

Functional neurobiology of episodic recollection: Identifying the temporal dynamics of retrieval

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Neural processes supporting recognition memory can be identified by comparing activation during correctly recognized old items (Hits) to that during correctly rejected new items (CR). Prior fMRI and electrophysiological (EEG) studies have revealed old/new effects in prefrontal and parietal cortices, suggesting that these regions support (1) control processes that subservise retrieval attempts and/or (2) processes that are sensitive to successful retrieval.

At present, the relation between retrieval-related responses observed with hemodynamic vs. electrophysiological based measures (e.g, fMRI vs. EEG/MEG) remains unclear. Using anatomically-constrained magnetoencephalography (aMEG) we sought to further identify the temporal dynamics of the circuitry and cortical sources supporting retrieval attempt and success. During encoding, subjects were engaged in two orienting tasks intermixed on a trial-by-trial basis. On the following day, MEG scans accompanied a one-step recognition test that probed for item and source memory. A companion fMRI study, conducted prior to MEG, revealed that left PFC subregions, and to a lesser extent left parietal cortex, were sensitive to familiarity-based retrieval success but were insensitive to recollection-based success. Accordingly, engagement of these neural processes appeared to depend on perceived familiarity, suggesting that these regions have early access to familiarity signals and are gated depending on the expected utility of attempts to recollect. Analyses of the MEG data, using an fMRI-driven region-of-interest approach, revealed multiple generators contributing to MEG differences between Hits and CR. These responses included (a) an early (300ms) and late (800-1200ms) left inferior parietal source, (b) a left inferior frontal/frontopolar source (350-400 ms), and (c) a left ventrolateral/dorsolateral PFC source (350-400ms; 550-600ms; and 750-800ms). Subsequent analyses, comparing recollection-based (Item plus Source) and familiarity-based (Item only) Hits, revealed differential correlates of these two recognition states. Collectively, the MEG data lend further support to the role of left parietal and PFC in guiding attempts to recollect details about past experience.