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Learning while sleeping? Our learning capabilities are limited

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Led by Philippe Peigneux, a group of researchers found that learning capabilities are limited during slow wave sleep. Using magnetoencephalography (MEG), they showed that while the brain is still able to perceive sounds during sleep, it is unable to group these sounds according to their organisation in a sequence.

Hypnopedia, or the ability to learn during sleep, was popularized in the 1960s via the dystopian *Brave New World* by Aldous Huxley, in which individuals are conditioned to their future tasks during sleep. This concept has been progressively abandoned due to a lack of reliable scientific evidence supporting in-sleep learning abilities.

Recently, however, a few studies have shown that the acquisition of elementary associations such as stimulus-reflex response is possible during sleep, both in humans and in animals. Nevertheless, it is not clear if sleep allows for more sophisticated forms of learning.

A study published this August 6 in the journal *Scientific Reports* by researchers from the ULB Neuroscience Institute (UNI) shows that while the brain is able to continue perceiving sounds during sleep, the ability to group these sounds according to their organization in a sequence is only active during wakefulness, and completely disappears during sleep.

Juliane Farthouat, while a research fellow of the FNRS under the direction of Philippe Peigneux, professor at the Faculty of Psychological Science and Education at Université libre de Bruxelles, ULB, used magnetoencephalography (MEG) to record the cerebral activity mirroring the statistical learning of series of sounds, both during slow wave sleep (a part of sleep during which brain activity is highly synchronized) and during wakefulness.

During sleep, participants were exposed to fast flows of pure sounds, either randomly organized or structured in such a way that the auditory stream could be statistically grouped into sets of three elements. During sleep, brain MEG responses demonstrated preserved detection of isolated sounds, but no response reflecting statistical clustering. During wakefulness, however, all participants presented brain MEG responses reflecting the grouping of sounds into sets of three elements.

The results of this study suggest intrinsic limitations in de novo learning during slow wave sleep that might confine the sleeping brain's learning capabilities to simple, elementary associations.

More information: Juliane Farthouat et al, Lack of frequency-tagged magnetic responses suggests statistical regularities remain undetected during NREM sleep, *Scientific Reports* (2018). DOI: 10.1038/s41598-018-30105-5

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