Sensation and Perception

Transduction = transforming incoming stimuli into neural signals

Sensory Adaptation = decreased responsiveness to stimuli due to constant stimulation

Sensory Habituation = focus of attention on sensations affects the perception of said sensations

Cocktail-party Phenomenon = ability to focus auditory attention on particular stimulus while filtering out other stimuli

Vision

Step 1 - Gathering Light

- Light is reflected off objects as electromagnetic waves and is gathered by the eye
- Color is affected by intensity (brightness) and wavelength (hue)
- Colors perceived is the specific color is reflected – every other color is absorbed

Step 2 – Within the Eye

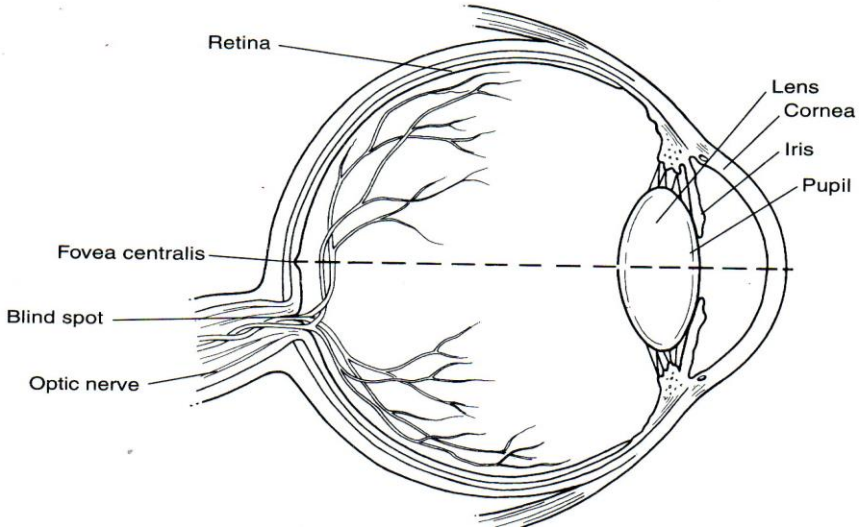
- Light enters through *cornea* (protective layer)
- The *iris* (eye muscles) dilates and constricts *pupil* (empty hole) to control how much light is allowed into the eye
- *Accommodation* by the *lens* focuses the light
- Focused light projects onto the *retina*, where specific neurons are activated

Step 3 – Transduction

- 2 types of cells on first layer of retina is activated:
  - *Cones* respond to color, concentrated toward the center of the retina, especially at the *fovea* (indentation with highest concentration of cones)
  - *Rods* respond to black and white, distributed throughout the retina, outnumber cones at 20:1
- Second layer of cells, *ganglion cells* (whose axons form the optic nerve), activate, and send impulses the *lateral geniculate nucleus* (LGN) in the thalamus
- Messages then sent to visual cortices in the occipital lobe
- Impulses right of the retina goes to the left side of the brain, and vice versa. The spot where nerves cross is called the *optic chiasm*

Step 4 – In the Brain

- Impulses activate specific neurons in the visual cortex (in the occipital lobe)
- Different groups of neurons in the visual cortex respond to different types of visual images, such as feature detectors for vertical lines, curves, motion, etc.



Theories of Color Vision

Trichromatic Theory

- Cones detect blue, red and green as primary colors of light, which are activated in different combinations to produce all the colors of the visible spectrum
- Supported by research and intuition, but does not explain visual phenomena, such as *afterimages* and *color blindness*

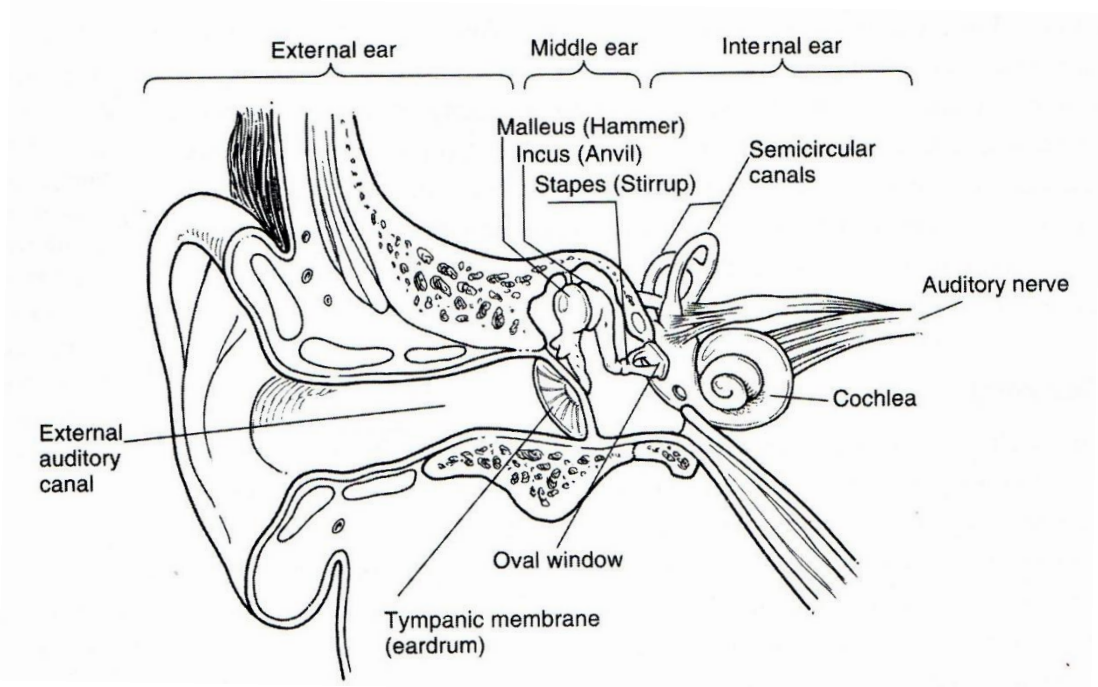
Opponent-Process Theory

- Sensory receptors arranged in retina as pairs: red/green, yellow/blue, black/white
- When one sensor is stimulated, its pair is inhibited from firing
- Developed from and now used along with Trichromatic Theory to explain color vision

Hearing

- Sound travels as vibrations in the air and are collected by the ears
- Affected by *amplitude* (loudness, in decibels) and *frequency* (pitch, in megahertz)

1. Waves travel down *ear canal* (auditory canal) and reach the *eardrum* (tympanic membrane)
2. Membrane is attached to a series of bones – *hammer* (malleus), *anvil* (incus), *stirrup* (stapes), and vibrations are sent from the membrane, through the 3 bones to the *oval window*
3. Vibrations sent to oval window moves the fluid in the attached cochlea, which moves the hair cells at the floor of cochlea
4. Hair cells in cochlea activate the *organ of Corti* (neurons), where auditory transduction occurs



Pitch Theories

Place Theory

- Hair cells in cochlea respond to different frequencies based on where they are lcaocated
- Some hair cells bend in response to high pitches and some to low

Frequency Theory

- Lower tones are sensed by rate at which the cells fire
- Pitches are sensed because the hair cells fire at different rates (frequencies) in chcolea

Deafness

Conduction deafness = when system of conducting sound to cochlea has problems

Nerve deafness = hair cells in cochlea are damaged, usually by loud noise

Touch

- Various senses of touch, such as pressure, temperature, pain, etc.
- *Gate-control theory* = some pain messages have a higher priority than others

Chemical Senses

Taste

- Taste buds detect 5 different types of tastes: sweet, salty, sour, bitter, umami
- Flavor intensity depends on concentration of *papillae* (where buds reside on)

Smell

- Smell molecules are detected by *receptor cells* in the nose
- Receptor cells are linked to the *olfactory bulb*, which gathers impulses from *olfactory receptor cells*
- Olfactory bulb connects to the brain at the amygdala and hippocampus – a strong piece of evidence for why smell is a trigger for memories and emotional impulses

Vestibular Sense

- Gives information on how body is oriented in space
- Three *semicircular canals* in inner ear have fluids that activate hair cells

Senses and Associated Receptors		
Energy Senses	Vision	Rods, Cones (in retina)
	Hearing	Hair cells connected to the organ of Corti (in cochlea)
	Touch	Temperature, pressure, pain nerve endings (in the skin)
Chemical Senses	Taste (gustation)	Sweet, sour, salty, bitter, umami, taste buds (in papillae on the tongue)
	Smell (olfaction)	Smell receptors connected to the olfactory bulb (in the top of the nose)
Body Position Senses	Vestibular Sense	Hairlike receptors in three semicircular canals (in the inner ear)
	Kinesthetic Sense	Receptors in muscles and joints

Thresholds

Absolute thresholds = smallest amount of stimulus humans can detect 50% of the time

Subliminal thresholds = stimuli below absolute threshold

Difference threshold = smallest change needed in a stimulus before the change is detected

Weber's law = the difference threshold is proportional to the original intensity of the stimuli

Perceptual Theories

Signal Detection Theory = investigates effects of distractions and interference we experience while perceiving the world

Receiver operation characteristics = factors that motivate us to detect certain stimuli and what we expect to perceive

False positive = when we think we perceive a stimulus that is not actually there

False negative = when we do not perceive a stimulus that is actually present

Schemata = mental representations of how we expect the world to be

Perceptual Set = a predisposition to perceive something in a certain way

Backmasking = supposed hidden messages recorded backward in music – demonstrated that, if people expected to hear threatening messages in random noise, they often will

Top-Down Processing =

- Perceiving by filling in gaps with what we sense
- Often based on experience
- Background knowledge to influence perception
- Faster but prone to error

Bottom-Up Processing (feature analysis):

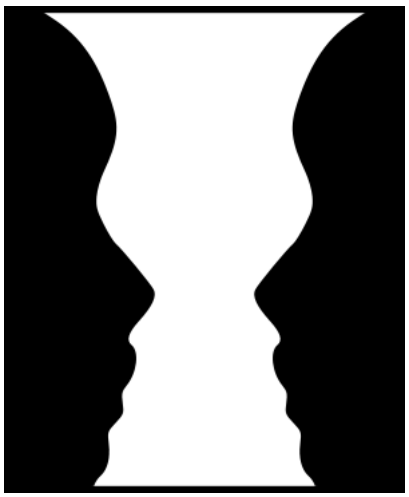
- Using only features of an object to build a complete perception
- Stimulus influences perception
- Data driven
- Slower but more accurate

Figure-Ground Relationship = perceptual grouping – a vital necessity for recognizing objects through vision

Example of *Figure-Group Relationship*:

You see words on a printed paper as the "figure" and the white sheet as the "background".

Which is the figure in the picture to the right – the faces or the vase?



Gestalt Rules

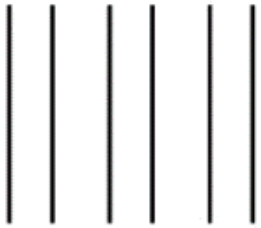
- We normally perceive images as organized groups, not as isolated elements
- Innate and inevitable process

Proximity = Objects that are close together are more likely to be perceived as belonging in the same group

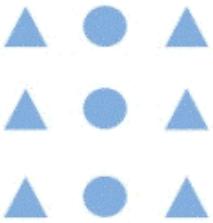
Similarity = Objects that are similar in appearance are more likely to be perceived as belonging in the same group

Continuity = Objects that form a continuous form (such as a trail or a geometric figure) are more likely to be perceived as belonging in the same group

Closure = Objects that make up recognizable images are likely to be perceived as belonging in the same group even if the image contains gaps that the mind needs to fill



Proximity



Similarity

Continuity

Connectedness

Constancy

- Maintaining consistent perception of an object despite changes every moment
- 3 types of constancy – Size, Shape, and Brightness

Perceived Motion

Stroboscopic Effect = an illusion of apparent motion or absence of motion that arises when an object or picture is viewed not continuously but during separate time intervals that succeed one another in a periodic manner

Phi Phenomenon = optical illusion of perceiving a series of still images, when viewed in rapid succession, as continuous motion

Autokinetic Effect = phenomenon of visual perception in which a stationary, small point of light in an otherwise dark or featureless environment appears to move

Depth Cues – Monocular Cues

Linear Perspective = parallel lines appear to converge at some point in the distance

Relative Size Cue = allows you to determine how close objects are to an object of known size

Interposition Cue = when one object overlaps with another object, and the object being covered is perceived as being farther away

Texture Gradient = gradual change in appearance of objects from coarse to fine, also involves groups of objects appearing denser as they move farther away

Shadowing = implying where the light source is and imply depth and position

Depth Cues – Binocular Cues

Binocular (retinal) disparity = the difference in image location of an object seen by the left and right eyes

Binocular convergence = the rotation of the eyes in their sockets to focus on a single object