

You can classify words in your sleep

September 11 2014



When people practice simple word classification tasks before nodding off—knowing that a "cat" is an animal or that "flipu" isn't found in the dictionary, for example—their brains will unconsciously continue to make those classifications even in sleep. The findings, reported in the Cell Press journal *Current Biology* on September 11, show that some parts of the brain behave similarly whether we are asleep or awake and pave the way for further studies on the processing capacity of our sleeping brains, the researchers say.

"We show that the sleeping [brain](#) can be far more 'active' in sleep than one would think," says Sid Kouider of Ecole Normale Supérieure in Paris. "Far from falling [into] a limbo when we fall asleep, parts of our brain can routinely process what is going on in our surroundings and

apply a relevant scheme of response. This explains some everyday life experiences such as our sensitivity to our name in our sleep, or to the specific sound of our alarm clock, compared to equally loud but less relevant sounds."

The study also extends earlier work on subliminal processing by showing that speech processing and other complex tasks "can be done not only without being aware of what you perceive, but [also] without being aware at all." Kouider suspects that such unconscious processing isn't limited by the complexity of the task, but by whether it can be made automatic or not.

In collaboration with the University of Cambridge, the researchers recorded the EEG of human participants while they were awake and instructed to classify spoken words as either animals or objects by pressing a button, using the right hand for animals and the left hand for objects. The procedure allowed Kouider and his colleagues to compute lateralized response preparations—a neural marker of response selection and preparation—by mapping each word category to a specific plan for movement in the brain. Once that process had become automatic, the researchers placed participants in a darkened room to recline comfortably with eyes closed and continue the word classification task as they drifted off to sleep.

Once the participants were asleep, the testing continued but with an entirely new list of words to ensure that responses would require the extraction of word meaning rather than a simpler pairing between stimulus and response. The researchers' observations of brain activity showed that the participants continued to respond accurately, although more slowly, even as they lay completely motionless and unaware.

Kouider says one could imagine people performing calculations on simple equations while falling asleep and then continuing to identify

those calculations as correct or not during a snooze. In Kouider's view, any task that could become automated might be maintained during sleep. On the other hand, he and his colleagues predict that tasks that can't be automated will stop as sleep takes over.

Kouider and his PhD student and co-author Thomas Andrillon are now investigating the consequences of their findings for learning as we slumber. But even if it is possible, it will be worth thinking carefully about why animals, from fruit flies to humans, all show sleep or [sleep](#)-like states in the first place.

"Research focusing on how to take advantage of our sleeping time must consider what is the associated cost, if any, and whether it is worth it," Kouider says.

More information: *Current Biology*, Kouider et al.: "Inducing task-relevant responses to speech in the sleeping brain."

[www.cell.com/current-biology/a ... 0960-9822\(14\)00994-4](http://www.cell.com/current-biology/a...0960-9822(14)00994-4)

Provided by Cell Press

Citation: You can classify words in your sleep (2014, September 11) retrieved 25 April 2024 from <https://medicalxpress.com/news/2014-09-words.html>

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