Hippocampal replay as context-driven memory reactivation

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Abstract

Hippocampal replay is not a simple recapitulation of recent experience, with awake replay often unrolling in reverse temporal order upon receipt of reward, in a manner dependent on reward magnitude. These findings have led to the proposal that replay serves to update values in accordance with reinforcement learning theories. We argue that there may be a more parsimonious account of these observations involving simple associations between contexts and experiences: During wakefulness, animals associate experiences with the contexts in which they are encoded, in a manner modulated by the salience of each experience. During periods of quiescence, replay emerges when contextual cues trigger a cascade of reactivations driven by the reinstatement of each memory's encoding context, which in turn facilitates memory consolidation. Our theory unifies numerous replay phenomena, including findings that reinforcement learning models fail to account for.