UNIT 4 GUIDE – 11/04/2019
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MODULE 16 – Basic Principles of Sensation and Perception

What are Sensation and Perception?	- **Sensation** is the process by which our sensory receptors and nervous system receive and represent stimulus energies from our environment - **Perception** is the process of organizing and interpreting sensory information, enabling us to recognize meaningful objects and events - **Bottom-up processing** starts at sensory receptors and works to higher levels - **Top-down processing** constructs perceptions from sensory input by drawing on experiences and expectations
Selective Attention	- **Selective attention** is the focusing of conscious awareness on one stimulus - *Cocktail party effect* - your ability to attend to one voice among many, while being able to detect your own name in an unattended voice - 28% of accidents in traffic happen due to cell phones, and talking on the phone is more dangerous than talking to a passenger (4x risk as opposed to 1.6) - **Inattentional blindness** is failing to see visible objects because our attention is directed elsewhere - this is what magicians use to perform magic tricks - **Change blindness** is failing to notice changes in an environment - **Choice blindness** is failing to recognize the difference between two choices

Transduction	- All of our sense:
	  - receive sensory stimulation using receptor cells
	  - transform that stimulation into neural impulses
	  - deliver the neural information to our brain
	- **Transduction** is the converting of one form of energy into another that the brain can use
	- **Psychophysics** is the study of relationships between the physical characteristics of stimuli (ex: intensity) and our psychological experience of them

Thresholds	- **Absolute thresholds** are the minimum stimulation needed to detect a particular stimulus, 50% of the time
	  - discovered by Gustav Fechner (1801-1887)
	- **Signal detection theory** predicts how and when we detect the presence of a faint stimulus amid background stimulation
	  - it assumes that your absolute thresholds at any given time are all dependent on your circumstances: expectations, motivation, etc
	- **Subliminal** stimuli can't be detected 50% of the time (under absolute threshold)
	- **Priming** is the unconscious activation of associations, predisposing your perception, memory or response
	  - a subliminal stimuli can pime you, and a masking stimulus can interrupt your processing before conscious perception occurs
	- The **difference threshold** is the minimum difference a person can detect between two stimuli, half the time
	- **Weber's law** - for an average person to perceive a difference, two stimuli

	must differ by a constant minimum percentage, not *amount*
Sensory Adaptation	- **Sensory adaptation** is a diminished sensitivity as a consequence of constant stimulation - It gives us the freedom to focus on *informative* changes in our environment, without being distracted by background chatter - We perceive the world not as it is, but as it is useful for us to perceive it

MODULE 17 – Influences on Perception

Perceptual Set	- Our **perceptual set** is our mental predisposition to perceive one thing and not another, a set of mental tendencies and assumptions - Some differences exist merely in the eyes of their beholders
Context Effects	- A given stimulus can trigger different perceptions not only because of perceptual sets, but because of context - The brain can work backward in time to allow a later stimulus to determine how we perceive an earlier one - eel is on the wagon vs. eel is on the orange

Emotion and Motivation	- Perception can also be influenced by emotion and motivation
	  - sad: mourning, die, pain
	  - happy: morning, dye, pane
	- Distance can look further if you're fatigued, and water can look closer if you're thirsty
	- Emotions can also color social perceptions
	- **Extrasensory Perception (ESP)** is the controversial claim that perception can occur apart from sensory input, including telepathy, clairvoyance and precognition
	- **Parapsychology** is the study of paranormal phenomena, like ESP and psychokinesis

MODULE 18 – Vision

The Stimulus Input: Light Energy	- Visible light is a thin slice of a spectrum of electromagnetic energy, from gamma waves (shortest) to radio transmissions (longest) - Light's **wavelength**, the distance between peaks of the waves, determines its **hue** (the color we experience) - **Intensity**, the amount of energy in the light waves, determined by *amplitude*/height, influences brightness

The Eye	- Light enters the eye through the *cornea*, which protects the eye and bend light to provide focus
	- Light passes through the adjustable **pupil**, whose size is controlled by the **iris**, a colored muscle that dilates/contracts in response to light intensity and emotions
	- Then, the **lens** focuses light rays into an image on the **retina**, a multilayered tissue on the eyeball's inner surface
	  - the lens focuses by changing its curve through **accomodation**
	  - the retina's receptor cells convert particles of light energy into neural impulses

	- The retina's receptor cells are **rods** and **cones**, and when light hits them it triggers chemical changes that spark neural signals, activating **bipolar cells** which activate **ganglion cells**, whose axons form the **optic nerve**
	- The optic nerve carries information to your thalamus
	- Where the optic nerve leaves the eye it created a blind spot b/c there are no receptor cells
	- Cones cluster around the **fovea**, the retina's area of central focus, and are better to detect fine detail b/c they have individual bipolar cells
	  - let you perceive colors
	- Rods share bipolar cells and are better in low light
	  - let you perceive black-and-white vision, and are sensitive in dim light unlike cones

Visual Information Processing	- Any given retinal area relays info to a corresponding area in the visual cortex, in the occipital lobe
	- Retinal cells are so responsive that pressure can trigger them, but the brain interprets their firing as light coming from the opposite side
	- **Feature detectors** are nerve cells that respond to specific features of stimuli like shape, angle or movement b.c they receive info from individual ganglion cells
	  - pass info to areas where *supercell clusters* of cells respond to complex patterns (ex: cluster for face recognition)
	  - David Hubel and Torsten Wiesel
	- **Parallel processing** is the processing of different aspects of a problem simultaneously
	  - the brain divides visual scenes into subdimensions and works on each simultaneously

Color Vision	- An object is "red" because it reflects everything but red wavelengths - For about 1 in 50 people, vision is color deficient (usually males) - The **Young-Helmholtz trichromatic theory** is the theory that the retina has three color receptors - red, green and blue, which produce colors when stimulated in combination - **Colorblind** people lack functioning red and/or green receptors - The **opponent-process theory** (also true) is the theory that color vision is enable by opposing retinal processes (red-green, yellow-blue, white-black) - Red/green/blue cells respond to color stimuli, and the nervous system's opponent-process cells process their signals

MODULE 19 - Visual Organization and Interpretation

Visual Organization	- A **gestalt** is an organized whole
	- The **figure-ground** relationship is the organization of the visual field into objects that stand out from their surroundings
	- **Grouping** is the perceptual tendency to organize stimuli into coherent groups
	  - proximity - we group nearby figures together
	  - continuity - we perceive smooth, continuous patterns rather than discontinuous ones
	  - closure - we fill in gaps to create a complete. whole objects
	- **Depth perception** enables us to estimate an object's distance from us

	- A **visual cliff** is a lab device to test depth perception in infants/animals
	  - biology predisposes us to be wary of heights, experience amplifies the feat
	- **Binocular cues** are depth cues that depend on the use of two eyes
	  - **retinal disparity** is a cue for perceiving depth - the images from the two retinas are compared - the greater the difference, the closer the object
	- **Monocular cues** are depth cues available to either eye
	- The **phi phenomenon** is an illusion of movement created when two or more adjacent lights blink on and off in quick succession
	- **Perceptual constancy** is a top-down process that enable us to perceive objects as unchanging despite changes in illumination or retinal image
	- **Color constancy** is perceiving familiar objects as having consistent colors even if changing illumination alters the wavelengths they reflect
	  - brightness constancy depends on relative luminance - the amount of light an object reflects relative to its surroundings
	  - we see color thanks to our perception of light relative to the objects surrounding it
	  - shape/size constance also exist

Visual Interpretation	- There is a *critical period* for sensory and perceptual development, in which nurture sculpts what nature has endowed - Sensory restrictions later in lie will not do permanent harm like they might in the critical period - **Perceptual adaptation** is the ability to adjust to an artificially displaced or inverted visual field

MODULE 20 - Hearing

The Stimulus Input: Sound Waves	- Our **audition** (sense of hearing) is highly adaptive, and we're very attuned to variations in sounds
	- Jostling molecules in the air create waves of compressed and expanded air, which are detected by our ear as pressure changes
	- The amplitude of sound waves determines their loudness, and their length/frequency determines their pitch
	  - long wave = low frequency, short = high
	- Sound is measured in decibels, with 0 decibels as the absolute threshold
	  - 10 db = a tenfold increase in sound intensity

The Ear	- The outer ear channels sound waves through the auditor canal to the eardrum, a tight membrane, making it vibrate - In the **middle ear**, the ossicles (hammer, anvil and stirrup) transmit those vibrations to the: - **Cochlea,** a snail shaped tube in the **inner ear** - The vibrations vibrate the cochlea's membrane, or **oval window,** jostling the fluid that fills the tube - This motion ripples the basilar membrane, bending its hair cells, which trigger adjacent nerve cells whose axons converge to form the auditory nerve - **Sensorineural hearing loss** is caused by damage to the hair cell receptors or their associated nerves

	- **Conduction hearing loss** is caused by damage to the mechanical system
	- The rate of teen hearing loss is 1 in 5, largely due to prolonged exposure to ear-splitting noise or music
	- A **cochlear implant** translates sounds into electrical signals which convey information about sound to the brain
	  - they can only enable normal hearing in people who have already learned to process sound - not in those with hearing loss from birth
	- The brain interprets loudness from the *number* of activated hair cells - so loudness is equally loud to those with hearing loss, they just don't hear soft things
	- The **place theory** proposes that we hear different pitches because different sound waves trigger activity at different places on the basilar membrane
	  - it doesn't explain how we hear high, but not low, sounds
	- The **frequency theory** suggests that the brain monitors the frequency of neural impulses on the auditory nerve to determine pitch
	  - however, it doesn't explain how some sounds have frequencies above a neurons max of 1000 waves per second

MODULE 21 - The Other Senses

Touch	- Touch is vital and essential to our development - Our sense of touch is a mix of distinct senses for pressure, warmth, cold and pain
Pain	- Pain is your body's way of telling you something has gone wrong - Pain sensitivity varies, but women tend to be more pain sensitive than men are - No one stimulus triggers pain, there are different *nociceptors*, sensory receptors that detect hurtful temperatures, pressure or chemicals - The **gate control theory** is the theory that the spinal cord has a neurological gate that blocks pain signals or allows them to pass - it's opened by the activity of pain traveling up small nerve fibers, and is closed by activity in large fibers or info from the brain - *Endorphins* are natural painkillers - The brain can create pain like it does during *phantom limb sensations*, where it misinterprets CNS activity that occurs in the absence of normal sensory input - Hearing loss can lead to tinnitus, or *phantom sounds* - Distraction and memory can "edit" our experiences of pain, as can our social situation and cultural traditions - Pain control: drugs, surgery, acupuncture, electrical stimulation, massage, exercise, hypnosis, relaxation training and thought distraction

Taste	- Taste comes in five basic tastes:
	  - sweet (energy), salty (sodium for physiological processes), sour (toxic acid), bitter (poison), umami (proteins for tissue)
	- Taste can be explained in terms of evolutionary psychology
	- A bump on your tongue has 200+ taste buds which each have a pore to catch food chemicals - in each pore, 50-100 taste receptor cells project "hairs" that sense food molecules
	  - receptors tend to be specialized, and reproduce every week or two

	(so you can burn your tongue@) - As you age, your number and sensitivity of taste buds decreases - smoking and drinking accelerate this process
Smell	- Smell is chemical like taste: molecules of a substance reach 20 million receptor cells at the top of each nostril, which respond selectively and alert the brain through axon fibers - Smell bypasses the thalamus because it is such a primitive sense - There are about 350 receptor proteins that recognize particular odor molecules, embedded on the surface of nasal cavity neurons - an odor can trigger a combo of receptors in a pattern interpreted by the olfactory cortex - We have a large capacity to associate old odors and associated memories - There is a brain hotline between the nose and memory/emotion centers

Body Position and Movement	- **Kinesthesia** is the system for sensing the position and movement of individual body parts
	  - enabled by sensors in joints, tendons and muscles
	- Your **vestibular sense** is your sense of body movement and position, including balance
	  - the gyroscopes for this sense are in your inner ear
	  - *semicircular canals* and *vestibular sacs* contain fluid that moves when you rotate/tilt our head, stimulating hairlike receptors that send messages to your cerebellum

Sensory Interaction	- **Sensory interaction** is the principle that one sense may influence another - smell + texture + taste = flavor - The *McGurk effect* demonstrates the interaction of vision and hearing - **Embodied cognition** is the influence of bodily sensations, gestures and other states on cognitive preferences and judgements - *Synesthesia* is a phenomenon where one sensation (hearing) produces another (seeing color)