

Detection of arithmetic violations during sleep

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Abstract

Can the sleeping brain develop predictions of future auditory stimuli? Past research demonstrated disrupted prediction capabilities during sleep in the context of novel, arbitrary auditory sequences, but the availability of overlearned knowledge already stored in long-term memory could still be preserved. We tested the sleeping brain capabilities to detect violations of simple arithmetic facts. Sleeping participants were presented with spoken arithmetic facts such as “two plus two is nine” and brain responses to correct or incorrect results were recorded in electro and magneto-encephalography. Sleep responses were compared to both attentive and inattentive wakefulness. During attentive wakefulness, arithmetic violations elicited a succession of N400 and P600 effects, whereas no such activations could be recorded in sleep or in inattentive wakefulness. Still, small but significant effects remained in sleep, advocating for a preserved but partial accessibility to arithmetic facts stored in long-term memory and preserved predictions of low-level and already learned knowledge. Those effects were very different from residual activities seen in inattention, highlighting the differences of information processing between the sleeping and the inattentive brain.

[arithmetic](#), [N400](#), [P600](#), [sleep](#), [EEG](#), [MEG](#), [consciousness](#), [predictive coding](#)

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