Motion Perception

Perception & Attention Course

George Mather

Figure-ground segregation

- Relative motion allows segregation

3-D structure and navigation

A case of motion-blindness

She had difficulty, for example, in pouring tea or coffee into a cup because the fluid appeared to be frozen, like a glacier. She found face-to-face conversations difficult because she could not see the movements of the speaker’s face and mouth. Crowded rooms or streets made her feel unwell, because “people were suddenly here or there but I have not seen them moving”. This problem was particularly acute when attempting to cross a road with moving traffic, although she had no difficulty in actually identifying the cars. (Zihl et al., 1983)

Detecting movement

- Responses in single receptive fields are ambiguous

Detecting movement

- Responses in pairs of receptive fields must be compared to detect movement.
Evidence for motion detectors

• Many cells in cat and primate visual cortex are direction-selective.

Evidence for motion detectors

• The motion after-effect.

Evidence for motion detectors

• Explaining the motion after-effect.

Object motion and observer motion

• Retinal image motion can result either from movement of an object in the world, or from movement of the observer’s eyes/head/body.

Object motion and observer motion

• During rapid eye movements (saccades), vision is suppressed.
• For slower eye movements, retinal motion signals are compared against a record of commands sent to the ocular muscles.
• The visual system assumes that uniform whole-field motion is due to observer motion, and local relative motion is due to object motion.

Real movement vs. apparent movement

• Real movement involves continuous change in position. Natural images contain real movement (e.g. actors walking across a theatre stage).
• Apparent movement involves discontinuous change in position. TV and cinema images contain apparent movement.
Why do TV and cinema work?

- Good apparent movement is perceptually indistinguishable from real movement.
- Cortical direction-selective cells respond to apparent movement (within limits).
- Apparent movement stimuli excite neural detectors in the same way as does real movement.

Motion integration

- Motion detectors suffer from the ‘aperture problem’.

Higher level integration

- The kinetic depth effect

Higher level integration

- Biological motion

Multiple processes in motion perception

- Some examples of apparent motion are difficult to explain in terms of neural motion detectors.
- Some argue that motion can be perceived as a result of shifts in attention, or of perceptual ‘inferences’.