

## Chapter 5: The Perceiving Mind- Sensation and Perception

### How does Sensation Lead to Perception?

- Sensation- the process of detecting environmental stimuli or stimuli arising from the body
- Sensory systems have developed through natural selection
- Perception- the process of interpreting sensory information

### Sensory Information Travels to the Brain

- Sensation begins with interaction between a physical stimulus and our biological sensory systems.
- Stimulus- anything that can elicit a reaction from our sensory systems
- Transduction- the translation of incoming sensory information into neural signals

### The Brain Constructs Perceptions from Sensory Information

- Attention- a narrow focus of consciousness
  - Often determines which features of the environment influence our subsequent thoughts and behaviors
- Unfamiliar, changing, or high- intensity stimuli impact our survival and have high priority for our attention
- Sensory adaptation- the tendency to pay less attention to a non-changing source of stimulation
- To prioritize input, we use selective attention, or the ability to focus on a subset of available information and exclude the rest
- Bottom-up processing- perception based on building simple input into more complex perceptions
  - Simple things
  - Only need this to respond appropriately to simple stimuli
- Top-down processing- a perceptual process in which memory and other cognitive processes are required for interpreting incoming sensory information
  - Reading a sentence
  - Recognizing a friend in a crowd

### Measuring Perception

- Psychophysics- The study of relationships between the physical qualities of stimuli and the subjective responses they produce
  - Allows us to establish the limits of awareness, or thresholds, for each of our sensory systems
  - Developed by Gustav Fechner
- Absolute threshold- the smallest amount of stimulus that can be detected
- Difference threshold- the smallest detectable difference between two stimuli
  - As stimuli get larger, differences must also become larger to be detected

## Signal Detection

- Signal detection- the analysis of sensory and decision making processes in the detection of faint, uncertain stimuli
  - Two step process
    - 1) the actual intensity of the stimulus, which will influence the observer's belief that the stimulus did occur
    - 2) the individual observer's criteria for deciding whether the stimulus occurred

## How Do We See?

- Vision- the sense that allows us to process reflected light
- 50% of our cerebral cortex processes visual information

## Visual Stimulus

- visible light is a type of radiation emitted by the sun, other stars, and artificial sources such as the lightbulb
- energy moves in waves
- Wavelength is decoded by our visual system as color or shades of grey
- The height of the waves is translated by the visual system into brightness

## The Biology of Vision

- The eye
  - Hard outer covering helps the fluid-filled ball retain shape
  - Cornea- the clear surface at the front of the eye that begins the process of directing light to the retina
  - Pupil- an opening formed by the iris
  - Iris- the brightly colored circular muscle surrounding the pupil of the eye
    - Adjusts the opening of the pupil in response to the amount of light present and to signals from the autonomic nervous system
    - Arousal- dilated pupils
    - Relaxation- constricted pupils
  - Lens- the clear structure behind the pupil that bends light toward the retina
    - Muscles attached to the lens can change its shape, allowing us to adjust our focus to see near or distant objects
  - Retina- layers of visual processing cells in the back of the eye
    - A thin but complex network of neurons specialized for the processing of light
    - In the deepest layer of the retina are specialized receptors called rods and cones that transduce the light info
    - Before light reaches these receptors, it must pass through numerous blood vessels and neural layers
    - We do not see the vessels and neural layers due to adaptation
    - Sensory systems tune out stimuli that never change

- Optic disk- where blood vessels leave the retina to form the optic nerve exit
  - Because there are no rods or cones in here, the eye has a blind spot
- Fovea- an area of the retina that is specialized for highly detailed vision
  - Responsible for central vision as opposed to peripheral vision
- The image projected on the retina is upside down and reversed relative to the actual orientation of the object being viewed

### **Rods and Cones**

- Rod- a photoreceptor specialized to detect dim light
  - More sensitive to light
  - More common as you move from the fovea to the periphery of retina
  - Do not provide info about color
  - Not clear, sharp images
- Cone- a photoreceptor in the retina that processes color
  - Excel at seeing dim light
  - Function best under bright light
  - See sharp images and color
- Human eye contains about 120 million rods and 6 million cones

### **Visual Pathways**

- Rods and cones are the only true receptors of the visual system
- They trigger responses in four additional layers of neurons within retina
- Optic nerve- the nerve exiting the retina of the eye
- Chiasm- the point at which the optic nerves cross the midline
- Optic tracts- nerve pathways traveling from the optic chiasm to the thalamus, hypothalamus, and midbrain
- The thalamus sends info about vision to the amygdala and primary visual cortex in occipital lobe
- Primary visual cortex responds to shape, location, movement, and color
- Parietal pathway- process movement in the visual environment
- Temporal pathway- responds to shape and color and contributes to our ability to recognize objects and faces

### **Visual Perception and Cognition**

#### **Color Vision**

- Red green and blue are primary colors
- Trichromacy theory- a theory of color vision based on the existence of different types of cones for the detection of short, medium, and long wavelength
  - One or no cones- see just black, white and grey
  - Two cones- are color blind
  - Three cones- normal