

UNIT 4: SENSATION AND PERCEPTION

BASIC PRINCIPLES OF SENSATION AND PERCEPTION

OBJECTIVE 1: Contrast sensation and perception, and explain the difference between bottom-up and top-down processing.

1. The perceptual disorder in which a person has lost the ability to recognize familiar faces is PROSOPAGNOSIA.
2. The process by which we detect physical energy from the environment and encode it as neural signals is SENSATION. The process by which sensations are organized and interpreted is PERCEPTION.
3. Sensory analysis, which starts at entry level and works up, is called BOTTOM-UP PROCESSING. Perceptual analysis, which works from our experience and expectations is called TOP-DOWN PROCESSING.

OBJECTIVE 2: Discuss how our perceptions are directed and limited by selective attention, noting how we may or may not be affected by unattended stimuli.

4. When we focus our conscious awareness on a particular stimulus, we are using SELECTIVE ATTENTION.
5. Your ability to attend to only one voice among many is called the COCKTAIL PARTY EFFECT. Failing to see a visible object when our attention is directed elsewhere is called INATTENTIONAL BLINDNESS.
6. When researchers distracted participants with a counting task, the participants displayed INATTENTIONAL BLINDNESS and failed to notice a gorilla-suited assistant who passed through. Two specific forms of this phenomenon are CHANGE BLINDNESS and CHOICE BLINDNESS. Another result of distraction involves not noticing that different people are speaking, called CHANGE DEAFNESS.
7. Some stimuli are so powerful they demand our attention, causing us to experience POP-OUT.

OBJECTIVE 3: Distinguish between absolute and difference thresholds, and discuss whether we can sense and be affected by subliminal or unchanging stimuli.

8. The study of relationships between the physical characteristics of stimuli and our psychological experience of them is PSYCHOPHYSICS.
9. The ABSOLUTE THRESHOLD refers to the minimum stimulation necessary for a stimulus to be detected 50 percent of the time.
10. According to SIGNAL DETECTION theory, a person's experience, expectations, motivation, and alertness all influence the detection of a stimulus.

11. Some entrepreneurs claim that exposure to "below threshold," or SUBLIMINAL, stimuli can be persuasive, but their claims are probably unwarranted.
12. Some weak stimuli may trigger in our sensory receptors a response that is processed by the brain, even though the response doesn't cross the threshold into CONSCIOUS awareness.
13. Under certain conditions, an invisible image or word can PRIME into a person's response to a later question. This illustrates that much of our information processing occurs AUTOMATICALLY.
14. The minimum difference required to distinguish two stimuli 50 percent of the time is called the DIFFERENCE THRESHOLD. Another term for this value is the JUST NOTICEABLE DIFFERENCE (JND).
15. The principle that the difference threshold is not a constant amount, but a constant proportion, is known as WEBER'S LAW. The proportion depends on the STIMULUS.
16. After constant exposure to an unchanging stimulus, the receptor cells of our senses begin to fire less vigorously; this phenomenon is called SENSORY ADAPTATION.

VISION

OBJECTIVE 4: Describe the characteristics of visible light, and explain the process by which the eye converts light energy into neural messages.

1. Stimulus energy is TRANSDUCED (transformed) into NEURAL messages by our eyes.
2. The visible spectrum of light is a small portion of the larger spectrum of ELECTROMAGNETIC energy.
3. The distance from one light wave peak to the next is called WAVELENGTH. This value determines the wave's color, or HUE.
4. The amount of energy in light waves, or INTENSITY, is determined by a wave's AMPLITUDE, or height, influences the BRIGHTNESS of a light.
5. Light enters the eye through the CORNEA, then passes through a small opening called the PUPIL; the size of this opening is controlled by the colored IRIS.
6. By changing its curvature, the LENS can focus the image of an object onto the RETINA, the light-sensitive inner surface of the eye.
7. The process by which the lens changes shape to focus images is called ACCOMMODATION.
8. The retina's receptor cells are the RODS and CONES.

9. The neural signals produced in the rods and cones activate the neighboring BIPOLAR cells, which then activate a network of GANGLION cells. The axons of ganglion cells converge to form the OPTIC NERVE, which carries the visual information to the BRAIN.
10. Where this nerve leaves the eye, there are no receptors; thus, the area is called the BLIND SPOT.
11. Most cones are clustered around the retina's point of central focus, called the FOVEA, whereas the rods are concentrated in more PERIPHERAL regions of the retina. Many cones have their own BIPOLAR cells to communicate with the visual cortex.
12. It is the CONES (rods/cones) of the eye that permit the perception of color, whereas RODS (rods/cones) enable black-and-white vision.
13. Unlike cones, in dim light rods are SENSITIVE (sensitive/insensitive). Adapting to a darkened room will take the retina approximately 20 minutes.

OBJECTIVE 5: Discuss the different levels of processing that occur as information travels from the retina to the brain's cortex.

14. Visual information percolates through progressively more ABSTRACT levels. In the brain, it is routed by the THALAMUS to the cortex. Hubel and Wiesel discovered that certain neurons in the occipital lobe's VISUAL CORTEX respond only to specific features of what is viewed. They call these neurons FEATURE DETECTORS.
15. Feature detectors pass their information to higher-level cells in the brain, which respond to specific visual scenes. Research has shown that in monkey brains such cells specialize in responding to a specific GAZE, HEAD ANGLE, POSTURE, or BODY MOVEMENT. In many cortical areas, teams of cells (SUPERCELL CLUSTERS) respond to complex patterns.

OBJECTIVE 6: Define *parallel processing*, and discuss its role in visual information processing.

16. The brain achieves its remarkable speed in visual perception by processing several subdivisions of a stimulus _____ (simultaneously/sequentially). This procedure, called _____, may explain why people who have suffered a stroke may lose just one aspect of vision.

17. Other brain-damaged people may demonstrate BLINDSIGHT by responding to a stimulus that is not consciously perceived.

OBJECTIVE 7: Explain how the Young-Helmholtz and opponent-process theories help us understand color vision.

18. An object appears to be red in color because it REFLECTS (REJECTS) the long wavelengths of red and because our mental CONSTRUCTION of the color.
19. One out of every 50 people is color deficient; this is usually a male because the defect is genetically SEX - LINKED.
20. According to the YOUNG - HELMHOLTZ TRICHROMATIC theory, the eyes have three types of color receptors: one reacts most strongly to RED, one to GREEN, and one to BLUE.
21. After staring at a green square for a while, you will see the color red, its OPPONENT color, as an AFTERIMAGE.
22. Hering's theory of color vision is called the OPPONENT - PROCESS theory. According to this theory, after visual information leaves the receptors it is analyzed in terms of pairs of opposing colors: RED versus GREEN, YELLOW versus BLUE, and BLACK versus WHITE.

Summarize the two stages of color processing.

IN THE FIRST STAGE OF COLOR PROCESSING, THE RETINA'S RED, GREEN AND BLUE CONES RESPOND IN VARYING DEGREE TO DIFFERENT COLOR STIMULI, AS SUGGESTED BY THE THREE-COLOR THEORY. THE RESULTING SIGNALS ARE THEN PROCESSED IN THE THALAMUS BY RED-GREEN, BLUE-YELLOW, AND BLACK-WHITE OPPONENT-PROCESS CELLS, WHICH ARE TURNED "ON" BY ONE WAVELENGTH AND TURNED "OFF" BY ITS OPPONENT.

HEARING

OBJECTIVE 8: Describe the auditory process, including the stimulus input and the structure and function of the ear.

1. The stimulus for hearing, or AUDITION is sound waves, created by the compression and expansion of AIR MOLECULES.
2. The amplitude of a sound wave determines the sound's LOUDNESS.
3. The frequency of a sound wave determines the PITCH we perceive.
4. Sound energy is measured in units called DECIBELS. The absolute threshold for hearing is arbitrarily defined as ZERO such units.
5. The ear is divided into three main parts: the OUTER ear, the MIDDLE ear and the INNER ear.

6. The outer ear channels sound waves toward the EARDRUM, a tight membrane that then vibrates.
7. The middle ear transmits the vibrations through a piston made of three small bones: the HAMMER, ANVIL, and STIRRUP.
8. In the inner ear, a coiled, bony, fluid-filled tube called the COCHLEA contains the receptor cells for hearing. The incoming vibrations cause the OVAL WINDOW to vibrate the fluid that fills the tube, which causes ripples in the BASILAR MEMBRANE, bending the HAIR CELLS that line its surface. This movement triggers impulses in the adjacent nerve fibers that converge to form the auditory nerve, which carries the neural messages (via the THALAMUS) to the TEMPORAL lobe's auditory cortex.
9. The brain interprets loudness from the NUMBER of hair cells a sound activates.

OBJECTIVE 9: Contrast place and frequency theories, and explain how they help us to understand pitch perception.

10. One theory of pitch perception proposes that different pitches activate different places on the cochlea's basilar membrane; this is the PLACE theory. This theory has difficulty accounting for how we hear LOW-pitched sounds, which do not have such localized effects.
11. A second theory proposes that the frequency of neural impulses, sent to the brain at the same frequency as sound waves, allows the perception of different pitches. This is the FREQUENCY theory. This theory fails to account for the perception of HIGH-pitched sounds because individual neurons cannot fire faster than 1,000 times per second.
12. For the higher pitches, cells may alternate their firing to match the sound's frequency, according to the VOLLEY principle.

OBJECTIVE 10: Describe how we pinpoint sounds, and contrast the two types of hearing loss.

13. We locate a sound by sensing differences in the SPEED (TIMING) and INTENSITY with which it reaches our ears.
14. A sound that comes from directly ahead will be HARDER (easier/harder) to locate than a sound that comes from off to one side.
15. Problems in the mechanical conduction of sound waves through the outer or middle ear may cause CONDUCTION HEARING LOSS.
16. Damage to the cochlea's hair cell receptors or their associated auditory nerves can cause SENSINEURAL hearing loss. It may be caused by disease, but more often it results from the

biological changes linked with AGING and prolonged exposure to ear-splitting noise or music.

OBJECTIVE 11: Describe how cochlear implants function, and explain why Deaf culture advocates object to these devices.

17. An electronic device that restores hearing among nerve-deafened people is a COCHLEAR IMPLANT.
18. Advocates of DEAF CULTURE object to the use of these implants on CHILDREN before they have learned to SPEAK. The basis for their argument is that deafness is not a DISABILITY.
19. Sign language IS (is/is not) a complete language, WITH (with/without) its own grammar, syntax, and semantics. People who lose one channel of sensation (such as hearing) SEEM TO (seem to/do not seem to) compensate with a slight enhancement in their other sensory abilities.
20. (Close-Up) Deaf children raised in a household where sign language is used express higher SELF-ESTEEM and feel more ACCEPTED.

OTHER SENSES

OBJECTIVE 12: Describe the sense of touch, and distinguish between kinesthesia and the vestibular sense.

1. The sense of touch is a mixture of at least four senses: PRESSURE, WARMTH, COLD, and PAIN. Other skin sensations, such as tickle, itch, hot, and wetness are VARIATIONS of the basic ones.
2. The TOP - DOWN influence on touch is illustrated by the fact that a self-produced tickle produces less activation in the SOMATOSENSORY CORTEX than someone else's tickle. This influence is also seen in the RUBBER - HAND illusion.
3. The system for sensing the position and movement of body parts is called KINESTHESIS. The receptors for this sense are located in the TENDONS, JOINTS, BONES, and EARS, as well as in your skin.
4. The sense that monitors the position and movement of the head (and thus the body) is the VESTIBULAR SENSE. The receptors for this sense are located in the SEMICIRCULAR CANALS and VESTIBULAR SACS of the inner ear.

OBJECTIVE 13: State the purpose of pain, and describe the biopsychosocial approach to pain.

5. People born without the ability to feel pain may be unaware of experiencing severe INJURY. More numerous are those who live with CHRONIC pain in the form of persistent headaches and backaches, for example.

6. Pain is a property of our **PHYSIOLOGY** as well as our **EXPERIENCES** and **ATTENTION**, and our surrounding **CULTURE**.
7. The pain system **IS NOT** (is/is not) triggered by one specific type of physical energy. The body has specialized **NOCICEPTORS** that detect hurtful stimuli.
8. Melzack and Wall have proposed a theory of pain called the **GATE** - **CONTROL** theory, which proposes that there is a neurological **GATE** in the **SPINAL** **CORD** that blocks pain signals or lets them through. It may be opened by activation of **SMALL** (small/large) nerve fibers and closed by the activation of **LARGE** (small/large) fibers or by information from the **BRAIN**.
9. Pain-producing brain activity may be triggered with our without **SENSORY** **INPUT**.
10. A sensation of pain in an amputated leg is referred to as **PHANTOM** **LIMB**. Another example is **TINNITUS**, experienced by people who have a ringing-in-the-ears sensation.
15. In a few rare individuals, the senses become joined in a phenomenon called **SYNAESTHESIA**.
16. Like taste, smell, or **OLFACTION**, is a **CHEMICAL** sense. There **IS NOT** (is/is not) a distinct receptor for each detectable odor.
17. Odors are able to evoke memories and feelings because there is a direct link between the brain area that gets information from the nose and the ancient **LIMBIC** centers associated with memory and emotion.

PERCEPTUAL ORGANIZATION

OBJECTIVE 15: Describe Gestalt psychology's contribution to our understanding of perception, and identify principles of perceptual grouping in form perception.

1. According to the **GESTALT** school of psychology, we tend to organize a cluster of sensations into a **WHOLE**, or form.
2. When we view a scene, we see the central object, or **FIGURE**, as distinct from surrounding stimuli, or the **GROUND**.
3. Proximity, similarity, closure, continuity, and connectedness are examples of Gestalt rules of **GROUPING**.
4. The principle that we organize stimuli into smooth, continuous patterns is called **CONTINUITY**. The principle that we fill in gaps to create a complete, whole object is **CLOSURE**. The grouping of items that are close to each other is the principle of **PROXIMITY**; the grouping of items that look alike is the principle of **SIMILARITY**. The tendency to perceive uniform or attached items as a single unit is the principle of **CONNECTEDNESS**.

List some pain control techniques used in health care situations.

PAIN CONTROL TECHNIQUES INCLUDE DRUGS, SURGERY, ACUPUNCTURE, THOUGHT DISTRACTION, EXERCISE, HYPNOSIS, RELAXATION TRAINING, ELECTRICAL STIMULATION, AND MASSAGE. SIMILARLY, FOR BURN VICTIMS, DISTRACTION DURING PAINFUL WOUND CARE CAN BE CREATED BY IMMERSION IN A COMPUTER-GENERATED 3-D WORLD.

OBJECTIVE 14: Describe the senses of taste and smell, and comment on the nature of sensory interaction.

11. The basic taste sensations are **SWEET**, **SOUR**, **SALTY**, **BITTER**, and a meaty taste called **UMAMI**.
12. Taste, which is a **CHEMICAL** sense, is enabled by the 200 or more **TASTE** **BUDS** on the top and sides of the tongue. Each contains a **PORE** that catches food chemicals.
13. Taste receptors reproduce themselves every **WEEK OR TWO**. As we age, the number of taste buds **DECREASES** (increases/decreases/remains unchanged) and our taste sensitivity **DECREASES** (increases/decreases/remains unchanged). Taste is also affected by **SMOKING** and by **ALCOHOL** use.
14. When the sense of smell is blocked, as when we have a cold, foods do not taste the same; this illustrates the principle of **SENSORY** **INTERACTION**. The **McGURK** effect occurs when we **SEE** a speaker saying one syllable while **HEARING** another.

OBJECTIVE 16: Explain the binocular and monocular cues we use to perceive depth.

5. The ability to see objects in three dimensions despite their two-dimensional representations on our retinas is called **DEPTH** **PERCEPTION**. It enables us to estimate **DISTANCE**.
6. Gibson and Walk developed the **VISUAL** **CLIFF** to test depth perception in infants. They found that each species, by the time it is **MOBILE**, has the perceptual abilities it needs.

Summarize the results of Gibson and Walk's studies of depth perception.

RESEARCH ON THE VISUAL CLIFF SUGGESTS THAT IN MANY SPECIES THE ABILITY TO PERCEIVE DEPTH IS PRESENT AT, OR VERY SHORTLY AFTER, BIRTH.

For questions 7-15, identify the depth perception cue that is defined.

7. Any cue that requires both eyes: BINOCULAR.
8. The greater the difference between the images received by the two eyes, the nearer the object: RETINAL DISPARITY. 3-D movies simulate this cue by photographing each scene with two cameras.
9. Any cue that requires either eye alone: MONOCULAR.
10. If two objects are presumed to be the same size, the one that casts a smaller retinal image is perceived as farther away: RELATIVE SIZE.
11. An object partially covered by another is seen as farther away: INTERPOSITION.
12. Objects lower in the visual field are seen as nearer: RELATIVE HEIGHT.
13. As we move, objects at different distances appear to move at different rates: RELATIVE MOTION.
14. Parallel lines appear to converge in the distance: LINEAR PERSPECTIVE.
15. The dimmer of two objects seems farther away: LIGHT AND SHADOW.

OBJECTIVE 17: State the basic assumption we make in our perceptions of motion, and explain how these perceptions can be deceiving.

16. Our brain normally computes motion based partially on the assumption that shrinking objects are RETREATING (approaching/retreating) and enlarging objects are APPROACHING (approaching/retreating). Sometimes we are fooled because larger objects seem to move MORE SLOWLY (faster/more slowly) than smaller objects.
17. The brain interprets a rapid series of slightly varying images as MOVEMENT. This phenomenon is called STROBOSCOPIC MOVEMENT.
18. The illusion of movement that results when two adjacent stationary spots of light blink on and off in quick succession is called the PHI PHENOMENON.

OBJECTIVE 18: Explain how perceptual constancies help us to organize our sensations into meaningful patterns.

19. Our tendency to see objects as unchanging while the stimuli from them change in size, shape, and lightness is called PERCEPTUAL CONSTANCY.
20. Due to shape and size constancy, familiar objects DO NOT (do/do not) appear to change shape or size despite changes in our RETINAL images of them.
21. Several illusions, including the MOON and PONZO illusions, are explained by the interplay between perceived SIZE and perceived DISTANCE. When distance cues are removed,

these illusions are DIMINISHED (diminished/strengthened).

22. The brain computes an object's brightness RELATIVE TO (relative to/independent of) surrounding objects.
23. The amount of light an object reflects relative to its surroundings is called RELATIVE LUMINANCE.
24. The experience of color depends on the surrounding CONTEXT in which an object is seen. In an unvarying context, a familiar object is seen. In an unvarying context, a familiar object will be perceived as having consistent color, even as the light changes. This phenomenon is called COLOR CONSTANCY.
25. We see color as a result of our brains' computations of light REFLECTED by any object relative to its SURROUNDING OBJECTS.

PERCEPTUAL INTERPRETATION

OBJECTIVE 19: Describe the contributions of restored vision, sensory deprivation, and perceptual adaptation research to our understanding of the nature-nurture interplay in our perceptions.

1. The idea that knowledge comes from inborn ways of organizing sensory experiences was proposed by the philosopher IMMANUEL KANT.
2. On the other side were philosophers who maintained that we learn to perceive the world by experiencing it. One philosopher of this school was JOHN LOCKE.
3. Studies of cases in which vision has been restored to a person who was blind from birth show that, upon seeing tactilely familiar objects for the first time, the person CANNOT (can/cannot) recognize them.
4. Studies of sensory restriction demonstrate that visual experiences during INFANCY are crucial for perceptual development. Such experiences suggest that there is a CRITICAL PERIOD for normal sensory and perceptual development.
5. Humans given glasses that shift or invert the visual field WILL (will/will not) adapt to the distorted perception. This is called PERCEPTUAL ADAPTATION.
6. Animals such as chicks DO NOT ADAPT (adapt/do not adapt) to distorting lenses.

OBJECTIVE 20: Define *perceptual set*, and explain why the same stimulus can evoke different perceptions in different contexts.

7. A mental predisposition that influences perception is called a PERCEPTUAL SET.
8. How a stimulus is perceived depends on the concepts, or SCHEMAS, we form and the CONTEXT in which the stimulus is experienced.
9. The context of a stimulus creates a TOP-DOWN (top-down/bottom-up) expectation that influences our

perception as we match our **__BOTTOM-UP__** (top-down/bottom-up) signal against it.

10. Our perception is also influenced by **__STEREOTYPES__** about gender and the **__EMOTIONAL__** context of our experiences.
11. To best understand perception, we need multiple levels of analysis because perception is a **__BIOPSYCHOSOCIAL__** phenomenon.

IS THERE EXTRASENSORY PERCEPTION?

OBJECTIVE 21: Identify the three most testable forms of ESP, and explain why most research psychologists remain skeptical of ESP claims.

1. Perception outside the range of normal sensation is called **__EXTRASENSORY__** **__PERCEPTION__**.
2. Psychologists who study ESP are called **__PARAPSYCHOLOGISTS__**.
3. The form of ESP in which people claim to be capable of reading others' minds is called **__TELEPATHY__**. A person who "senses" that a friend is in danger might claim to have the ESP ability of **__CLAIRVOYANCE__**. An ability to "see" into the future is called **__PRECOGNITION__**. A person who claims to be able to levitate and move objects is claiming the power of **__PSYCHOKINESIS__**.
4. Analyses of psychic visions and premonitions reveal **__CHANCE-LEVEL__** (high/chance-level) accuracy. Nevertheless, some people continue to believe in their accuracy because vague predictions often are later **__INTERPRETED (RETROFITTED)__** to match events that have already occurred. In addition, people are more likely to recall or **__RECONSTRUCT__** dreams that seem to have come true.
5. Critics point out that a major difficulty for parapsychology is that ESP phenomena are not consistently **__REPRODUCIBLE__**.
6. Researchers who tried to reduce external distractions between a "sender" and a "receiver" in an ESP experiment reported performance levels that **__BEAT__** (beat/did not beat) chance levels. Follow-up studies **__FAILED TO REPLICATE THE RESULTS__** (failed to replicate the results/found equally high levels of performance).