PS2011/16
Cognitive Psychology

Visual Perception

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Reading

Essential
- Gordon (1997) Theories of Visual Perception
 2nd edition, New York, Wiley, or
3rd Edition, Hove, Psychology Press
(also available as e-book from the library catalogue)
- Bruce, Green & Georgeson (2003) Visual Perception,
 Hove, Psychology Press, 4th Edition.
Highly Recommended
- Eysenck & Keane (2000) Cognitive Psychology
 Hove, Psychology Press
Additional Reading
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Additional reading

- Roth & Bruce (1995) Perception and Representation
 Buckingham , Open University Press, Second Edition

- Pinker, S. (1984) Visual Cognition: An introduction.
 Cognition, 18: 1-63

- Wade & Swanston (2001) Visual Perception
Hove, Psychology Press, 2nd Edition

- Pinker (1997). How the mind works
London, Penguin

More references provided for each lecture

Overview

Functions of vision
          - provide data for memory
                    maps
                    objects
          - guide action
                    obstacle avoidance
                    navigation
                    homing
                    reaching
                    object manipulation

How are we able to derive a correct interpretation of
the environment from the pattern of light intensity
registered by the retina?

Six lectures
•Traditional approaches
•Physiology
•Perceptual organisation
•Object recognition
•Ecological approaches
•Functions of vision

Lecture 1
Traditional approaches to visual perception
Reading

Essential
- Gordon (2004), Chapter 5; or Gordon (1997), Chapter 6.
 Bruce, Green & Georgeson (2003), Chapter 4, pp. 77-80;
Chapter 7. Pp. 169-176; 187-197.
- Eysenck & Keane (2000). Chapter 2, pp. 30-38;
Chapter 3, pp. 53-58.

Additional
- Wade & Swanston (2001). Chapter 1, pp. 25-29;
Chapter. 2, pp. 59-74
- Pinker (1997). Chapter 4, pp. 211-233.

Traditional approaches

Roots in philosophical empiricism

- knowledge and ideas are derived from the senses

- opposed to nativism

- sensory information (e.g. from the retina) provides an inadequate description of distal objects

Constructivism

- dominant paradigm in perceptual research 1950-1980

- origins in the work of H. Helmholtz (1821-1894)

- constructive processes between sensation and awareness of real world

- perception as unconscious inference
    - constructive processes are like thinking
    - they are not available to introspection

Modern constructivism

Theoretical and experimental work by e.g. Bruner (1957); Neisser (1967); Gregory (1972-1980); Palmer (1975).

Shared assumptions

- perception not determined entirely by external stimuli

- interaction of external and internal sources of information (e.g. expectations, motivations, emotions)

- hypotheses and expectations can lead to errors producing visual illusions

Bottom-up versus top-down processing

Perception used to form conscious experiences of the world or to guide appropriate actions towards objects can be obtained using two different types of processes:

Bottom-up or data-driven
    all information obtained from sensory input

Top-down or conceptually-driven
    extraction of information from sensory input guided by prior knowledge of properties of objects or events

Constructivist approaches emphasise top-down processing

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For example,
the shape in this image can, in principle, be derived:

- on the basis of spatial groupings of points etc.

- using specific hypotheses about what shape to search for, knowledge about shading and characteristic component parts of the hypothesised shape etc.

The role of context and expectations in recognition

Ambiguous stimuli, e.g.
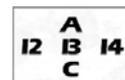
Experiments, e.g. Palmer (1975)
- presentation of a context (e.g. kitchen)

- briefly presented picture of objects
    - relevant to the context (loaf of bread)
    - irrelevant to the context (e.g. letter box)
    - neutral (no previous presentation of context)

- frequency of errors in object recognition
    - high following inappropriate context
    - medium following neutral context
    - low following appropriate context

"New look" experiments

Carried out after WW2 and influenced by psychoanalysis, aimed at stressing the role of motivation and emotion in perception

e.g. Bruner and Goodman (1947)

Children from different economic backgrounds judge coin size Differently (overestimation of size by poorer children)

Mostly discredited as different variables could have affected the Results (e.g. familiarity with coins of richer children)

Poverty of the stimulus and the problem of size constancy

Size constancy: ability to judge correctly the size of objects from different distances. Why is it problematic?

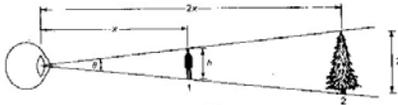- An object of height h at a distance x subtends a visual angle θ.

- The size of the retinal image is size uniquely determined by the visual angle

- Two objects of the same height at different distances subtend different visual angles

- Objects of different heights at different distances can subtend the same visual angle

- The information carried by the size of the retinal image alone cannot provide an unambiguous interpretation of the external world

- Yet in normal situations we are able to judge correctly the sizes of objects viewed from different distances

- The information provided by retinal size must be integrated with information from other sources during the perceptual process

- The perceptual system needs information about distance

- How can information about the third dimension be obtained from a two dimensional retinal image?

Depth cues

Philosophical roots: British empiricism, notably Berkley (1709) Knowledge of third dimension acquired by associating visual cues with position felt by touch
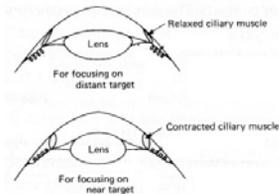
• Convergence

- the eyes converge more on nearer objects
- the strain in muscles involved provides a cue to depth

• Accommodation

Different degree of strain in muscle (ciliary) around lenses

Convergence and accommodation can provide information about only one of the objects in the visual field

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• Blurring

When the eyes are focused on an particular object, objects out of focus will be blurred to a different degree according to their distance from the object in focus

• Binocular stereopsis

For animals with overlapping visual fields, information provided by a comparison of the image from the two eyes

The psychological importance of this disparity for depth perception is illustrated by stereoscopes

• occlusion

Objects partially occluded by other objects are as being more distant than the occluding object

It provides information about ordering in depth but not about absolute distance

• atmospheric perspective

light absorbed and scattered by the atmosphere makes distant objects appear less clear
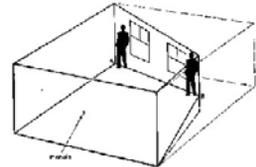
• linear perspective

The horizontal distance of parallel lines receding from the observer is larger for nearer points and smaller for more distant points
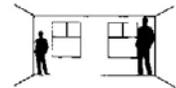
Depth cues can be powerful enough to produce visual Illusions about size

The Ames room

Trapezoidal room with trapezoidal windows that seems rectangular when se from a pinhole

People of the same size located at the far corners are seen as of different sizes

Visual illusions, such as those produced by the Ames room have been used to stress that visual perception:

- perception is indirect (e.g. size is not perceived directly but is inferred on the basis of other information, such as that provided by depth cues)

- the retinal image is unable to capture the properties of real objects in the external world

Summary

• Constructivism
• Top down *versus* bottom-up processing
• Internal variables and context can affect perception
• Size constancy
• Depth cues
• Visual illusions