L E A R N I N G G U I D E

MAKING SENSE OF SENSORY INFORMATION

With

D A L E P U R V E S, M.D.

(30 minutes)

DAVIDSON *films*

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MAKING SENSE OF SENSORY INFORMATION

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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 experience, from trial and error testing*

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 perspective- 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 lob; 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. Eyes need to adjust to different levels of light.*

Acuity*: The fineness of discrimination. Perception is best when the object being 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 viewed objects*

Transmittance: *The effect of the atmosphere through which light is passing*

Color

The ability to see color depends on three different cone types which react to short, medium or long wavelengths of the light spectrum.

Perceptual qualities to experience color:

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 from when it is on a chip in a different environment

Color constancy: *Same appearance of surfaces that have different measured spectral returns.* Examples: squares appear red on the cube that are really orange and purple and the fruit that "keeps" its color in different lighting

Motion

We can't perceive all motion because some is too fast or too 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 line lengths or angles accurately.
We tend to see horizontal lines as shorter and oblique lines as longer and 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 with measuring instruments like rulers, photometers and protractors.

Visual systems have evolved over millions of years based on the reproduction 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 the same shaped graph as the psychological tests of people's perceptions of the relative length of lines. In each graph there is a bias towards oblique lines being being longer and horizontal lines shorter.

Perception is a reflex action of visual circuitry based on the past experience.

"Optical illusions" are examples of the normal discrepancies between retinal images and what we perceive and 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.

R E L A T E D V I D E O S

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