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Neural states affect learning

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Theta-band activity in hippocampus after an event seems to be crucial for learning. A study at the University of Jyväskylä also proved that the absence of theta facilitated learning a simple task while training during theta had no effect on learning.

Hippocampus is a brain structure that has a critical role in mammalian learning. The identification of different hippocampal states is based on the oscillatory properties of electrophysiological activity. Traditionally, rhythmic slow activity, theta, has been linked to attention, whereas transient bursts of synchronised neuronal firing, ripples, have been connected to the consolidation of recent experiences.

Post-doctoral fellow Miriam Nokia and senior researcher Jan Wikgren from the Department of Psychology, University of Jyväskylä, studied the effect of presenting learning task stimuli during theta activity and without it. Training in the absence of theta facilitated learning a simple hippocampus-dependent task, whereas training in the presence of theta had no effect on learning at all. This is seemingly paradoxical, as theta is usually linked with attention and associated to better learning. However, the results also indicated that learning was faster when the hippocampal theta-band responses to the learning stimuli were uniform. Thus, theta-band activity immediately after an event seems to be crucial for learning.

In addition, Nokia and Wikgren tested the idea that an internal neural state could affect memory retrieval in the same way as the external environment. In a classic experiment, a previously learned item was better remembered when memory was tested in the training

environment. Nokia and Wikgren found that, in addition to an external environment, a given neural state also can act as a context for learning.

Ultimately, the results of the current study could be utilised, for instance, in the development of brain-computer interfaces designed to optimise learning.

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