Spatio-temporal dynamics of neural mechanisms underlying component operations in working memory

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Miller, BT, Deouell LY, Dam C, Knight RT, D'Esposito M. 2008.

Abstract:

Neuroimaging and neurophysiology evidence suggests that component operations in working memory (WM) emerge from the coordinated interaction of posterior perceptual cortices with heteromodal regions in the prefrontal and parietal cortices. Still, little is known about bottom-up and top-down signaling during the formation and retrieval of WM representations. In the current set of experiments, we combine complementary fMRI and EEG measures to obtain high-resolution spatial and temporal measures of neural activity during WM encoding and retrieval processes. Across both experiments, participants performed a face delayed recognition WM task in which the nature of sensory input across stages was held constant. In experiment 1, we utilized a latency-resolved fMRI approach to assess temporal parameters of the BOLD response during stage-specific encoding and retrieval waveforms. Relative to the latency at encoding, the PFC exhibited an earlier peak of fMRI activity at retrieval showing stage-specific differences in the temporal dynamics of PFC engagement across vim operations. In experiment 2, we analyzed the first 200 ms of the ERP response during this Vim task providing a more sensitive temporal measure of these differences. Divergence of the ERP pattern during encoding and retrieval began as early as 60 ms post-stimulus. The parallel fMRI and ERP results during memory-guided decisions support a key role of the PFC in top-down biasing of perceptual processing and reveal rapid differences across WM component operations in the presence of identical bottom-up sensory input. (C) 2008 Elsevier B.V. All rights reserved.

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