

Are unattended memory items under cognitive control? Electrophysiological evidence

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In our variant of the dual-serial retrocuing (DSR) paradigm, two sample items are presented simultaneously at the beginning of each trial, and recognition is tested twice in succession, each time after a delay-period retrocue has indicated (with 100% validity) which of the two items will be tested (thereby giving the probed item the temporary status of “attended memory item”; AMI). Importantly, the initially-uncued item cannot be forgotten because it may be tested by the second memory probe, and so it temporarily takes the status of “unattended memory item” (UMI). Previous work has shown that multivariate pattern analysis (MVPA) evidence for an active representation of the UMI often drops to baseline, raising the possibility that the UMI may not be held in working memory, but instead may be transferred to long-term memory (LTM) and then retrieved from LTM on trials when it is cued by the second retrocue. Initial evidence that the UMI is held in working memory, not LTM, came from the demonstration that it can be “reactivated” by a single pulse of transcranial magnetic stimulation (spTMS): 1) spTMS transiently reinstated the MVPA decodability of the UMI from the concurrently measured electroencephalogram (EEG); and 2) spTMS increased false-alarm responses when the UMI was presented as the recognition memory probe (i.e., as a lure; Rose et al., 2016). Here, we tested predictions made by the model that an active representation of the UMI’s spatial context is held in a dynamically reconfigurable parietal salience map: Behavioral and EEG reactivation of an uncued item with spTMS targeting IPS2 would only occur on DSR trials when the uncued item was a UMI, but not on single-probe trials, when the uncued item could be dropped from working memory (“dropped memory item”; DMI). (Critically, the temporal lag between sample presentation and retrocue was identical for DSR and single-probe trials.) Results supported these predictions, showing UMI reactivation effects – in behavior and in the EEG – only during the first delay of DSR trials and not on single-probe trials. The specificity of reactivation effects for UMIs, but not for DMIs, confirms that information about the UMI is held in working memory. The presence, and strength, of elevated effective connectivity between a frontoparietal salience map (including IPS2) and the posterior networks that can represent a recently presented stimulus may govern whether or not that stimulus remains “in working memory.”