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Abrupt visual onsets elicit involuntary reflexive eye movements

Some previous research suggests that the attentional system does not drive the ocular motor system unless the motor system is already programming an eye movement (Tse et al., 2002, *Vis. Res.*), while other work suggests that attentional shifts elicit oculomotor responses (Theeuwes et al., 1999, *JEP:HPP*). We set out to answer the question, “Do abrupt onsets elicit reflexive eye movements?” Observers performed a 2AFC peripheral orientation discrimination task, while attempting to maintain fixation on a fixation mark at the center of the screen. In condition 1, a spatially coincident cue preceded the onset of the target. In condition 2, a cue preceded the onset of the target but appeared in the opposite visual hemifield (spatially disparate). The subjects’ eye movements were recorded with an SRI Dual-Purkinje eye tracker and analyzed offline using a reverse correlation technique where the eye movements from each trial were averaged. In condition 1, the onset of the cue induced an involuntary ocular drift away from fixation towards the cue, and the drift continued on its trajectory through the onset of the coincident target. In condition 2, the onset of the cue induced an involuntary ocular drift towards the cue (i.e. away from the known target velocity), followed by a higher velocity drift to the opposite visual hemifield in anticipation of the appearance of the disparate target. Across three subjects, we noticed a spectrum of suppression of the reflexive eye movements from little suppression (naïve observer) to much suppression (experienced observer). These findings suggest the evidence of a mandatory activation of an eye movement response elicited by an abrupt onset, though this response can be suppressed to varying degrees by volitional fixation.