

## Sensation and Perception

### 5.1 How Does Perception Emerge from Sensation?

- Sensation: the detection of external stimuli and the transmission of this information to the brain.
  - Basic experience of stimuli
- Perception: the processing, organization, and interpretation of sensory signals.
  - Results in our conscious experience of the world
  - Construction of useful and meaningful information about a particular sensation
- Bottom-up processing: perception based on the physical features of the stimulus.
  - As each sensory aspect of a stimulus is processed, the aspects build up into perception of that stimulus
- Top-down processing: how knowledge, expectations, or past experiences shape the interpretation of sensory information
  - What we expect to see influences what we perceive
- Transduction: the process by which sensory stimuli are converted to signals the brain can interpret.
  - Sensory receptors receive physical or chemical stimulation and pass the resulting impulses to the brain in the form of neural impulses
  - Most go to the thalamus then the cerebral cortex
- Absolute threshold: the minimum intensity of stimulation that must occur before you experience a sensation
- Difference threshold: the minimum amount of change required for a person to detect a difference between two stimuli
  - Just noticeable difference
- Signal detection theory (SDT): a theory of perception based on the idea that the detection of a stimulus requires a judgement, it is not an all-or-nothing process
  - 1. Sensitivity to the stimulus in the presence of distractions from other stimuli
  - 2. The criteria used to make the judgment from ambiguous information
- Sensory adaptation: a decrease in sensitivity to a constant level of stimulation
- Sensory coding is our sensory systems translating the properties of stimuli into patterns of neural impulses
  - Different features of a physical environment are coded by activity in different neurons
- To function effectively the brain needs qualitative (basic qualities) and quantitative (degree or magnitude of those qualities) information about a stimulus
- Perceptual experience is constructed by information detected by sense organs
- Psychophysics: the relationship between the world's physical properties and how we sense and perceive them

- Weber's Law: the just noticeable difference between two stimuli is based on a proportion of the original stimulus rather than on a fixed amount of difference
- Response bias is a participant's tendency to report detecting the signal in an ambiguous trial

## 5.2 How are we Able to See?

- Retina: the thin, inner surface of the back of the eyeball; it contains the sensory receptors that transduce light into neural signals
- Rods: retinal cells that respond to low levels of light and result in black-and-white perception
  - o Poor at fine detail
- Cones: retinal cells that respond to higher levels of light and result in color perception
- Fovea: the center of the retina, where cones are densely packed
- Binocular depth cues: cues of depth perception that arise from the fact that people have two eyes
- Monocular depth cues: cues of depth perception that are available to each eye alone
- Binocular Disparity: a depth cue; because of the distance between the two eyes, each eye receives a slightly different retinal image
  - o Retinal disparity
- Convergence: a cue of binocular depth perception; when a person views a nearby object, the eye muscles turn the eyes inward
- Object constancy: correctly perceiving objects as constant in their shape, size, color and lightness despite raw sensory data that could mislead perception.
- Light first passes through the cornea, the eye's thick transparent outer layer. The cornea focuses the incoming light and then enters the lens where light is bent farther inward and focused to form an image on the retina.
- The pupil, by contracting and dilating, determines how much light enters the eye
- The iris determines the eye's color and controls the pupil's size
- Behind the iris, muscles change the shape of the lens. They flatten it to focus on distant objects and thicken it to focus on closer objects— accommodation
- Each retina holds about 120 million rods and 6 million cones. Densely packed in the fovea
- Photopigments: protein molecules that become unstable and split apart when exposed to light
- Decomposition of photopigments alters the membrane potential of the photoreceptors and triggers action potentials in downstream in downstream neurons
- Ganglion cells are the first neurons to generate action potentials. Send their signals along their axons from inside the eye to the thalamus
- Axons are gathered in a bundle, the optic nerve, and exits out the back of the retina
- Object agnosia: the inability to recognize objects

- Color of light is determined by the wavelengths that reach the eye
- Trichromatic theory: color vision results from activity in three different types of cones
  - o Two main types of color blindness determined by the relative activity among the three types of cones
- Opponent processing theory: red and green are opponent colors as are blue and yellow
- Hue: the distinctive characteristics that place a particular color in the spectrum
  - o Depend on the light's dominant wavelength when it reaches the eye
- Saturation: the purity of the color
  - o Mixture of wavelengths in a stimulus
- Brightness: the color's perceived intensity
  - o Total amount of light touching the eye
- Gestalt Principles of perceptual Organization
  - o Proximity: the closer two figures are to each other, the more likely we are to group them and see them as part of the same object
  - o Similarity: we tend to group figures according to how closely they resemble each other, whether in shape, color, or orientation
  - o Continuity: we tend to group together edges or contours that have the same orientation, known as "good continuation"
  - o Closure: we tend to complete figures that have gaps
  - o Illusory contours: we sometimes perceive contours and cues to depth even when they do not exist
- The ability to determine an object's depth based on that object's projections to each eye
- Monocular Depth Perception
  - o Occlusion: a near object occludes an object that is farther away
  - o Relative size: far-off objects project a smaller retinal image than close objects do, if the far-off and close objects are the same size
  - o Familiar size: because we know how large familiar objects are, we can tell how far away they are
  - o Linear perspective: seemingly parallel lines appear to converge in the distance
  - o Texture gradient: as a uniformly textured surface recedes its texture continuously becomes denser
  - o Position relative to the horizon: all else being equal, objects below the horizon that appear higher in the visual field are perceived as being farther away
- Motion aftereffects may occur when you gaze at a moving object for a long time and then look at a stationary scene
- For size constancy we need to know how far away the object is from us
- For shape constancy we need to know what angles we are seeing the object from
- For color constancy: we need to compare the wavelengths of light reflected from the object with those reflected from its background