Introduction

- Advances in visual processing due to:
  - Single cell recording
  - Lesion techniques
  - Technology in computer vision systems
- Paper will cover:
  - Knowledge in early 1980s
  - Advances in visual object processing

From 1984 to 2004

- Converging research has helped advance cognitive neuropsychological studies
  - Neurophysiology: lower-level vision
  - Cognitive psychology & computer modeling: intermediate & higher-level vision
- This section will cover:
  - Processing of features
  - Processing of objects
  - Use of vision for action

The Cognitive Neuropsychology of Visual Object Processing in 1984

- Associative agnosia vs. apperceptive agnosia
  - Associate: impaired retrieval of stored knowledge
  - Apperceptive: impaired coding of basic sensory properties
- Processes involved in object processing can fractionate.
- View-invariant object coding and access to stored functional knowledge are localized in different hemispheres
- “What” and “where” in ventral and dorsal pathways

Features, objects, action: The cognitive neuropsychology of visual object processing, 1984-2004

Glyn W. Humphreys and M. Jane Riddoch
(1) Feature processing

1. Coding basic visual features
   - Specialized areas for color, motion, shape, etc.
   - Achromatopsia
2. Binding visual features
   - How do we combine features into a perception of a coherent world?
   - Balint’s syndrome
   - Extinction
3. Feature coding, binding, and awareness
   - Blindsight

(2) Object Processing

4. Fractioning the association process:
   Structural and semantic representations
   - Associative stages of recognition can fractionate
   - JB: Poor at judging whether drawings were correctly colored
5. Objects, faces, and words
   - There can be relatively independent breakdowns in processing different classes of objects

(2) Object Processing

1. Shape integration
   - HJA: integrative agnosia
2. Parallel forms of shape coding: Wholistic and parts-based representations
   - Humphreys et al. 1985
   - Simultanagnosia
3. Coding orientation and view-invariance
   - Poor at mental rotation; could identify misorientated letters, objects, and numbers.
   - A process additional to mental rotation seems required

6. The real object advantage and the recalibration of visual memories
   - Long term memory needs to be constantly updated and recalibrated through interaction
   - Therefore, if the process is disrupted by a perceptual deficit, then long-term memory deteriorates
7. Object perception and imagery
   - Differing opinions on integration between object perception and imagery
(3) Action

1. Prehensile action in agnosia
   - Shift from object recognition to understanding how visual info is used to control and access actions to objects

2. Optic aphasia and direct action
   - Patients can be impaired on object recognition tasks, but still be able to use objects appropriately

Dissociation between mental imagery and object recognition in a brain-damaged patient

Marlene Behrmann, Gordon Winocur & Morris Moscovitch

Summary

- Selective deficits in grouping and binding
- Apperceptive and associative stages can be fractionated
- “Weighting” of independent visual processes
- Direct role of vision in action and recognition

C.K.

- Strongly impaired object recognition
- Can identify if allowed to touch without looking
- Face recognition intact
- Unable to identify his own drawings
- Perfect on visual imagery tests for color identification, size comparison, letter description, etc.
- Excellent mental imagery despite poor object recognition
- Serves as a double dissociation to patients with intact perception and impaired mental imagery
Hypotheses

- Hypothesis 1: “There are separate underlying representations in long-term memory, one set used for generating mental images and a second set used for perceiving objects.”
- Hypothesis 2: “There is a single set of higher-level visual representations with separate routes of access for imagery and for perception.”

Figure 1. Example stimuli from the Efron shape test.
Figure 5. Example of a compound letter used in studies of hierarchical pattern processing. The task is either to identify the global or the local form.

Figure 6. Example stimuli from Shalev and Humphreys (2002). A patient with Balint’s syndrome was able to decide on the relative positions of the small circles within the larger oval when instructed to think of the stimuli as faces, but not when instructed to treat them as shapes.
Figure 8. Examples of HJA’s drawing from memory, when tested in 1985 and 1995 (after M.J. Riddoch et al., 1999). The drawings are of an eagle and celery.