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HOW COGNITIVE CONTROL IS REPRESENTED IN THE BRAIN: AN EEG REPRESENTATIONAL SIMILARITY ANALYSIS STUDY

POSTER SESSION 03 - SECTION: FUNCTIONAL CONNECTIVITY AND COGNITION

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Aims: Cognitive control is a fundamental human ability that allows pursuing specific relevant goals. Several theories postulate that cognitive control relies on neural representations. However, univariate approaches that have been classically used to investigate it are not suitable for studying such representations. Therefore, the aim of our EEG study was to explore how cognitive control representations are encoded at the neural level and to investigate the contribute of different theory-based representations. Methods: To this aim, we used Representational Similarity Analysis (RSA) to model theory-based representations and correlate them to the observed brain patterns.
We designed a spatial Stroop task, in which both list-wide and item-specific proportion of congruency were manipulated, respectively, to measure the effects of proactive and reactive control on Stroop interference resolution. We assessed the similarity between control-related representational models and temporal and spatial multivariate patterns of EEG activity, while controlling for low-level confounding effects. Results: RSA revealed specific spatiotemporal EEG correlates not only of low-level sensorial, motor, and cognitive representations, but also of both proactive and reactive control representations. Specifically, significant similarities were found between proactive control representational models and pre-stimulus multivariate patterns of EEG activity, as well as between reactive control representational models and post-stimulus multivariate patterns of EEG activity, in line with theoretical accounts of Stroop interference resolution. Conclusions: Our results suggest that RSA better informs cognitive control theory by revealing the dynamics of its neural representations. Indeed, temporal and spatial RSA patterns provided insights into cognitive control theory-based representations but also into low-level representations.

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It is not always positive: emotional bias in young and older adults.
Healthy ageing has been associated with a bias toward positive information and greater psychological well-being. However, to what extent this positivity bias also applies to prioritizing positive information under emotional competition is unclear. Old and young adults performed a word-face interference task, in which they responded to the valence of positive and negative target-words while ignoring happy or angry distractor-faces that could be affectively congruent or incongruent. A control condition with scrambled neutral distractor-faces was also used. Findings showed small facilitation effects with faster responses when targets and distractors were affectively congruent and large interference effects with slower responses when targets and distractors were affectively incongruent compared to the control condition. Importantly, whereas for younger adults there was a similar pattern of interference from happy and angry distractor-faces, for older adults there was greater interference from angry distractor-faces. The present findings are discussed in the context of emotional bias literature. Psychol Res, 2021;
34117795: Viviani G, Vallesi A
EEG-neurofeedback and executive function enhancement in healthy adults: A systematic review.
Electroencephalographic (EEG)-neurofeedback training (NFT) is a promising technique that supports individuals in learning to modulate their brain activity to obtain cognitive and behavioral improvements. EEG-NFT is gaining increasing attention for its potential "peak performance" applications on healthy individuals. However, evidence for clear cognitive performance enhancements with healthy adults is still lacking. In particular, whether EEG-NFT represents an effective technique for enhancing healthy adults' executive functions is still controversial. Therefore, the main objective of this systematic review is to assess whether the existing EEG-NFT studies targeting executive functions have provided reliable evidence for NFT effectiveness. To this end, we conducted a qualitative analysis of the literature since the limited number of retrieved studies did not allow us meta-analytical comparisons. Moreover, a second aim was to identify optimal frequencies as NFT targets for

specifically improving executive functions. Overall, our systematic review provides promising evidence for NFT effectiveness in boosting healthy adults' executive functions. However, more rigorous NFT studies are required in order to overcome the methodological weaknesses that we encountered in our qualitative analysis.
Psychophysiology, 2021; 58