Introduction

- Demonstrations indicate that we don't see the world as our measuring devices indicate it is.
- ***Empiricism***: Philosophical stance that knowledge must be based on trial and error experience.
  - British Empiricists: George Berkeley, John Locke and David Hume.
- The retinal image is two-dimensional, and can't accurately report size, orientation (angle), or distance. For example, the two men who are about the same height are perceived differently depending on their distance from the viewer.

Human Visual System

- ***Light*** is a narrow portion of the electromagnetic spectrum
- ***Light receptors****:* Rods and cones
  - *Rods*: Predominant in low light situations
  - *Cones*: Predominant in greater light intensities, more numerous near the fovea than rods
- ***Ventral stream***: Occipital lobe to temporal lobe; deals with analysis of form and color
- ***Dorsal stream***: Occipital lobe to parietal lobe; deals with analysis of motion and spatial relationships
- ***Visual sensitivity***: Ability to see in different levels of light.
  - Some animals have broader ranges than humans do.
  - Eyes need to adjust to different levels of light.
- ***Acuity***: The fineness of discrimination.
  - Perception is best when the object viewed is directly in front of the eye.
- ***Receptive field characteristics***: Visual neurons don't respond equally to all stimuli.

Perception

Lightness and darkness

- Demonstrations indicate that the perception of lightness and darkness does not match the measurement of light intensity.
- The retina cannot disentangle the elements contributing to lightness and darkness:
  - *Illumination*: Amount of light falling on an object
  - *Reflectance*: The reflective properties of the surfaces of a viewed object
  - *Transmittance*: The effect of the atmosphere through which light is passing

Color

- The ability to see color depends on three different cone types that react to short, medium, or long wavelengths of the light spectrum.
- ***Hue***: Perception of relative redness, blueness, greenness or yellowness
- ***Saturation***: Degree to which a perception approaches a neutral gray
- ***Color lightness/darkness***: Sense of the overall intensity of a light stimulus
- ***Color contrast*:** Different appearances of surfaces that have same measured spectral returns. Examples: the squares on the cube that look blue or yellow but are actually gray, and the paint that looks different when on a wall than it does when it is on a chip in a different environment.
- ***Color constancy***: Same appearance of surfaces that have different measured spectral returns. Examples: squares on the cube that are really orange and purple appear red, and the fruit that "keeps" its color in different lighting

Motion

- We can't perceive all motion, because some movement is too fast or slow.
- We depend on context to see direction, as shown by the same line moving behind different screens and by the barber pole.

Geometric form

- We don't perceive angles or line lengths accurately.
- We tend to see horizontal lines as shorter and oblique lines as longer. These perceptions, as assessed in psychological testing, form a "McDonald's–arch-like" graph.

Making Sense of Sensory Information

- What we see is determined by neural activity, but it does not directly match what can be assessed using measuring instruments such as rulers, photometers, or protractors.
- Visual systems have evolved over millions of years, based on the reproductive success of more visually fit individuals.
- **Laser range scanner**: A device that measures the distances between two points in physical structures; it can be thought of as visual radar
    - The lengths of lines as accurately assessed by laser range scanned images of natural scenes produces a graph of the same shape as the psychological tests of people's perceptions of the relative length of lines. In each graph, there is a bias toward oblique lines being longer and horizontal lines shorter.
- Perception is a reflex action of visual circuitry based on experiences.
- "Optical illusions" are examples of the normal discrepancies between retinal images and what we perceive. They are useful in showing us how our visual system deals with information from the outside world.
- It is most likely that this reflex action theory, based on evolutionary development, can account for the way our other senses operate as well.

Related Films Also Available from Davidson Films

This is one of four films in Davidson Films' "Neuroscience" series. The other titles are:

- ***Discovering the Human Brain: New Pathways to Neuroscience*** (2006) 29 Minutes
- ***Human Brain Development: Nature and Nurture*** (2007) 30 Minutes
- ***The Emotional Brain: An Introduction to Affective Neuroscience*** (2009) 33 Minutes