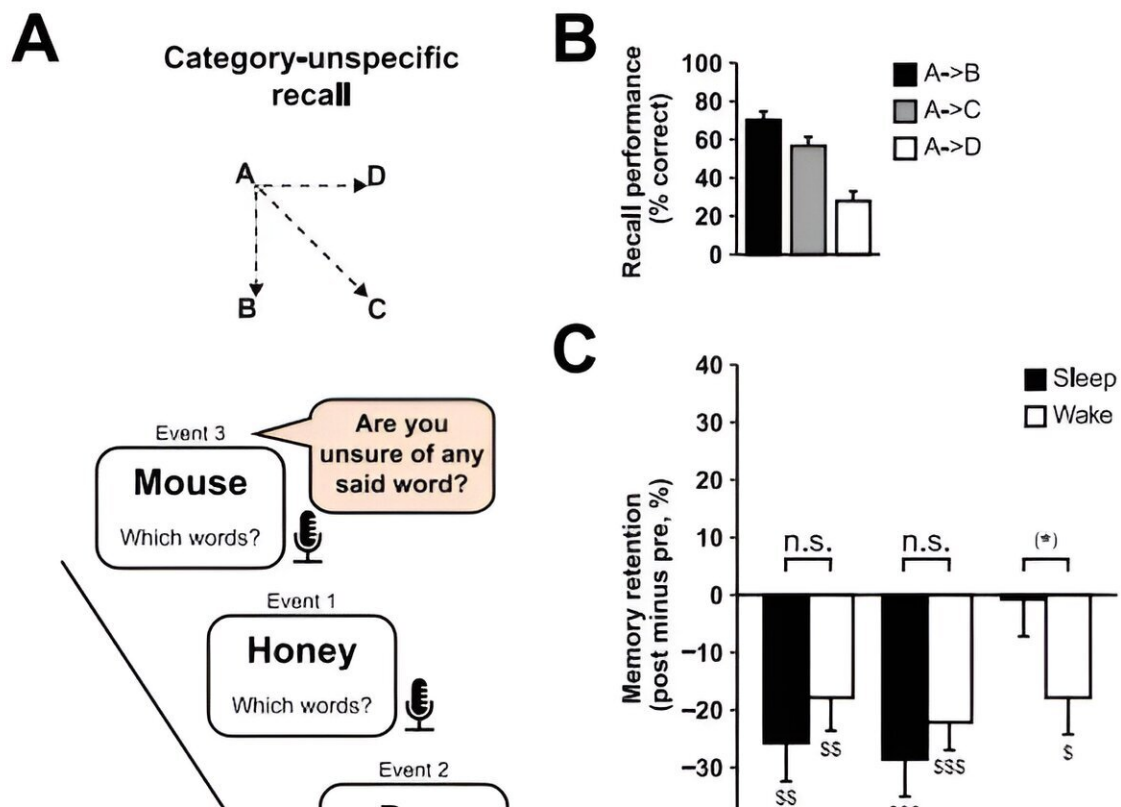


Sleep improves ability to recall complex events, shows study

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Task and results of the category-unspecific recall. Credit: *Proceedings of the National Academy of Sciences* (2024). DOI: 10.1073/pnas.2314423121

Researchers have known for some time that sleep consolidates our memories of facts and episodic events. However, the research to date has

concentrated mainly on simple associations—that is to say, connections between elements, such as we make when learning new vocabulary.

"But in real life, events are generally made up of numerous components—for example, a place, people, and objects—which are linked together in the brain," explains Dr. Nicolas Lutz from LMU's Institute of Medical Psychology.

These associations can vary in strength and some elements might be connected with each other only indirectly. "Thanks to the [neural connections](#) that underlie these associations, a single cue word is often all it takes for somebody to recall not only individual aspects of an event but multiple aspects at once," says Lutz.

This process, which is known as pattern completion, is a fundamental feature of episodic [memory](#). Lutz is lead author of a [study](#) recently published in the *Proceedings of the National Academy of Sciences*, which investigated the effect of sleep on memory of such complex events.

After the study participants had learned events with complex associations, in one condition they spent the night in a sleep laboratory, where they were allowed to sleep as usual, while in another condition, they had to stay up all night. In both conditions, the participants were allowed to spend the following night at home to recover. Then they were tested on how well they could recall different associations between elements of the learned events.

"We were able to demonstrate that sleep specifically consolidates weak associations and strengthens new associations between elements that were not directly connected with each other during learning. Moreover, the ability to remember multiple elements of an event together, after having been presented with just a single cue, was improved after sleep compared to the condition in which the participants had stayed awake,"

summarizes Nicolas Lutz. This demonstrates the importance of sleep for completing partial information and processing complex events in the brain.

By monitoring the brain activity of the study participants during sleep, the authors of the study were also able to show that the improvement in memory performance is connected with so-called sleep spindles—bursts of neural oscillatory activity during sleep, which are associated with the active consolidation of memory contents. This occurs through reactivation of the underlying neural structures while sleeping.

"This finding suggests that sleep spindles play an important role in the consolidation of complex associations, which underlie the completion of memories of whole events," says Professor Luciana Besedovsky, lead researcher of the study.

According to Lutz and Besedovsky, the identified effects of sleep on memory can be seen as an important adaptation of the human brain, because they help people draw a more coherent picture of their environment, which in turn enables them to make more comprehensive predictions of future events.

"And so our results reveal a new function by which sleep can offer an [evolutionary advantage](#)," states Besedovsky. "Furthermore, they open up new perspectives on how we store and access information about complex multielement events."

More information: Nicolas D. Lutz et al, Sleep shapes the associative structure underlying pattern completion in multielement event memory, *Proceedings of the National Academy of Sciences* (2024). [DOI: 10.1073/pnas.2314423121](https://doi.org/10.1073/pnas.2314423121)

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