Sensation & Perception
Perceiving Form, Depth, and Color

Bottom-up Processing
• Data-driven
• Build up from features to more complex shapes
• Pandemonium model
Top-Down Processing

• Conceptually-driven
• Knowledge interacts with sensation to yield our perception of the world
• Concepts become important in determining perception
  – Allow for the recognition of sensations

Prior-experience and Memories

• Prior experience or memories of objects and events in our environment influence perception
• Aid in object identification

• Prior experience with a stimuli can affect interpretation and perception of an ambiguous stimuli
• Stereotypes
Context

- **Context**: the surroundings within which a stimulus is embedded
- Influences ease with which objects are perceived
- Influences the manner in which objects are perceived

Context: Scenes

- Biederman – real-world scenes
- Object identification
  - Variable of interest: length of time needed to identify object

Expectations

- Expectations can also influence perception of stimuli in the environment
- Our expectations of what we are going to perceive in the environment heavily influence what we actually perceive
Sensation versus Perception

• **Sensation** involves integrating and analyzing stimuli
• **Perception** involves awareness of the elements of the environment through physical sensation
  – Implicit distinction between simple sensation (sensa) and complex perceptions (percepts)

Gestalt Approach

• Some of the first psychologists to study the nature of perception
  – 1930’s
• “The whole is more than the sum of its parts”
• Need to go beyond features to understand the nature of perception

Laws of Grouping: Similarity

• Objects that are similar to each other tend to be seen as a unit
Laws of Grouping: Proximity

- Objects near each other tend to be seen as a unit

Laws of Grouping: Good Continuation

- Objects arranged in either a straight line or a smooth curve tend to be seen as a unit

Laws of Grouping: Closure

- When a figure has a gap we tend to see it as a closed, complete figure
Laws of Grouping: Law of Common Fate

• When objects move in the same direction we tend to see them as a unit

Figure-Ground Relationships

• When two objects/figures share a boundary
  – Figure: distinct shape with clearly defined edges
  – Ground: The background for the figure
• Can switch our perception of figure and ground

Depth Perception: Binocular Disparity

• Brain receives different images of the world from each eye
• The difference between these views provides depth information
• Lateral separation
  – The larger the separation, the greater the distance of object from observer
Monocular Cues: Interposition

- When one object overlaps or partially covers another one
- Object in front seen as closer
- Very important depth cue

Monocular Cues: Size

- Object taking up more space on the retina will be perceived as being closer
- Relative Size
- Familiar Size

Monocular Cues: Atmospheric Perspective

- Distant objects appear hazy, blurry and bluish compared to closer objects
Monocular Cues: Texture Gradient

- The texture of a surface appears to become denser as the distance increases
- Powerful cue – even simple representations give the illusion of depth

Monocular Cues: Linear Perspective

Shading
Monocular Cues: Height

- Elevation cues
- Objects nearer the horizon appear farther away
- When combined with size, the illusion is enhanced

Illusions

- Perceptual interpretations are usually correct
- Sometimes mistakes occur
  - Illusions that are misperceptions
  - Occurs when two objects produce exactly the same retinal image
- Illusions are incorrect but they are not abnormal
- Provide insight into how our perceptual systems operate

Muller-Lyer Illusion
Horizontal-Vertical Illusion

Ponzo Illusion

Ames Room
Illusory Contour Figures

- Subjective contour figures
- Contextual elements with true contours – **inducing areas**
- **Inducing lines** that encourage the illusory contour

Color Perception

- Can influence emotions
- Can reflect personality
- Can “alter” the taste of food

Purpose of Color Vision

- **Detection**
  - Color facilitates picking an object out from the background
- **Discrimination**
  - Helps to distinguish between objects in the environment
Properties of Color

- Subjective
  - Reflectance
  - Illumination
  - Sensitive nervous system

Three Dimensions to Color

- Each dimension affects our perception of color
- Hue
  - Psychological reaction to wavelength
Three Dimensions of Color

- Hue
- Saturation
  - Psychological reaction to purity of wavelength

- Hue
- Saturation
- Brightness
  - Psychological reaction to the amplitude of wavelength

Spindle Dimensions
Saturation (purity)

Subtractive Mixtures

- Occurs through color mixing
  - Pigments
  - Filters
- Wavelengths get subtracted from mixture resulting in the perception of color

Additive Mixtures

- Produced when we add together beams of light from different parts of the spectrum
- Wavelength of each light reaches receptors in eye
  - In subtractive, those wavelengths are subtracted out of mix before reaching eye
- Can not be highly saturated
  - If mixing complimentary color, the result is white or gray (very unsaturated)
Subtractive Color Wheel
Additive Color Wheel

Trichromatic Theory

- Different combinations of wavelengths can yield the same color experience
  - Metamer
- Can duplicate any color with a combination of three colors
  - Red, green, blue
- Metamers suggested we must have three different types of color receptors to process color information

Three Cone Types

- Three types of cones
- Each type is maximally sensitive to a certain wavelength of light
  - Short wavelength cones
  - Medium wavelength cones
  - Long wavelength cones
Opponent Process Theory

• Placing certain colors together exaggerates their differences
  – Red-green, blue-yellow
• Certain color combinations do not exist
  – Reddish green, blueish yellow
• Suggests antagonistic linkages within the visual machinery that processes color information

Simultaneous Color Contrast

• Appearance of a color changed because of surrounding colors
  – 2 complimentary hues and a neutral or antagonistic color on both sides

Successive Color Contrast

• Appearance of a color is changed because another color was presented beforehand
• Negative Afterimage
Chromatic & Achromatic Systems