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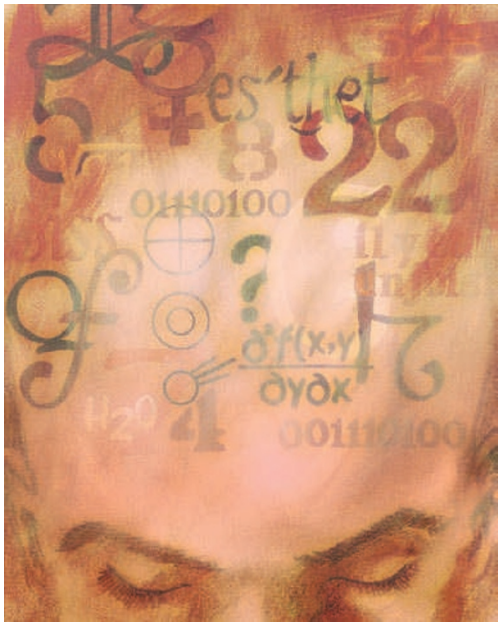
SLEEP

A sleep–wake divergence

According to the reconsolidation theory, reactivation of a memory renders it unstable — and thereby vulnerable to external influences — after which it can be reconsolidated in order to persist. Memory reactivation can also occur during slow-wave sleep (SWS) and probably underlies the consolidating effect of sleep, but whether this also involves transient destabilization of a memory has remained unknown. Diekelmann *et al.* now show that memory reactivation has opposing effects on memory stability during wakefulness and sleep.



Participants learned a visuospatial object-location task involving card pairs in the presence of an odour. After learning, subjects were re-exposed to the odour — to reactivate memory of the learned material — or exposed to an odourless vehicle, either while awake or during SWS. Shortly afterwards, subjects in the sleep group were awakened, and memory stability was probed in both groups using an interference learning task involving the same card pairs as the original task but with the second card associated with a different location. Afterwards, subjects were asked to recall the card locations from the initial task.

Subjects from the awake group who had been exposed to the odour performed less well when asked to recall the card locations in the initial task than those who were exposed to vehicle, showing that odour-induced reactivation during wakefulness had made the memory of the original task vulnerable to the interference learning task. By contrast, subjects in the sleep group exposed to the odour performed better than those exposed to vehicle, demonstrating that reactivation during sleep had stabilized the memory.

Functional MRI revealed that odour presentation following learning elicited activity in prefrontal cortical areas in awake subjects, whereas hippocampal and posterior cortical regions were activated by odour presentation during SWS. The opposite effects of memory reactivation during SWS and wakefulness could have adaptive functions, enabling the brain to update existing memories according to experience during wakefulness and supporting the 'consolidation mode' of the brain during sleep.

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ORIGINAL RESEARCH PAPER Diekelmann, S. *et al.* Labile or stable: opposing consequences for memory when reactivated during waking and sleep. *Nature Neurosci.* 23 Jan 2011 (doi:10.1038/nn.2744)

FURTHER READING Diekelmann, S. & Born, J. The memory function of sleep. *Nature Rev. Neurosci.* **11**, 114–126 (2010)

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