

Can EEG neurofeedback of theta during consolidation enhance episodic memory?

ABSTRACT:

Background

Electroencephalography neurofeedback (EEG-NF) is a self-regulatory technique where an individual is given feedback about certain patterns of brain activity which are proposed to be linked to a target behaviour. It is unclear from previous studies whether this technique can enhance episodic memory, our ability to remember details from our personal past.

Aims

i) To complete a meta-analysis to determine whether this technique can enhance episodic memory, and ii) To conduct an empirical study to examine if EEG- NF, of the theta oscillatory band (4-8 Hz), could enhance memory performance.

Method

A search of the literature was conducted focusing on papers which had an active control group and who randomised participants to groups for inclusion in the meta-analysis. For the empirical study healthy young adults were given an encoding task and were then randomised to either the experimental theta group or an active control low-beta group to complete 30 minutes of EEG-NF. At retrieval, participants completed a memory test which allowed us to derive several measures of memory performance.

Results & Conclusions

Twenty studies were included in the meta-analysis, which revealed a small but significant positive effect of EEG-NF on episodic memory performance relative to an active control group ($g = 0.31$). In contrast, in the empirical study there were no significant differences between the theta experimental group and the low-beta control on any of the memory measures. This is likely because a substantial number of participants were unable to upregulate their target brain activity. This might have been due to the increased safety measures, due to COVID-19, which enhanced participants' anxiety levels and negatively affected their ability to regulate brain activity.

Keywords

Episodic memory, Neurofeedback, EEG, Meta-analysis

Published Work:

Jackson, L. E., Han, Y. J., & Evans, L. H. (2023). The efficacy of electroencephalography neurofeedback for enhancing episodic memory in healthy and clinical participants: A systematic qualitative review and meta-analysis. *Neuroscience and Biobehavioral Reviews*, 155, 105455. doi: 10.1016/j.neubiorev.2023.105455

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