EEG and direction-of-gaze correlates of goal-directed vs. stimulus-driven selection in working memory

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Previous work has shown that when multiple items are held in working memory, goal-directed and stimulus-driven factors can compete to influence selection. Subjects first encoded two oriented bars, left and right of fixation, each a different color, then a colored probe indicated which orientation to report. During the delay, a retrocue appeared in one of the two colors, indicating during ‘pro’ blocks the item that would be tested, during ‘anti’ blocks the item that would NOT be tested, and during ‘null’ blocks that either item could be tested (i.e., load remained 2). On ‘anti’ trials gaze bias toward the cued item, indicating selection, was delayed, indicating competition between exogenous and endogenous factors. Here we recorded EEG while replicating the behavioral and eye-tracking procedures. Behavioral results confirmed that informative retrocues benefited reaction time and precision. Location-specific ERPs to the retrocue indicated that selection was delayed on ‘anti’ relative to ‘pro’ trials, confirming the interpretation of the gaze bias results, and specifying a neural and temporal locus of the competition for selection. In the EEG, midline frontal theta was greater on ‘anti’ vs. ‘pro’ trials beginning at 150 msec after retrocue onset, and was greater on ‘anti’ vs. ‘null’ trials beginning at 800 msec after retrocue onset. These results are consistent with an elevated need for ongoing monitoring after selection-related conflict, a process that may differ from the demands on control of elevated working memory load.

Working memory, internal selection, attention, behavioral, theta oscillations, retrocue