Shifting selection may control apparent motion

(Supplementary Material)

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Methodological Details

Participants and Experiment

Eighteen participants (18-35 yr) completed the experiment. All participants had normal or corrected-to-normal vision, were paid for participation, and gave written consent. The experiments were controlled by a Dell Precision M65 laptop computer running SR Research Experiment Builder on Windows XP. The display subtended 32.6° x 24.4° at an approximate viewing distance of 56cm, on a ViewSonic E70fB CRT monitor with a 75-Hz refresh rate, and 1024x768 pixel resolution, 33.6 pixels per degree. Each participant was trained to maintain central fixation using a previously documented method[1]. The participant's head was not restrained so as to reduce muscle artifact in the electroencephalographic recording, but head position as well as eye position were tracked with an eye tracker (see below for the trial rejection criteria).

Self-initiated trials began with a 400ms word cue. When the cue was "move," participants were instructed to attempt to see the yellow circle moving between the left and right positions. When the cue was "change," participants were instructed to attempt to see up-down motions separately on the left and right sides, which was accompanied by apparent changes in the color of the circles (between red and yellow on one side and between green and yellow on the other side). Following 1600-2000 ms (randomly jittered across trials), the six-frame animation sequence (333 ms per frame) was presented. The sequence consisted of three repetitions of a two-frame apparent-motion display (see Figure 1). At the end of each trial, participants indicated whether they actually experienced the cued motion via a button press. Trials in which participants did not experience the cued motion were eliminated from analysis.

Each participant was tested in 30 blocks of 12 trials. In each block, participants were cued to perceive a specific motion percept (either left-right, or up-down). The cued percept was alternated across blocks, and the cued percept for the initial block was counterbalanced across participants. On each trial, the initial location of the yellow circle was randomly left or right.

EEG Recording and Analysis

EEG signals were recorded using a Biosemi Active 2 EEG/ERP system. The DC recording was made at 512Hz with a hardware low-pass filter, and then was decimated in software to 256Hz. All sites were re-referenced to the post-recording average of the left and right mastoids and low-pass filtered at 80Hz (half-amplitude cutoff). For visual clarity, all waveforms in Figure 1 were additionally low-pass-filtered by convolving them with a Gaussian impulse-response function (SD = 16 ms; 50% amplitude cutoff at approximately 20 Hz). We recorded from 64 silver/silver chloride electrodes mounted in an elastic cap, and the Horizontal and Vertical EOG electrodes. The placement of the 64 channels was in accordance with a modification of the international 10/20 system [2]. The EEG data were epoched within a stimulus-locked time window spanning 200 ms before the stimulus onset until the button response, and baseline corrected to the 200 ms pre-stimulus period. The electrode-based region of interest (P3/4, PO3/4, P7/8, O1/2, PO7/8) was chosen based on prior research on N2pc and CDA [3,4].

Eye movements were monitored by a table-mounted SR-Research Eyelink 1000 Remote eyetracker. If participants' eyes moved outside of the 1 degree radius window around the fixation point within the time window from 800-1200ms before the stimulus (depending on the randomly chosen inter-trial jitter value) to response (via button press), the trial was rejected and recycled.

To double-check the effectiveness of the eyetracker, we also analyzed and compared EOG signals for both the left-right motion percept and up-down motion percept according to Reviewer 2's suggestion. For each participant, we computed the average horizontal EOGs (HEOGs) when the yellow light was on the right visual field (frame 1, 3, 5 on trials where the yellow light appeared on the right first, and frame 2,4,6 on trials where the yellow light appeared on the left first), and the HEOGs when the yellow light was on the left visual field (frame 2, 4, 6 on trials where the yellow light appeared on the right first, and frame 1,3,5 on trials where the yellow light appeared on the left first).

Eye gaze did not deviate towards the side that the yellow light was on in either the left-right percept condition or the up-down percept condition. In the left-right percept condition, when the yellow light was in the right visual field, the average HEOG was 1.21 uv, which indicated an eye movement of at most a fraction of a degree (Hillyard and Galambos, 1970; Lins et al., 1993). This deviation is also not significantly different from zero, $t(17)=1.58$, $p=.13$, ns. When the yellow light was in the left visual field, the average HEOG was 1.2 uv. This deviation was also not significantly different from zero, $t(17)=1.51$, $p=.15$, ns. More critically, HEOGs for when the yellow light was in the left visual field and when the yellow light was in the right visual field did not differ from each other, $t(17)=.07$, $p=.95$, ns.

Similarly, in the up-down percept condition, when the yellow light was in the right visual field, the average HEOG was 1.00uv. When the yellow light was in the left visual field, the average HEOG was 1.03uv. Neither deviation was significantly different from zero, t's$(17)<.96$, $p>.35$, ns, and these two deviations were not different from each other, $t(17)=.29$, $p=.78$, ns. Similar results were found if we only look at HEOGs in frame 3-6, where we primarily sought significant deflection of the n2pc/CDA signals, all t's$(17) <1.5$.

References:

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