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Submitted By: Scott Watamaniuk

Opposing motion aftereffects and storage in the eye movement system

Scott Watamaniuk¹, Stephen Heinen²

¹Department of Psychology, Wright State University, Dayton OH, ²Smith-Kettlewell Eye Research Institute, San Francisco CA

Prolonged viewing of motion in a single direction can induce a motion aftereffect (MAE); static objects are perceived as moving opposite the adapted direction while motions similar to the adapting stimulus are repelled away from the adapted direction, and perceptually slowed (Wohlgemuth, 1911). Placing observers in the dark before presenting them with a textured stimulus can postpone the MAE (storage). Motion adaptation can also induce a smooth pursuit MAE (Braun & Gegenfurtner, 2004), decrease the speed of smooth pursuit eye movements, and bias the direction of pursuit away from the adapted direction (Heinen et al., 2003; Gardner et al. 2004). Here, we present evidence that MAE storage occurs in the pursuit system, and propose a model to explain it.

Observers adapted for 60 sec to a random-dot cinematogram (RDC) in which all dots moved upward at 10 deg/sec. After adaptation, observers were presented either immediately or following 1000 msec in the dark (GAP), with an RDC pursuit stimulus that moved at 0.5 deg/sec in one of five directions, -20° to 20°, centered around rightward. A 10 sec adaptation top-up interval was presented before each subsequent trial. When stimuli were presented immediately after adaptation, eye movements were biased opposite the adapted direction, consistent with a pursuit MAE. Eye velocity reached a peak of .3-.5 deg/sec, before dissipating in ~ 800 msec. During the gap, the eyes moved in the adapted direction, presumably an optokinetic response. After the GAP, the MAE occurred with a similar time course and peak velocity as in the no GAP condition. We propose a model where adaptation creates an imbalance of activity between motion detectors during adaptation as a result of a recalibration of synaptic connections. The imbalance is too small to override the optokinetic eye movements during the GAP, but the presence of visual input magnifies the imbalance, thereby causing the eyes to move opposite the adapted direction for expression of the pursuit MAE.

Methodology: Behavior/Psychophysics

Content Area: Eye movements

Primary Topic Descriptor: eye movement mechanisms

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