Posterior activities during encoding and early delay support the context binding during visual working memory

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Abstract: Visual working memory (VWM) requires accurate binding between trials' content and their unique contexts (e.g. color-location binding). The neural mechanism underlying context binding is still unclear. In a behavioral study (n=41), we modified a delayed recall task by including self-reports about "remember-or-forget" and recall confidence. In this task, the targeted location is marked by its color, and the set size is 6. Combining 3-factor model-fitting and self-report results, we distinguished correct-recall trials (highest probability of recalling the target, remembered with high confidence), mis-binding trials (highest probability of recalling a nontarget, remembered with high confidence), and informed guessing trials (highest probability of recalling a nontarget, forgot and with low confidence). We found correct-recall and mis-binding trials revealed comparable response times and recall errors (relative to target/nontarget respectively). Then, this specific task was adopted in our EEG study (n=8) and we identified neural activities supporting context binding by comparing well-matched correct-recall trials and mis-binding trials. Event-related potential analysis (with a 6 Hz low-pass filter) found a larger N170 in correct-recall trials and a posterior more negative wave in mis-binding trials during retrieval, suggesting successful binding required accurate perceptual encoding while wrong binding may result in more voluntary retrieval efforts. Meanwhile, time-frequency analysis found a larger posterior α oscillation during encoding and a larger α suppression during early delay in correct-recall trials. No such differences were found in theta or beta bands. These results suggested extra attention control in early periods is critical for context binding. Together, our study provided evidence that early posterior activities are crucial for context-binding during VWM and they are independent of the delay-period neural activities which support memory maintenance.

Keywords: context binding; visual working memory; EEG; ERP; α oscillation