Unsupervised Temporal Learning during Sleep Supports Insight

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Presentation Abstract Summary Sleep, and particularly Slow Wave Sleep, is known to facilitate insight learning. The mechanism, however, remains unclear. Here, we suggest that sleep-dependent facilitation of insight is typically achieved in tasks requiring temporal pattern detection, and propose that compressed memory reactivations during sleep support such detection. We demonstrate this mechanism with a spiking neural network model of hippocampus-prefrontal cortex interactions. We show that supervised learning in the prefrontal cortex during wake benefits from prior sleep-dependent unsupervised learning in the hippocampus, allowing for quick extraction of temporal regularities that can be utilized to predict upcoming events. Without hippocampal learning, prediction of temporal patterns is very slow or fails completely. Thus, compressed memory replay at sleep gives a unique opportunity for developing insight into temporal patterns.

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