CHAPTER SIX: Sensation and Perception

STUDY GUIDE

LEARNING OBJECTIVES

- **Distinguish between sensation and perception.**
- **Distinguish between anatomical and functional codes in the nervous system.**
- **Define psychophysics, absolute and difference thresholds and signal detection theory.**
- **Explain sensory adaptation, sensory deprivation, sensory overload and selective attention.**
- **List the characteristics of light waves and their correspondence to the visual experience.**
- **Identify the parts of the eye and describe how they convert light to vision.**
- **Discuss two theories of color vision and their connection to stages of processing.**
- **Explain how form, distance and depth perception occur.**
- **List and explain visual constancies and distinguish them from visual illusions.**
- **Describe how sound wave characteristics correspond to loudness, pitch, and timbre.**
- **Identify the parts of the ear, describe how they convert sound to hearing, and discuss the role of perceptual processes in making sound meaningful.**
- **List and explain the factors that affect gustation (taste) and olfaction (smell).**
- **List the four skin senses.**
- **Describe the gate-control theory of pain and the updated version of this theory.**
- **Describe the internal senses of kinesthesis and equilibrium.**
- **Summarize the evidence for innate abilities in perception and describe the psychological and cultural influences on perception.**
- **Discuss the evidence on the effectiveness of "subliminal perception" tapes and the existence of ESP.**

CHAPTER 6 SUMMARY:

This chapter examines the processes of sensation and perception and the relationship between them. Receptors in the senses change physical energy into neural energy. The physical characteristics of the stimuli correspond to psychological dimensions of our sensory experience. Psychophysics (how the physical properties of stimuli are linked to psychological experiences), signal detection theory, sensory adaptation and sensory overload are discussed. The general processes of vision, hearing, taste, smell, pain, equilibrium and kinesthesis are reviewed. For each of these senses, the chapter examines the relevant biological structures processes (e.g., rods and cones) as well as the relevant theories that explain perception (e.g., trichromatic theory and opponent-process theory to explain how we see color). Once sensation has occurred, the process of organizing and interpreting the sensory information, or perception, begins. Perceptual strategies, including depth and distance strategies, visual constancies and form perception strategies, are described. Some perceptual abilities appear to be inborn, whereas others are influenced by psychological, environmental and cultural factors. The gate control theory of pain and a newer, modified version of the theory are reviewed. Conscious and non-conscious processes are examined, and extrasensory perception (ESP) is critically evaluated.

OUR SENSATIONAL SENSES

A. Definitions

1. Sensation - the detection of physical energy emitted or reflected by physical objects by cells (receptors)

2. Perception - organizing sensory impulses into meaningful patterns

B. The riddle of separate sensations - how we can explain separate sensations?

1. There are five widely known senses and other lesser-known senses; all of them evolved to help us survive

2. Sense receptors (cells in sense organs) detect a stimulus and convert the energy into electrical impulses that travel along nerves to the brain

3. The nervous system encodes the neural messages using anatomical codes and functional codes (Doctrine of specific nerve energies)

C. Measuring the senses

1. Psychophysics - how the physical properties of stimuli are related to our psychological experience of them

2. Absolute threshold - the smallest amount of energy a person can detect reliably (50 percent of the time)

3. Difference thresholds - the smallest difference in stimulation that a person can detect reliably; also called just noticeable difference (j,n.d)

4. Signal detection theory

    a. Accounts for response bias (tendency to say yes or no to a signal)

    b. Separates sensory processes (the intensity of the stimulus) from the decision process (influenced by observer's response bias)

D. Sensory adaptation

1. Senses designed to respond to change and contrast in the environment

2. Decline in sensory responsiveness occurs when a stimulus is unchanging; nerve cells temporarily get "tired" and fire less frequently

3. Sensory deprivation studies - subjects became edgy, disoriented, confused

E. Sensory overload

1. "Cocktail party phenomenon" - blocking out unimportant sensations

2. Selective attention - protects us from being overwhelmed with sensations

VISION

A. What we see

1. Psychological dimensions of visual world - hue, brightness, saturation

2. Physical properties of light - wavelength, intensity, complexity

B. An eye on the world - parts of the eye

1. Parts of the eye include cornea, lens (focuses light), iris (controls amount of light that gets into eye) and pupil (dilates to let light in)

2. Retina - in the back of the eye where the visual receptors are located

    a. Rods - sensitive to light, not to color

    b. Cones - see color, but need more light to respond

C. Why the visual system is not a camera

1. Eyes are not a passive recorder of external world; neurons build picture
2. Visual system cells have response specialties (feature detectors in animals)
3. Controversy over specialized "face modules" in the brain

D. How we see colors

1. Trichromatic theory - first level of processing - three types of cones
2. Opponent-process theory - second stage of processing (ganglion cells)

E. Constructing the visual world

1. Visual perception - the mind interprets the retinal image and constructs the world using information from the senses
2. Form perception - Gestalt descriptions of how we build perceptual units include: figure/ground, proximity, closure, similarity, continuity
3. Depth and distance perception - binocular cues and monocular cues
4. Visual constancies - when seeing is believing
    a. Perceptual constancy - perception of objects as unchanging though the sensory patterns they produce are constantly shifting
    b. Shape, location, brightness, color and size constancies

HEARING

A. What we hear

1. Stimulus for sound is a wave of pressure created when an object vibrates, which causes molecules in a transmitting substance (usually air) to move

2. Characteristics of sound

a. Loudness - intensity (amplitude) of a wave's pressure; decibels

b. Pitch - frequency (and intensity) of wave; measured in hertz

c. Timbre - complexity of wave; the distinguishing quality of a sound

3. Psychological properties of sound - loudness, pitch, timbre

B. An ear on the world - the process of hearing

1. Sound wave passes into the outer ear through a canal to strike the eardrum

2. Eardrum vibrates at the same frequency and amplitude as the wave

3. The wave vibrates three small bones, then to the cochlea

4. Organ of Corti in the cochlea contains the receptor cells called cilia, or hair cells, which are imbedded in the basilar membrane

5. The hair cells initiate a signal to the auditory nerve, which carries the message to the brain

C. Constructing the auditory world

1. Perception is used to organize patterns of sounds to construct meaning

2. Strategies include figure/ground, proximity, continuity, similarity, closure

3. Loudness is a distance cue; using both ears helps estimate direction

OTHER SENSES

A. Taste: Savory sensations

1. Chemicals stimulate receptors on tongue, throat and roof of mouth

   a. Papillae - bumps on tongue - contain taste buds

   b. Replaced every 10 days - number declines with age

2. Four basic tastes: salty, sour, bitter, sweet - and a new one (umami)

   a. Each taste produced by a different type of chemical

   b. Flavors are a combination of the four, but unclear how this occurs

   c. Taste is heavily influenced by smell, temperature and texture of food, culture, and individual differences

B. Smell: The sense of scents

1. Receptors are specialized neurons (5 million) in a mucous membrane in upper part of nasal passage that respond to chemical molecules in the air

2. Signals travel from receptors to the brain's olfactory bulb by the olfactory nerve to the higher regions of the brain

3. The psychological impact of odors may be because olfactory centers in the brain are linked to areas that process memories and emotions

C. Senses of the skin

1. Skin protects the innards, it helps identify objects, it is involved in intimacy, and it serves as a boundary

2. Skin senses include - touch, warmth, cold and pain

D. The mystery of pain

1. Pain differs from other senses in that the removal of the stimulus doesn't always terminate the sensation

2. Gate-control theory of pain - for years, the leading explanation

a. To experience pain sensation, impulses must pass a "gate" of neural activity that sometimes blocks pain messages

b. The theory correctly predicts that thoughts and feelings can influence pain perception

c. Limitations of gate-control theory - cannot explain pain that occurs without injury or disease or phantom limb pain

3. Updating the gate-control theory

a. The brain not only responds to incoming pain signals, but it is also capable of ; generating pain on its own

b. An extensive matrix of neurons in the brain may have an abnormal pattern of activity, resulting in the experience of pain

E. The environment within

1. Kinesthesis - tells us about location and movement of body parts using pain and pressure receptors in muscles, joints, and tendons

2. Equilibrium - gives information about body as a whole

3. Normally, kinesthesis and equilibrium work together

PERCEPTUAL POWERS: ORIGINS AND INFLUENCES

A. Inborn abilities and perceptual lessons

1. Studies show that experience during a critical period may ensure survival and the development of skills already present at birth

2. Research concludes that infants are born with many perceptual abilities

B. Critical periods - research on visual acuity of kittens

C. Psychological and cultural influences on perception

1. Perceptions affected by needs, beliefs, emotions, expectations

2. Culture and experience also influence perception

PUZZLES OF PERCEPTION

A. Subliminal perception; perceiving without awareness

1. Evidence exists that simple visual images can affect your behavior even when you are unaware that you saw it

2. Non-conscious processes in memory, thinking, decision making

3. However, there is no evidence for subliminal persuasion

B. Extrasensory perception: Reality or illusion?

1. Most reports come from anecdotal accounts

2. Some studies under controlled conditions found positive results, but methodological problems existed and results were not replicated

3. Conclusion is that there is no supporting scientific evidence

C. Lessons from a magician - we can be easily tricked by our senses