

Advanced Placement Psychology

Chapter 5: Sensation

(<http://www.ApPsychology.net>)

- **Sensation** is referred to as being **bottom-up processing**, detecting environmental stimuli from senses *up* to the brain.

Sensing the World: Some Basic Principles

- An **Absolute Threshold** is the lowest amount of stimulus needed to notice it **50%** of the time. For example, you turn down the radio to a point where you only hear the faint sound half the time. Then that loudness (decibel) is your absolute threshold for sound.
- But your detection of a stimulus also depends on your state of arousal, expectations, experiences, and motivation. This is described by the **Signal Detection Theory** – predicting when we will notice a weak stimulus (signal).
- A stimulus is **Subliminal** if it is below your absolute threshold, you detect it less than 50% of the time. For instance, a microscopic cell is subliminal to you because you cannot see it with your naked eye.
- **Subliminal advertisements** (Drink Coke, eat popcorn etc.), does have an affect on you but **do not persuade you**.
- The **Difference Threshold** (*just noticeable difference* or *jnd*) is the lowest difference you can detect between 2 stimuli 50% of the time. For example, you are just able to notice the difference between 1kg and 1.02kg half the time.
- **Weber's Law** states that two stimuli must differ in percentages or ratios, not amount, for a person to detect it (jnd).
- **Sensory Adaptation** – lowered sensitivity due to constant exposure from a stimulus. For example, when you go into someone's house you notice an odor...but this only lasts for a little while because sensory adaptation allows you to focus your attention on changing environment; it is irritating to be constantly reminded that your foot is in contact with the floor.

Vision

- **Transduction** refers to Sensory energy being convert (*transformed*) into Neural energy/impulses.
- Light is composed of electromagnetic waves with **Wavelengths** (distance from one peak to another peak on a wave) and **Amplitudes** (height of the wave)
- **WAVELENGTH** determines **HUE** (Color, i.e. Red, Blue, Green) and **PITCH/FREQUENCY** in sound.
- **AMPLITUDE** determines **INTENSITY** (Brightness, i.e. Bright red, dark red) and **LOUDNESS** in sound.
- External Light entering the eye first travels through the *Cornea* (protective layer) ~ **Pupil** (an adjustable opening) control by **Iris** (muscle around the pupil) ~ **Lens** (an oval transparency) that changes shape to focus light by a process called **Accommodation**; light is then focused onto the back of the eye called **Retina** (multi-neuron surface).
- There are 3 basic types of **Acuity** (how sharp/clear vision is) : normal, **nearsightedness** (only see *near* things clearly), and **farsightedness** (only see *far* things clearly)
- The Retina has 2 types of receptor cells : **Rods** (detect brightness of light, sensitive in dark), **Cones** (detect color and detail, sensitive in daylight). Cells connecting these detectors form the **Optic Nerve** that sends the impulses to brain.
- Everyone has a **Blind Spot**, a small region in the visual field where nothing could be seen. This is because there are **no receptor cells where the optic nerve leaves the eye** in the retina. Normally, we don't witness this effect because we have two eyes that compensate for each other's blind spot, and the fact that our eyes are constantly moving.
- **Fovea** is the region in the retina where light is centrally focused. The fovea has no rods, only cones.
- Nobel prize winners Hubel and Wiesel discovered **Feature Detectors** in the brain cortex that are sensitive to specific *features* in what we see (i.e. shape, color, depth, movement, form, and even postures, arm angle, gaze).
- **Parallel Processing** - Our brain *Processes* lots of information **simultaneously**. For example, looking at an orange, the brain processes the orange color, the round shape, and the bumpy texture all at the same time.
- People who cannot consciously perceive can still remarkably locate objects but are consciously unaware of how they knew. Such a phenomenon is called **Blind Sight**.

- Color processing is described in 2 stages : 1) **Young-Helmholtz trichromatic (three-color) theory** – Light is detected by 3 types of cones each specifically sensitive to Red, Blue, or Green. Combinations of them produce intermediate colors (yellow, cyan, purple) 2) **Opponent-Process theory** – Color is then processed by their opponent colors (red-green, blue-yellow, black-white). Some cells are excited by blue and inhibited by yellow, vice versa. Thus, you cannot see a bluish-yellow.
- **Color constancy** refers to the importance of surrounding background effects on perceived color. Color constancy states that colors don't look different even in different illumination (i.e. sunlight or dark room). *Green leaves will still be green whether on a clear or cloudy day.*

Hearing

- **Frequency (Pitch)** is the number of waves travelling through a point in one second, relates to how fast a wave travels.
- **Audition**, or hearing, requires sound waves converted into neural impulses, and this is done in the ear.
- Sound travels through the 3 sections of the ear to the brain :
 - **OUTER EAR** : *Auditory Canal*
 - **MIDDLE EAR**: *Ear drum* (tight membrane) ~ *Hammer, Anvil, Stirrup* (3 small bones connected to ear drum that vibrates when sound waves hit ear drum)
 - **INNER EAR** : **Cochlea** (coiled, fluid-filled tube) that contains the *Basilar Membrane*, which is lined with hair cells that vibrates to excite nerve fibers. The fibers form the *Auditory Canal* connecting to the brain.
- **Place theory** says that we hear different pitches because specific “*places*” in the cochlea are stimulated.
- **Frequency theory** says that we hear different pitches because the speed of neural impulses travelling to the brain matches the speed of the sound waves (“*frequency*”).
- We can tell which direction a sound is coming from because if it is closer to our right ear, the right ear will receive the sound slightly faster than left ear and the brain calculates this difference. Consequently, if the sound is directly behind or in front, where the distance between 2 ears is the same, then it is difficult to differentiate.
- **Conduction Deafness** – loss of hearing due to damage of eardrum, and/or the tiny bones in middle ear. (Could be fixed by hearing aid)
- **Nerve Deafness** – loss of hearing due to damage to cochlea, basilar membrane, and/or hair cells in the inner ear. (Could be fixed by a bionic ear, implanting a cochlea)

The Other Senses

- Touch is composed of 4 senses : *Warmth, Pain, Cold*, and **Pressure** (the only sense with identifiable receptors. The other three don't have specific receptors)
- Combinations of these create amazing feelings.
I.e. **Warmth and Cold = HOT**
Pressure and Cold = WET
Pressure and Pain = TICKLING ITCH
- *Phantom Limb Sensations* occur when pain is felt in a nonexistent limb. Even though the leg is not present, the receiving neurons previously connected to them are still there. And they will fire, resulting in pain sensations.
- The **Gate-Control Theory** states that the spinal cord has “*gates*” that opens/closes to transmit pain impulses. **Small fibers open Gate = pain. Large fibers close Gate = no pain.**
- Pain is merely a physical and psychological interpretation. Distraction methods, where attention is focused elsewhere, can ease the felt pain. Acupuncture (may affect gate-control), electrical stimulation, exercise can also relieve pain.
- Taste is a *Chemical Sense* composed of 4 basic senses : *Sweet, Sour, Salty*, and *Bitter*.
- Taste receptors (taste buds) regenerate every 1 or 2 weeks, but age, smoking, and alcohol will lower taste bud number and sensitivity.
- **Sensory Interaction** is when one sense affects another sense, thus *interacting*. For example, tasting apples and potatoes seem the same if we cannot see it or smell it.
- Smell or **Olfaction** is also a *Chemical Sense* that *directly transmits information from nose to the temporal lobe. The only sense that doesn't first relay impulses to the Thalamus.*
- **Kinesthesia** (using sensors in muscles, tendons, and joints) while, **Vestibular sense** (using fluids in semicircular canal, cochlea, and vestibular sacs in inner ear), both senses our position, movement, and balance.

Sensory Restriction

- Psychologists use REST (Restricted Environmental Stimulation Therapy), where you are put into a warm bath with eyes closed, or in a totally dark room, to lower stimulation and reduce stress, or unwanted behaviors (i.e. drinking).

Bibliography

Myers, David G., Psychology Fifth Edition. Worth Publishers, Inc. New York, NY ©1998