modular communication (participation coefficient) of the default mode network was associated with decreased verbal and working memory scores. The pattern of results obtained from our study helps to explain the complex contribution of the brain's functional architecture to cognitive abilities. While high efficiency in specific networks is necessary to achieve good cognitive scores, the cross-network interference gated by default mode (paralimbic) regions may intrude on the ongoing behavior, causing lower performance.

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Topic: AS13 Emotion, Memory and Cognition

DO VARIATIONS IN EMOTIONAL STATE MODULATE THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) ON MEMORY IN HEALTHY HUMAN PARTICIPANTS?

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Implementation of non-invasive brain stimulation (NIBS) methods in research has been extremely successful in expanding the knowledge of neural mechanisms behind distinct cognitive processes. A form of NIBS, Transcranial Direct Current Stimulation (tDCS), has increasingly been used over the past decade as a potential tool for the modulation of cognitive functions. Although tDCS has been shown to have neurophysiological and behavioural impacts on a variety of cognitive functions, the results are frequently inconsistent. Among many potential factors that could contribute to the variability of the findings, the participants' emotional state is one that seems to be frequently overlooked. In the present study, we aimed to determine whether participants' emotional states influenced tDCS effects on associative (AM) and working memory (WM) performance. We analysed the results from six within-subject, sham-controlled tDCS experiments involving a total of 144 young, healthy volunteers. In each experiment, parallel forms of either AM or WM tasks were used to assess the effects of real vs. sham tDCS. The emotional state was assessed before each tDCS session using the Depression Anxiety Stress Scales (DASS) questionnaire. The results did not show a systematic effect of variations in the emotional state across sessions on the tDCS effects. Namely, neither variations in depression, anxiety, nor stress acted as a systemic modulator of tDCS effects on memory outcomes across different experiments. Nevertheless, in some of the experiments, either depressiveness or stress was found to modulate the tDCS effects. This would suggest that variability in the emotional state should be taken into account when assessing tDCS effects, especially at the individual level.

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PLACE CELLS MAP THE NEURAL SIGNATURES OF EXTINCTION LEARNING

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During extinction learning (EL) an individual learns that a previously learned association is no longer behaviourally salient. The hippocampus is involved in both EL and renewal of spatial appetitive experience. However, to what extent hippocampal place cells respond to EL events remains unclear. Here, we recorded from CA1 place cells of the dorsal hippocampus while rats performed a spatial appetitive task in a T-maze and evaluated place cell activity along task acquisition in rewarded context A, EL in unrewarded context B, and renewal in unrewarded in context A. EL occurred successfully in all animals, but only half showed renewal. This latter facet was subjected to further scrutiny. During the first acquisition day, we observed a higher number of fields located nearby the rewarded arm for the 'renewer' group, suggesting that this cohort underwent faster acquisition of the reward location. When animals engaged in EL, place cells in renewers showed a higher rate of remapping. This difference was absent when the late acquisition was compared with renewal, suggesting that place cells differentiated between context A and context B. Place cells in the 'non-renewer' group maintained similar firing rates and positive, stable spatial correlations between learning conditions, suggesting that non-renewers did not remap between contexts. Our results suggest that higher remapping of place cell firing rates corresponds to better discrimination and stabilization of context-dependent EL that in turn supports the effective renewal of the extinguished behavior. Thus, these findings support the idea that de novo learning is an important aspect of effective extinction learning.

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