

# UNIT 4: SENSATION AND PERCEPTION

**Sensation:** pg 116

–Sensation represents the first series of steps in processing of incoming information

**Perception:** pg 116

–Perception draws heavily on memory, motivation, emotion, and other psychological processes to give them meaning.

**The human mind lacks direct access to the outside world.**

All external events are filtered through the sense organs and then combined with the individual's unique mix of memories, emotions, motives, and expectations.

Humans lack the acute senses of many other species, but have evolved sensory equipment that enables us to process a wider range and variety of sensory input than any other creature.

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**Key Question:** How does stimulation become sensation?

**Core Concept:** The brain senses the world indirectly because the sense organs convert stimulation into the language of the nervous system: neural messages

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***The main role of our stimulus detectors is to announce change in the external world***

## THREE ATTRIBUTES COMMON TO ALL THE SENSES

**1. Transduction:** pg124

**2. Sensory Adaptation:** pg 123

**3. Thresholds:** pg 120-122 - edge or limit

**Absolute threshold:** pg 120

**Difference Threshold:** The smallest difference between two stimuli that can be still recognized pg 122

Example: turning down stereo volume...you may hear a differences, your sister with a different threshold may not

If you can hear the difference, it exceeds your threshold...if she can't, it hasn't exceeded hers

**Just Noticeable Difference:** The minimal amount of change in a signal that is still recognizable

Example: How many lights must be turned off before you notice a difference

**Weber's Law:** pg 123 The size of the JND is proportional to the intensity of the stimulus  
-Is always large when the stimulus energy is high, and small when the stimulus intensity is low  
Example: If the TV volume is high, you have to turn it down a lot to make the difference noticeable

**Signal Detection Theory:** pg 121

-SDT recognizes that the observer, whose physical and mental status is always in flux, must compare sensory experience with ever-changing expectations and biological conditions.

**Subliminal Persuasion:** pg121-122

**Key Question:** How are the senses alike? How are they different?

**Core Concept:** The senses all operate in the same way, but each extracts different information and sends it to its own specialized processing region in the brain

## VISION pg 124-133

Colors of the Light Spectrum: Red Orange Yellow Green Blue Indigo Violet

***Sensation occurs in the eyes...perception occurs in the brain***

### HOW WE SEE

1. Light passes through transparent **cornea**
2. Amount of light allowed to enter controlled by the muscle called the **Iris** (colored part of the eye) - opening of the iris is the **pupil**
3. The **lens** adjusts the image, allowing a clear image to be projected onto the **retina**
4. The **retina**: Incoming light hits **photoreceptors** (rods and cones) at the back of the eye
5. **Rods and cones**: Absorb light energy, create neural impulses
6. **Bi-polar cells** then collect impulses from photoreceptors (rods and cones), pass them onto **ganglion cells**
7. Ganglion cell axons bundle together to form the optic nerve, which transports information to the brain

**Retina:** The thin, light sensitive layer at the back of the eye, contains millions of photoreceptors and other nerve cells  
-Transduces the characteristics of light into neural signals that the brain can process

**Photoreceptors:** Light sensitive cells (neurons), rods and cones, that absorb light energy and respond by creating neural impulses  
-This is as far as light gets in the visual system

**Rods:** Photoreceptors in the retina that are sensitive to dim light but not to colors  
-Enable us to see in dark/low light places

**Cones:** Photoreceptors in the retina that are especially sensitive to colors, but not dim light.  
-Enable us to see colors...each cone is specialized to detect light waves we sense either as blue, green, or red.

**Fovea:** The tiny area of sharpest vision in the retina where the cones focus

**Optic Nerve:** The bundle of neurons that carries visual information from the retina to the brain

**Blind Spot:** The spot where the optic nerve exits each eye

\*\*\* What one eye misses the other compensates for and the brain fills in the information

### Visual Cortex

–We look with our eyes but see with our brain.

–The visual cortex takes two-dimensional patterns from each eye and assembles them into a three-dimensional world of depth

–Combines these visual sensations with memories, motives, emotions, and sensations of body and touch to create a representation of the visual world that fits our current concerns and interests.

**Brightness:** a psychological sensation caused by the intensity (or amplitude) of light waves

**Color:** A psychological sensation created in the brain from information obtained by the eyes from the wavelengths of visible light

–Does not exist outside of the brain

–Also called hue

**Electromagnetic Spectrum:** The entire range of electromagnetic energy, including radio waves, X waves, microwaves, and visible light

**Visible Spectrum:** A small section of the electromagnetic spectrum to which our eyes are sensitive

–Longer wavelengths = red    Medium length = yellow, green    shorter = blue

–Humans are capable of *discriminating among five million different colors*

**Trichromatic Theory:**

**Opponent-process Theory:**

**Afterimages:** Sensations that linger after the stimulus is removed.

**Color blindness:** the total inability to distinguish colors

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## HEARING pg 133-140

**Frequency:**

**Amplitude:**

### **HOW WE HEAR SOUND WAVES**

1. Vibrating waves of air enter the outer ear and strike the membrane: the **eardrum**
2. The eardrum transmits the vibrations to three tiny bones: the **hammer, anvil, and stirrup**
3. The hammer, anvil, and stirrup pass the vibrations to the primary organ of hearing, the **cochlea**.
4. The cochlea focuses the vibrations on the **basilar membrane**.
5. The basilar membrane converts the vibrations into **neural messages**
6. The neural messages travel to the **auditory cortex** in the brain
7. The neurons from the two ears meet at the brain stem

**Cochlea:** The primary organ of hearing where sound waves are converted (transduced) into nerve messages

The coiled tube of the cochlea is filled with fluid that is sent into motion from the stirrup vibrating against the oval window of the cochlea, as a result the basilar membrane vibrates.

**Basilar Membrane:** a thin strip of tissue running through the cochlea that is sensitive to vibrations.

–The Basilar Membrane contains hair cells connected to neurons.

–When a sound wave causes a hair cell to vibrate, the associated neuron becomes excited. As a result, the

sound waves are converted into nerve activity

**\*\*\*\*Sounds have only three sensory qualities: pitch, loudness, and timbre\*\*\*\***

**Pitch:** A sensory characteristic of sound produced by the frequency of the sound wave

**Loudness:** A sensory characteristic of sound produced by the amplitude of the sound wave.  
–More intense sound waves produce louder sounds

**Timbre:** The quality of a sound wave that derives from the waves complexity.  
–All sounds are peculiar mixes of tones.

**Conduction Deafness:** The inability to hear resulting from damage to structures in the middle or inner ear

**Nerve Deafness:** An inability to hear linked to a deficit in the body's ability to transmit impulses from the cochlea to the brain

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## **POSITION and MOVEMENT** pg141

The physical mechanisms that keep track of our body position, movement, and balance consist of Vestibular Sense and Kinesthetic Sense.

### **Vestibular Sense:**

- Tells how our bodies, especially the head, are postured. (Straight, leaning, upside down,...)
- Also, how we are moving and how our motion is changing
- Closely associated with the inner ear and is carried to the brain on a branch of the auditory nerve

### **Kinesthetic Sense:**

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## **SMELL** pg148-150

**Olfaction:** The sense of smell

- Olfaction has a strong connection to memory
- The sense of smell adapts rapidly to odors so that we lose awareness of them.....Ex: strong perfume

**Pheromones:** Chemical signals released by organisms to communicate with other members of their species

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## **TASTE** pg 146-148

**Gustation:** The sense of taste

- The senses of smell and taste work together  
Ex: Much of the taste of an onion is odor, not flavor. If you did not have the sense of smell, an onion and an apple would taste the same.

## Four Primary Taste Qualities

sweet, sour, salty, bitter

New Fifth Quality: Umami ..the flavor associated with MSG

**Taste Buds:** Taste receptor cells where neurons are located

**Supertasters:** those that have more taste buds for bitter flavors who are more sensitive than regular tasters or extreme nontasters.....tend to dislike things such as diet soda

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## THE SKIN SENSES

**Skin Senses:** Sensory system for processing touch, warmth, cold, texture, and pain

- Skin sensitivity varies on the body...fingertip more sensitive than our backs
- the receptors for sensing temperature are located just beneath the skin
- Connected to the somatosensory cortex in the brain's parietal lobe

**Touch:** Plays a central role in human relationships. Through touch we communicate our desire to give or receive comfort, support love, and passion

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## PAIN<sub>pg 142-146</sub>

- Pain means something is wrong with the body
- Part of the body's adaptive mechanism that makes us respond to conditions that threaten damage to the body
- Pain is not merely the result of stimulation: EX: Phantom Limb

**No one has yet to develop a theory that explains everything about pain**

**Gate-Control Theory:** Theory that pain control is due to a neural 'gate' that can, under certain circumstances, can block incoming pain signals

**Gate-Control Theory Explained.....:**

1. Pain travels on two different sensory pathways to the brain
2. Fast fibers vs. Slow fibers
3. Fast fibers deliver most of the sensory information to the brain.
4. Very intense stimuli send strong signals on the slow fibers
5. Competing messages from the fast fibers can block the pain message in the slow fibers, preventing the slow fiber's message from reaching the brain

-The nervous system can only process a limited amount of stimulation at a time

**Placebo Effect:** A response to a placebo (fake drug) caused by the subject's belief that they are taking a real drug

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**Key Question:** What is the relationship between sensation and perception?

**Core Concept:** Perception brings *meaning* to sensation, so perception produces an interpretation of the world, not a perfect representation of it

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**Percept:** What we perceive

the meaningful product of perception -often an image that has been associated with concepts, memories, emotions, and motives

## Perceptual Processing: Finding Meaning In Sensation pg 151-165

*The primary goal of perception is to get an accurate 'fix' on the world - to recognize friends, foes, opportunities, and dangers.*

**Feature Detectors:** Cells in the cortex that specialize in extracting certain features (such as length, slant, color, boundary, human facial features) of a stimuli.

**Binding Problem:** The process used by the brain to combine the results of many sensory operations into a single meaningful percept.

Example: Recognizing a face

pg116

**Bottom-Up Processing:** Stimulus driven processing

-Characters of a stimulus are attend to first

Perceptual analysis that emphasizes the characteristics of the stimuli rather than our concepts and expectations.

Example: Following the motion of a ball, identifying sound of a bell

**Top-Down Processing:** Perceptual analysis that incorporates the perceiver's expectations, memories, goals, knowledge, motivation, cultural background, in the interpretation of an object or event.

-This sort of thinking relies heavily on concepts in the perceiver's own mind.

Ex: Is that my lost dog barking

**Perceptual Constancy:** The ability to recognize the same object as remaining 'constant' under different conditions, such as lighting, distance, or location

Example: A door open vs. A door closed

**Illusion:** The incorrect interpretation of a stimulus pattern

**Ambiguous Figures:** Images that are capable of more than one interpretation.

## **THEORETICAL EXPLANATIONS FOR PERCEPTION**

The fact that perception is an interpretation and the fact that most people perceive illusions in essentially the same ways suggests that some fundamental psychological principles must be involved.

So how does perception actually work?

### **THEORY ONE: THE GESTALT THEORY** pg 151

**The theory that humans tend to create patterns and see the 'wholes' and not simply the parts**

Example: People see a square and not four straight lines connected...a school of fish...a melody

Gestalt psychologists believe that much of perception is shaped by innate factors built into the brain

Example: Illusion of moving lights on a movie marquee

**Gestalt psychology divides the perceptual experience into two parts.**

**1. Figure:** the part of a pattern that demands attention. The figure stands out against the ground

**2. Ground:** Everything else besides the figure...the background..does not command attention

**Closure:** The Gestalt principle that identifies the tendency to fill in the gaps in figures and to see incomplete figures as complete

## **Laws of Perceptual Grouping:** pg 152

**Max Wertheimer** (1923) established the Laws of Perceptual Grouping

**Laws of Perceptual Grouping:** The Gestalt principles of similarity, proximity, continuity, and common fate. These laws suggest how our brains prefer to group stimulus elements together to form a percept

**Law of Similarity:** The Gestalt principle that we tend to group similar objects (look, sounds, feel, etc...) together in our perceptions Example: Two football teams in a game

**Law of Proximity:** The Gestalt principle that we tend to group objects together when they are near each other. Example: Two socks of different color

**Law of Continuity:** The Gestalt principle that we prefer perceptions of connected and continuous figures over disconnected and disjointed ones.

**Continuity in the Realm of Person Perception:** We expect people we haven't seen in years to essentially be the same

**Law of Simplicity:** The principle that we perceive the simplest pattern possible. This is what makes things such as proofreading a text so difficult

**Binocular Cues:** pg 153 Information taken in by *both* eyes that aids in depth perception

**Monocular Cues:** pg 154 Information about depth that relies on the input of *one* eye

## **THEORY TWO: LEARNING BASED INFERENCE**

**Learning Based Inference:** The view that perception is primarily shaped by learning or experience, rather than innate (instinctive) factors

–People use prior learning to interpret new sensory information, and then make inferences (guesses or predictions) about what the sensations mean

Examples: You infer a birthday party when you see lighted candles on a cake

**Perceptual Set:** pg 161 Readiness to detect a particular stimulus in a given context –as when someone who is afraid will interpret all unfamiliar noises as dangerous as a threat....(being afraid in the dark)

Cultural Influences On Perception p.162-165