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The effect of repetition-related neural pattern similarity on subsequent episodic memory retrieval

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Two competing hypotheses are often referenced when considering the conditions that lead to formation of lasting memories. Whereas it is sometimes argued that thinking about an event in a variety of ways (i.e. encoding variability) leads to memory improvement, the repeated and similar retrieval (i.e. reactivation) of an event can also enhance memory durability. We examine the possible mechanisms of reactivation versus variability by using high-resolution functional magnetic resonance imaging (fMRI) to track neural similarity during memory encoding. Patterns of fMRI activity across multiple encoding instances, particularly focusing on regions of the medial temporal lobe and hippocampus, are used to relate similarity to performance on a subsequent test of memory retrieval. Young adults (N=19) were presented with 120 words corresponding to objects. The words were repeated across three encoding blocks that each required a distinct judgment: How pleasant/unpleasant is it? How likely is it to be found indoors/outdoors? How large/small is it relative to a shoebox? Subjects were then presented with the encoded words intermixed with new words and had to judge the quality of their memory for each. One response option indicated that specific details about the word were retrieved (remembered); in the absence of such details, subjects judged old/new confidence on a four-point scale. High-resolution fMRI data (~1.7-mm voxels) was acquired during encoding and pre-processed using standard protocols. Subjects were highly accurate at old/new discrimination, with the majority of old words associated with remembering details, indicating that the repetitive and elaborate nature of encoding produced durable memory traces. For the fMRI analysis, our preliminary results indicate a slight positive correlation between correct RTs and neural pattern similarity(r=.036), supporting the hypothesis that encoding variability leads to improved access during later retrieval.