

# Collecting your thoughts: You can do it in your sleep!

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(PhysOrg.com) -- It is one thing to learn a new piece of information, such as a new phone number or a new word, but quite another to get your brain to file it away so it is available when you need it.

A new study published in the [Journal of Neuroscience](#) by researchers at the University of York and Harvard Medical School suggests that [sleep](#) may help to do both.

The scientists found that sleep helps people to remember a newly learned word and incorporate new vocabulary into their "mental lexicon".

During the study, which was funded by the Economic and Social Research Council, researchers taught volunteers new words in the evening, followed by an immediate test. The volunteers slept overnight

in the laboratory while their [brain activity](#) was recorded using an electroencephalogram, or EEG. A test the following morning revealed that they could remember more words than they did immediately after learning them, and they could recognise them faster demonstrating that sleep had strengthened the new memories.

This did not occur in a control group of volunteers who were trained in the morning and re-tested in the evening, with no sleep in between. An examination of the sleep volunteers' brainwaves showed that deep sleep (slow-wave sleep) rather than rapid eye movement (REM) sleep or light sleep helped in strengthening the new memories.

When the researchers examined whether the new words had been integrated with existing knowledge in the mental lexicon, they discovered the involvement of a different type of activity in the sleeping brain. Sleep spindles are brief but intense bursts of brain activity that reflect information transfer between different memory stores in the brain -- the [hippocampus](#) deep in the brain and the neocortex, the surface of the brain.

Memories in the hippocampus are stored separately from other memories, while memories in the neocortex are connected to other knowledge. Volunteers who experienced more sleep spindles overnight were more successful in connecting the new words to the rest of the words in their mental lexicon, suggesting that the new words were communicated from the hippocampus to the [neocortex](#) during sleep.

Co-author of the paper, Professor Gareth Gaskell, of the University of York's Department of Psychology, said: "We suspected from previous work that sleep had a role to play in the reorganisation of new memories, but this is the first time we've really been able to observe it in action, and understand the importance of spindle activity in the process."

These results highlight the importance of sleep and the underlying brain processes for expanding vocabulary. But the same principles are likely to apply to other types of learning.

Lead author, Dr Jakke Tamminen, said: "New memories are only really useful if you can connect them to information you already know. Imagine a game of chess, and being told that the rule governing the movement of a specific piece has just changed. That new information is only useful to you once you can modify your game strategy, the knowledge of how the other pieces move, and how to respond to your opponent's moves. Our study identifies the brain activity during sleep that organizes new memories and makes those vital connections with existing knowledge."

**More information:** The paper 'Sleep spindle activity is associated with the integration of new memories and existing knowledge' is published in the *Journal of Neuroscience* at link [www.jneurosci.org/cgi/content/abstract/30/43/14356](http://www.jneurosci.org/cgi/content/abstract/30/43/14356)

Provided by University of York

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