve. Basically, hair cells send neural messages to auditory nerve. Prolonged exposure to decibel levels over 85 can damage the ears, as well as age.

Audition: A sense of hearing.

Frequency: The number of complete wavelengths that pass a point in a given time.

Pitch: A tones highness or lowness.

Middle Ear: The chamber between eardrum and cochlea, containing three tiny bones.

Inner Ear: contains the cochlea, semicircular canals, and vestibular sacs.

Cochlea: fluid filled tube in the inner ear, through which sound waves trigger nerve impulses.

Conduction Deafness: Hearing loss caused by damage to mechanical system that conducts sound waves to cochlea.

Nerve Deafness: Hearing loss caused by damage to the cochlea's receptor ccells or the auditory nerves.

Table 6:

Auditory

Key Ideas fromPages 214-218**A Noisy Noise**

- Brief exposure to extremely intense sounds such as gunfire near ones ear and prolonged exposure to intense sounds such as amplified music can damage receptor cells and auditory nerves.
- If we experience ringing of the ears after exposure to loud machinery or music we have been bad to our unhappy hair cells.
- Ringing of the ears is equivalent of bleeding. "Earplugs or walk away."
- People in noisy surroundings work less efficiently and make more errors, because noise effects not only our hearing but also our behavior.
- Noise is especially stressful when unanticipated or uncontrollable.

How Do We Perceive Noise?

- *Place Theory*-presumes that we hear different pitches because different sound waves trigger activity at different places around the cochlea's basilar membrane.
 - This means that the brain can determine a pitch by where it strikes the membrane and receives the neural signals.
- High Frequencies are near the beginning of the cochlea, low frequencies at the end.
- *Frequency Theory*-suggests alternate explanation for how we detect pitch.
- The whole basilar membrane vibrates with the incoming sound wave, which triggers a neural impulse to the brain at the same rate as a sound wave.

How Do We Locate Sounds?

- The reason we have two ears is because we can detect noises quicker from one side to the other depending where the noise came from.
- Our sensitive auditory system can detect small differences from where a sound comes from.
- Sound waves strike one ear sooner and more intensely than the other. From this information, our nimble brains compute the sound's location.

Hearing Loss and Deaf Culture

- *Conduction Hearing Loss*-if the eardrum is punctured or the tiny bones of the middle ear lose their ability to vibrate.
- *Sensorineural Hearing Loss*-damage to the cochlea's hair cells.
 - This can be caused by old age or constant exposure to ear splitting noise
- Scotland's Evelyn Glennie, who has been profoundly deaf since she was 12 years old, is a full-time percussion soloist. In performance she relates to her instruments through her sense of touch (performing without shoes) and to the conductor through her keen visual sense. This happens because when one sense is lost the others are heightened.

Living in a Silent World

- Deaf children raised in a signing household express higher self-esteem and can feel more accepted.

Table 7:**Other Senses**

1) Other senses

a) **Touch**-essential to our development

i) Our sense of touch is a mix of four distinct skin senses

(1) Pressure-The only sense that contains identifiable receptors

(2) Warmth-The receptors are unsure

(3) Cold- The receptors are unsure

(4) Pain-There is no single receptor of pain. The body's way of telling you that something has gone wrong. Pain is a property of not only the senses but of the brain.

(a) Phantom Limb- This is when a person feels pain in a limb that is not existing, or when the brain misinterprets the spontaneous central nervous system activity that occurs in the absence of normal sensory input. This may be caused because pain is not only a sense but also from the brain.

(b) Gate Control Theory- This theory says 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 of large fibers by information from the brain.

(c) When we are distracted from pain and soothed by endorphins then the experience of pain is lessened. This explains social influences on pain because it depends on how people perceive pain and if they are distracted by a social situation or a situation in general they do not feel pain. This can also happen if the person experiencing pain is focusing on the outside environment rather than on their personal pain. This is because pain is not just a physical thing but the brain makes pain as well, thus the brain activity for pain can be triggered with or without the environment.

(d) Memories of pain

(i) People remember pain mostly at the end of the painful experience.

(ii) Sometimes after a medical treatment people focus more on how intense the pain was rather than the duration of the pain.

(e) Pain control- If pain is where body meets mind then it could be treatable both physically and psychologically. You could use pictures of fond things or counting backwards are two examples of ways to reduce pain

(i) Mind Over Matter: Fire walking- You can walk on the coals because the coal and wood have poor heat conductivity. If you hesitate while you are standing on them you will be burned because it allows for the heat to transfer into your feet, however, if you do not hesitate you will not get burned because the coals do not have time to transfer the heat.

Table 8:**Smell (olfaction)**

- Each day we inhale and exhale 20,000 breaths, which go through your nostrils.
- Odors cannot be divided into more elementary odors
- Odors can provoke memories
- There are 1000 or so receptors for smell

Taste- 4 basic sensation: Sweet, Sour, Salty, Bitter, and Umami. The other tastes are mixtures of the basic tastes.

- Taste is a chemical sense
- 200 or more taste buds with pores that catch food chemicals
- Taste receptors reproduce themselves every week or two
- As you grow, the number of taste buds decrease so does sensitivity
- Alcohol and smoking decline taste buds and sensitivity

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

Body Position and Movement-

- Couldn't move without these
- We are equipped with millions of position and motion sensors in muscles, tendons, and joints.

Vocabulary: Kinethesis- sense of our body parts' position and movement.

Vestibular Sense- monitors the heads position and movement and influences balance.

They are in the inner ear