

Chapter 4: Sensation and Perception

Truth or Fiction?

- People have five senses.
- If we could see waves of light with slightly longer wavelengths, warm-blooded animals would glow in the dark.
- People sometimes hear what they want to hear.

Truth or Fiction?

- When we mix blue and yellow light, we obtain green light.
- The bodies of catfish are covered with taste buds.
- The skin is a sensory organ as well as a protective coating for the body.

Truth or Fiction?

- Many people experience pain “in” limbs that have been amputated.
- You have a sense that keeps you an upright person.
- Some people can read other people’s minds.

Preview of Chapter Three

- Sensation and Perception
- Vision
- Visual Perception
- Hearing
- The Chemical Senses
- The Skin Senses
- Kinesthesia and the Vestibular Sense
- Virtual Reality and ESP

Sensation and Perception

What are Sensation and Perception?

- Sensation is stimulation of sensory receptors and transmission of sensory information to the central nervous system.
- Perception is process by which sensations are organized and interpreted to form an inner representation of the world.

Absolute Threshold

- Weakest amount of a stimulus that can be distinguished from no stimulus at all
 - Detected 50% of the time

Difference Threshold

- Minimum difference in magnitude of two stimuli required to tell them apart
 - Detected 50% of the time
- Weber's constant
 - Standard of difference
- Just noticeable difference (jnd)
 - Minimum difference a person can detect

Signal-Detection Theory

- Stimulus characteristics and psychological factors interact to influence whether a stimulus is detected.
 - Factors such as learning, motivation, and psychological states

Feature Detectors

- Neurons that respond to different aspects of features
 - visual – respond to lines, color, textures, movement
 - auditory – respond to pitch, loudness, etc.

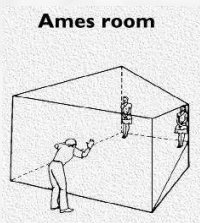
Sensory Adaptation

- Sensitization
 - Positive adaptation - Process by which we become more sensitive to stimuli of low magnitude
- Desensitization
 - Negative adaptation – Process by which we become less sensitive to stimuli that remains the same

Video Connections: The Ames Room

- Based on what you learn from the video about the Ames Room, how do visual artists use illusions to create a sense of depth in two-dimensional paintings?

The Ames Room



Windows
PLAY ANIMATION

Mac OS X
PLAY ANIMATION

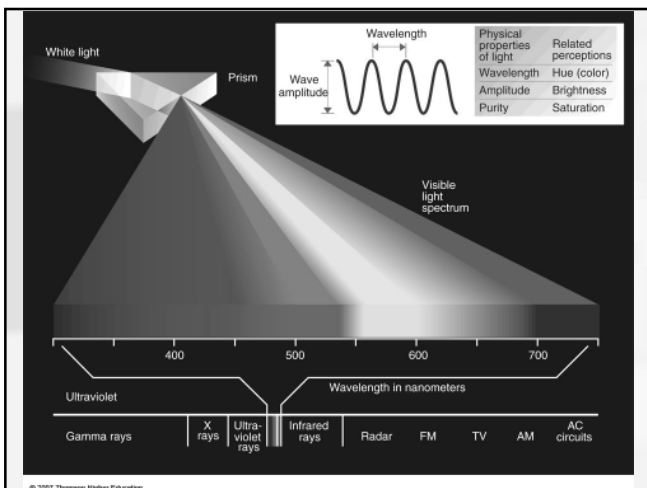
Video Connections: The Ames Room

- Have you ever been surprised at how large the moon looks on the horizon, “resting” atop buildings or trees in the distance? How do you explain why it looks larger under these circumstances than when it is high in the sky?
- Can we rely on our past experience of rooms to make sense of the Ames Room? Why or why not?

Vision

Light

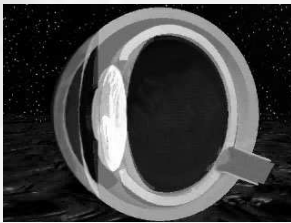
- Spectrum of electromagnetic energy
 - Vary in wavelength
 - Within visible light, color is determined by wavelength
 - Prism separates wavelengths
 - Vary in amplitude
 - Affects intensity - brightness



The Eye

- Light enters through a narrow opening
 - Cornea – transparent eye cover
 - Iris – muscle; colored part of the eye
 - Pupil – opening in the iris
 - Sensitive to light and emotion

Transmission of Light Through the Eye



PLAY VIDEO

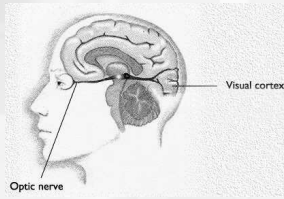
The Eye

- Lens
 - Changes in thickness for focusing
 - Image is projected onto retina
- Light Sensitive Surface
 - Retina
 - Photoreceptors
 - Rods, Cones, Bipolar and ganglion cells

The Eye

- Optic Nerve
 - Axons of ganglion neurons form optic nerve
 - Conducts sensory input to brain (occipital lobe)

Light and the Eye



Windows
PLAY
ANIMATION

Mac OS X
PLAY
ANIMATION

Rods and Cones

- Cones
 - Most densely packed in center of retina (fovea)
 - Provide color vision
- Rods
 - Provide vision in black and white
 - More sensitive to dim light than cones

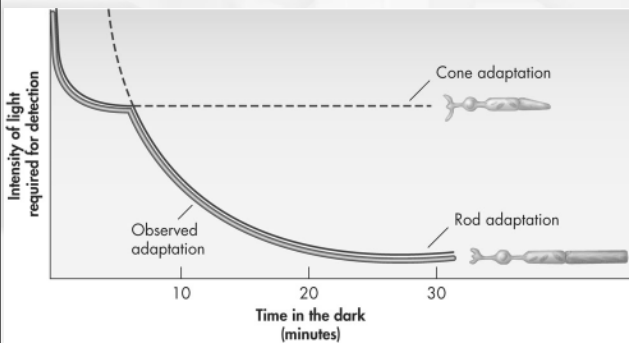
Visual Acuity

- Greatest in the fovea
- Blind spot
 - Point in retina where ganglion cells converge
- Nearsightedness
- Farsightedness
- Presbyopia

Light Adaptation

- Dark adaptation
 - Process of adjusting to lower lighting
 - Cones reach maximum adaptation in about 10 minutes
 - Rods continue to adapt up to 45 minutes
- Adaptation to bright light

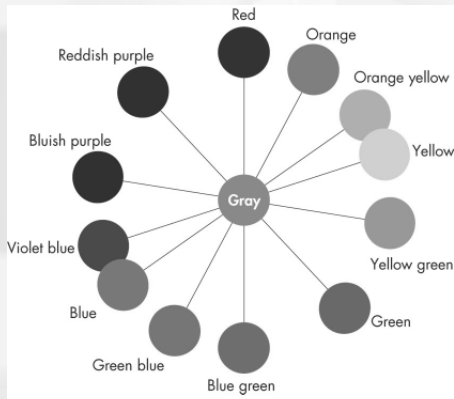
Dark Adaptation



Perceptual Dimensions of Color

- Hue
 - Wavelength of light
- Value
 - Degree of lightness or darkness
- Saturation
 - How intense a color appears to us

Color Wheel

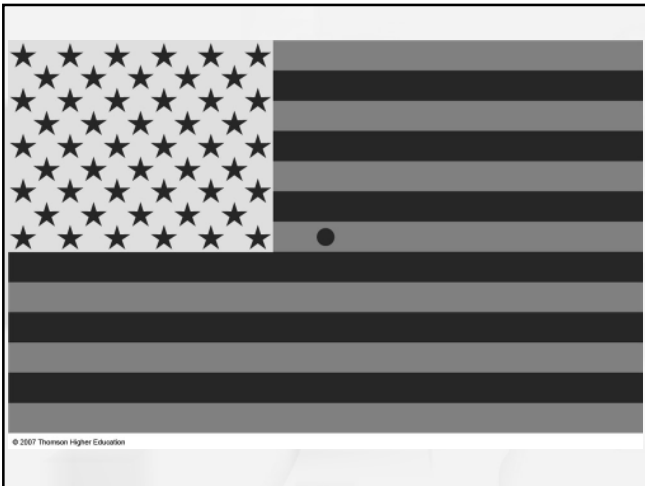


Perceptual Dimensions of Color

- Color Wheel
 - Bend the colors of the spectrum into a circle
- Warm and Cool Colors
 - Green-blue side of color wheel – cool
 - Yellow-orange-red side of color wheel – warm

Perceptual Dimensions of Color

- Complementary Colors
 - Colors across from one another on color wheel
 - Mix complementary colors = gray
- Refers to light not pigments
 - Light is the source of all colors
 - Pigments reflect and absorb light selectively



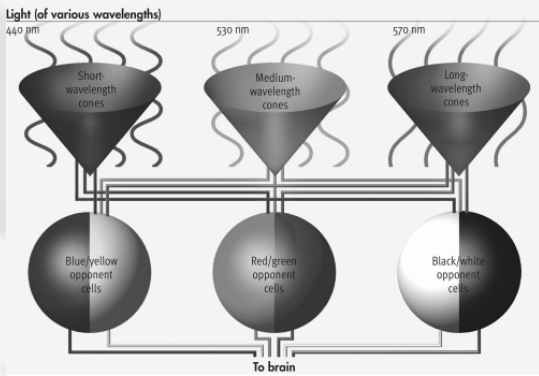
Perceptual Dimensions of Color

- Afterimage
 - Persistent sensations of color are followed by perception of the complementary color when the first color is removed

Theories of Color

- Trichromatic Theory
 - Three types of cones
 - Sensitive to red, green, or blue
- Opponent-Process Theory
 - Three types of color receptors
 - Red-green, blue-yellow, and light-dark

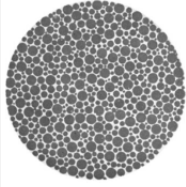
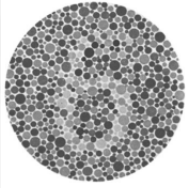
The Perception of Color



Color Blindness

- Trichromat
 - Normal color vision
- Monochromat
 - Totally color blind
- Dichromat
 - Partial color blindness
 - Discriminate between two colors
 - More common in males (sex linked trait)

Plates from a Test for Color Blindness



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Visual Perception

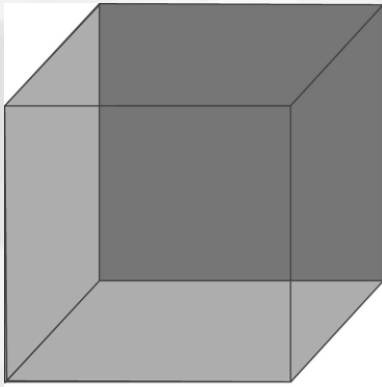
Visual Perception

- Process used to organize sensory impressions caused by the light that strikes our eyes
- Sensation is a mechanical process
- Perception is an active process
 - Involves experience, expectations and motivations

Perceptual Organization

- Figure and Ground
 - Ambiguous, unstable figures

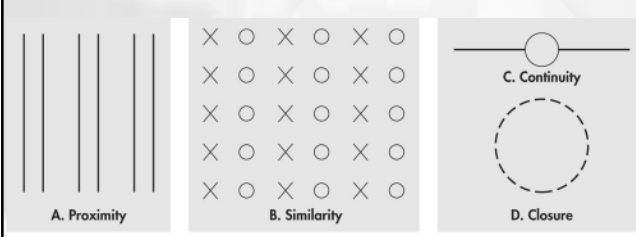
The Necker Cube



Gestalt Rules for Perceptual Organization

- Proximity
 - Nearness of objects
- Similarity
 - Similarity of objects
- Continuity
 - Series of points having unity

Gestalt Rules for Perceptual Organization



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Gestalt Rules for Perceptual Organization

- Common Fate
 - Elements moving together are grouped together
- Closure
 - Perception of a complete figure, even when there are gaps in sensory information

Top-Down Versus Bottom-Up Processing

- Top-Down Processing
 - Perception of the whole followed by perception of the parts
- Bottom-Up Processing
 - Perception of the parts leads to perception of the whole

Perception of Motion

- Visual perception of motion is based on change of position relative to other objects
- Illusions of movement
 - Stroboscopic motion

Depth Perception

- Monocular Cues
 - Perspective
 - Clearness
 - Interposition
 - Shadows
 - Texture gradient
 - Motion parallax
- Binocular Cues
 - Retinal disparity
 - Convergence

Perceptual Constancies

- Acquired through experience; creates stability
 - Size Constancy
 - Color Constancy
 - Brightness Constancy
 - Shape Constancy

Size Constancy 2



PLAY VIDEO

Visual Illusions

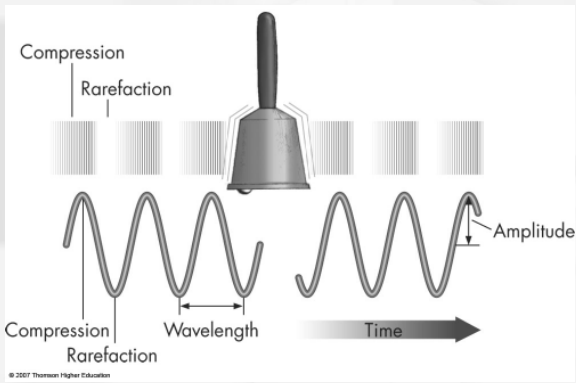
- Hering-Helmholtz Illusion
 - Perceive drawing as three-dimensional
- Müller-Lyer Illusion
 - Compare lines to corners of buildings
- Ponzo Illusion
 - Depth created by converging lines and size constancy

Hearing

Sound

- Sound waves require a medium; air or water
- Sound waves compress and expand molecules of the medium, creating vibrations
 - A single cycle of compression and expansion is one wave of sound
- Human ear is sensitive to sound waves with frequencies of 20 to 20,000 cycles per second

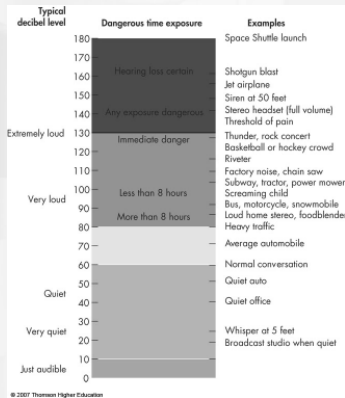
Creation of Sound Waves



Pitch and Loudness

- Pitch
 - Frequency (# of cycles per second)
 - Expressed in hertz (Hz)
 - Pitch of women's voice is higher than men's
- Loudness
 - Height (amplitude) of sound waves
 - Expressed in decibels (dB)

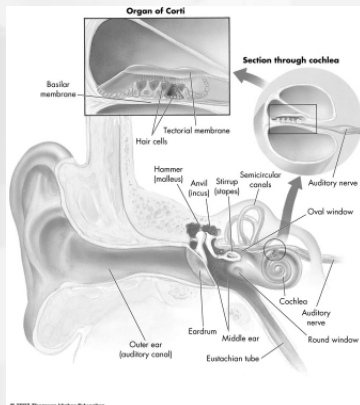
Decibel Ratings of Familiar Sounds



The Ear

- Shaped and structured to
 - capture sound waves,
 - vibrate in sympathy with them, and
 - transmit auditory information to the brain

The Human Ear



Parts of the Ear

- Outer Ear
 - Funnel sound waves to the eardrum
- Middle Ear
 - Eardrum, hammer, anvil and stirrup
- Inner Ear
 - Cochlea
 - Basilar membrane
 - Organ of Corti
- Auditory nerve

Locating Sounds

- Loudness and sequence in which sounds reach the ear provide cues
 - May turn head to clarify information

Perception of Loudness and Pitch

- Sounds are perceived as louder when more sensory neurons fire
 - Receptor neurons on the organ of Corti

Perception of Loudness and Pitch

- Place theory
 - Pitch is sensed according to place that vibrates
- Frequency theory
 - Pitch perceived on stimulation of impulses that match the frequency of the sound
- Both theories work together

Deafness

- Conductive deafness
 - Damage to middle ear
 - Hearing aids can help
- Sensorineural deafness
 - Damage to inner ear or auditory nerve
 - Cochlear implants may help with damage to inner ear, but not auditory nerve

The Chemical Senses Smell and Taste

Smell

- Odors trigger receptor neurons in olfactory membrane
 - Odors are sample molecules of substances in the air
- Sensory information about odors is sent to the brain through the olfactory nerve
- Odor contributes to flavor of foods
- Sense of smell adapts rapidly to odors

Taste

- Taste is sensed through taste cells
 - Receptor neurons on taste buds
- Four primary taste qualities
 - Sweet, sour, salty and bitter
 - Umami (fifth basic taste) – savory
- Flavor of food depends on odor, texture, temperature and taste
- Individuals have taste sensitivities

The Skin Senses

Touch and Pressure

- Sensory receptors in skin fire when skin surface is touched
 - Active touching
- Some areas of the body are more sensitive
 - Nerve endings are more densely packed
 - More sensory cortex is devoted to perception of sensations

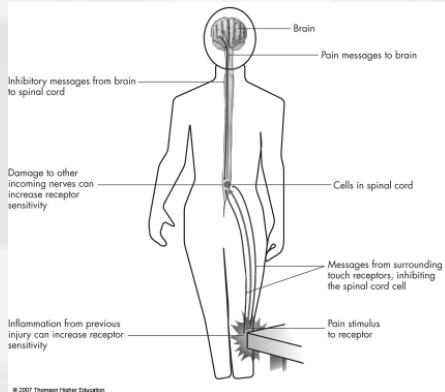
Temperature

- Receptors are located just beneath the skin
 - Skin temperature increases – receptors for warmth fire
 - Skin temperature decreases – receptors for cold fire
- Sensations for temperature are relative

Pain

- Nociceptors in skin are stimulated
 - Pain is usually sharpest where nerve endings are densely packed
 - Pain can be felt deep in body
 - No nerve endings for pain in the brain

Perception of Pain



Gate Theory of Pain

- Nervous system can only process a limited amount of stimulation
 - Rubbing the pained area competes for neural attention
 - Closes the “gate” on pain messages to the brain

Acupuncture

- Ancient Chinese method of pain control
 - Research shows it stimulates nerves to the hypothalamus releasing endorphins
 - Endorphins are similar in structure and effect to morphine



Kinesthesia and the Vestibular Sense



Kinesthesia

- Sense that informs you about the position and motion of your body
 - Sensory information is sent to the brain from sensory organs in joints, tendons and muscles



Vestibular System

- Housed mainly in semicircular canals in your ears
- Monitor your body's motion and position in relation to gravity

Virtual Reality and ESP: Sensation and Perception on the Edge

Virtual Reality

- Perception of events that are fed directly into the sense via electronic technology
- Computer generated images used to overcome phobias
- Cybersex

Extrasensory Perception - ESP

- Perception through means other than sensory organs
 - Precognition
 - Psychokinesis
 - Telepathy
 - Clairvoyance

Existence of ESP

- Ganzfield Procedure
 - Method for studying the existence of ESP
- No reliable evidence for existence of ESP
