Simon Sees as Simon Does: Evidence for a Perception-Action Model of Letter Recognition

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Introduction

Does the perception of objects that are the result of human actions reflect the dynamic structure of the actions that give rise to them?

- Large body of evidence supporting interdependence of action and perception systems (Rizzolatti & Craighero, 2004).
- Perception of a stimulus can be sensitive to temporal order (Sanocki, 2001).
- Perception of characters can be influenced by character production (Freyd, 1983; Li & Yeh, 2003; Tse & Cavanagh, 2000).

Temporal stroke order priming (Parkinson & Khurana, ASSC 2005)

If a machine-generated letter is presented using a stroke order Consistent with writing action, recognition is primed compared to presentation using an Inconsistent stroke order. Motoric writing action suggested as the source of the priming effect.

Rationale:

- Is the source of the priming effect really writing action i.e., the action system? Or is it a conscious, strategic process based on percepts of learnt sequences, implying a non-motoric perceptual effect?
- If the effect is strategic in nature, then reducing the ability to assemble the stroke sequence consciously should diminish or remove the stroke order priming effect.
- Perception of strokes in the sequences were manipulated by pattern masking and varying exposure duration.

Masking Experiment

Pattern masks of 100ms duration were inserted after each of the first two frames in a stimulus sequence.

An example of the stimulus sequences incorporating pattern masks. (Shown here is the Consistent presentation mode.)

The temporal order priming effect is still observed even with pattern masking. This argues against a conscious, strategic decision account of the observed priming effect. Additionally, the site of priming is not likely to be visual short-term memory.

Exposure Duration Experiment

- Two experiments were run using various frame durations ranging from 10 to 500 ms. The final target frame remained onscreen for 100 ms in all conditions.
- Significant temporal stroke order priming in letters occurred even at a frame duration of 20 ms per stroke.
- The magnitude of the priming effect is normally distributed as a function of frame duration.
- Peak priming occurs at animation speeds of 100-200 ms per frame duration. This is consonant with average writing speed in terms of time-per-stroke (Plamondon, 1991), suggesting that the more the unfolding percept reflects writing action, the greater the priming for character recognition.

Conclusions

- Temporal stroke order priming is a robust effect that occurs under a variety of conditions.
- The priming effect occurs under both masking conditions and at fast animation speeds. This contradicts a conscious strategic decision account, and discounts visual short-term memory as the site of the effect.

- The more a temporally unfolding percept reflects an action in terms of both stroke order and time-per-stroke, the greater the priming for the recognition of the perceptual result of that action.
- This supports an account of the priming based on a link between writing action and letter perception, even in the absence of dynamic information associated with each individual stroke.

References