Cueing newly learned information in sleep improves memory, and here's how

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Scientists have long known that sleep plays an important role in the formation and retention of new memories. That process of memory consolidation is associated with sudden bursts of oscillatory brain activity, called sleep spindles, which can be visualized and measured on an electroencephalogram (EEG). Now researchers reporting in *Current Biology* on March 8 have found that sleep spindles also play a role in strengthening new memories when newly learned information is played back to a person as they sleep.

The findings provide new insight into the process of memory consolidation during sleep. They may also suggest new ways to help people remember things better, according to the researchers.

"While it has been shown previously that targeted memory reactivation can boost memory consolidation during sleep, we now show that sleep spindles might represent the key underlying mechanism," says Bernhard Staresina of the University of Birmingham in the United Kingdom. "Thus, direct induction of sleep spindles—for example, via transcranial electrical stimulation—perhaps combined with targeted memory reactivation, may enable us to further improve memory performance while we sleep."

Sleep spindles are half-second to two-second bursts of brain activity, measured in the 10-16 Hertz range on an EEG. They occur during non-rapid eye movement sleep stages two and three. Earlier studies had shown that the number of spindles during the night could predict a person's memory the next day. Studies in animals also linked sleep spindles to the process by which the brain makes new connections. But many questions about the link between sleep spindles and reactivated memories during sleep remained.

Staresina along with Scott Cairney at the University of York, UK, suspected that experimental reactivation of memories might lead to a surge of sleep spindles in a sleeping person's brain. To find out, they devised an experiment in which people learned to associate particular adjectives with particular objects and scenes. Some study participants then took a 90-minute nap after their study session, whereas others stayed awake. While people napped, the researchers cued those associative memories and unfamiliar adjectives.

As expected, the researchers saw that memory cues led to an increase in sleep spindles. Interestingly, the EEG patterns during spindles enabled the researchers to discern what types of memories—objects or scenes—were being processed.

The findings add to evidence for an important information-processing role of sleep spindles in the service of memory consolidation, the researchers say.

"Our data suggest that spindles facilitate processing of relevant memory features during sleep and that this process boosts memory

consolidation," Staresina says.

This new understanding of the way the brain normally processes and strengthens memories during sleep may help to explain how that process may go wrong in people with learning difficulties, according to the researchers. It might also lead to the development of effective interventions designed to boost memory for important information.

More information: Scott A. Cairney et al, Memory Consolidation Is Linked to Spindle-Mediated Information Processing during Sleep, *Current Biology* (2018). DOI: 10.1016/j.cub.2018.01.087

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