

Tuning sensory representations using episodic memory

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The medial temporal lobe (MTL), including the hippocampus, is well known to be essential for declarative memory. Based on experiments in which hippocampal and MTL patients show impaired performance on visual discrimination tasks [1], studies suggest that the MTL is involved in perceptual processes as well. We adopt a previous computational model of hippocampal episodic memory and neocortical sensory representations [2] to account for the perceptual deficits of MTL patients. We hypothesize that the sensory representation is learned through sensory experience but can be improved further by replaying episodes from memory during a process of systems consolidation. We model the effect of episodic memory as 1) repeated verbatim replay of the memory of the episodes and 2) generating novel sequences using a simple hetero-associative sequence storage model. We demonstrate that the sensory representation is better when episodic memory is present. We simulate a visual discrimination task and demonstrate that the lower quality sensory representation of MTL patients might be sufficient to explain their perceptual deficits. We conclude that the MTL can, even if it has a purely mnemonic function, influence perceptual discrimination indirectly.

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