

Object-based Cross-attribute Attentional Effects in Bivectorial Motion

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Object-based Attention

- o The units of attentional selection are "visual objects" as a whole with all of their concomitant attributes
- o Prediction: even if an observer attempts to direct attention to a particular attribute of an object, the whole object - and thus all of its attributes - are selected

Cross-attribute Attentional Effects and Object-based Attention

- o Cross-attribute attentional (CAA) effects: the spread of attentional effects from one attribute to another
- o O'Craven et al. (1999)
Attention directed to the motion of a face not only activates motion processing area MT, but also FFA, the area thought responsible for face detection

However...

- o Does "object formation" precede CAA effects?
- o Early local binding of visual attributes?

Evidence for local binding of visual attributes

- o Contingent aftereffects

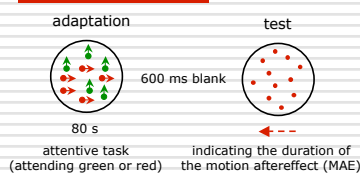
Color-Orientation: McCollough Effect
- as early as V1 where neurons have small receptive fields (Humphrey & Goodale, 1998)

Polarity-Motion/Color-Motion for locally paired dots (Blaser et al., 2003)

Experimental Hypothesis

- o If CAA occurs locally, then it should not be affected by object-level reconfigurations.

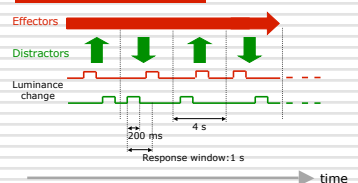
Experiment: general procedure



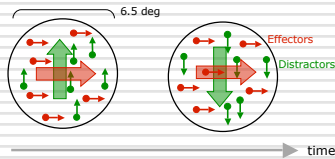
Experiment: general procedure

- o During adaptation, two populations of random, limited lifetime (200 ms) dots were drifting at 0.8 deg/s against a black background. Half of the dots (Effectors; n=50) moved along 0° (rightward) and the other half (Distractors; n=50) moved orthogonally. Distractor dots alternated direction every 4 s between +90° and -90°.
- o During test, the MAE duration was measured.

Attentional Task (During Adaptation)



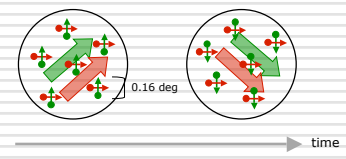
Adapting Stimulus: Transparency (TP)



Global and local motion components: TP

- o The attributes (for instance, luminance and color) of the two dot fields are associated with different surfaces and accordingly with different local and global motion directions.

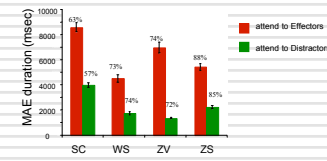
Adapting stimulus: Locally Paired Dots (Qian et al., 1994a)



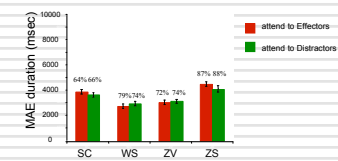
Global and local motion components: LPD

- o Attributes of two dot fields are associated with different motion directions only at the local motion stage (V1). Globally, they are integrated into a single surface with the vector average motion of the two directional components (MT). (Qian et al., 1994b)

Results: TP



Results: LPD



Results

- o We found cross-attribute attentional effects (color - motion), but only when dots were perceptually segregated into two surfaces.

Transparent condition: the MAE duration after attending to the color of effectors was longer than after attending to that of distractors.

LPD condition: the duration of the MAE was not significantly different for the two attentional states.

Conclusions

- o Binding at the local motion processing stages does not mediate cross-attribute attentional (CAA) modulation
- o CAA effects are mediated by object-based attention
- o MT is likely to be responsible for object-based CAA in bivectorial transparent motion

References

- o Blaser, E., Papathomas, T. V., & Vidnyánszky, Z. (2003). Polarity-contingent motion aftereffects at the stage of local motion processing. *Vision Science Society Conference*.
- o Humphrey, G. K., & Goodale, M. A. (1998). Probing unconscious visual processing with the McCollough effect. *Consciousness and Cognition*, 7, 494-519.
- o O'Craven, K., Downing, P., & Kanwisher, N. (1999). fMRI evidence for objects as the units of attentional selection. *Nature* 401, 584-587.
- o Qian, N., Andersen, R.A., & Adelson, E. H. (1994a). Transparent motion perception as detection of unbalanced motion signals, I. *Psychophysics. Journal of Neuroscience*, 14, 7357-7366.
- o Qian, N., Andersen, R.A., & Adelson, E. H. (1994b). Transparent motion perception as detection of unbalanced motion signals, II. *Physiology Journal of Neuroscience*, 14, 7367-7380.