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## EFFECTS OF TRANSCRANIAL ELECTRICAL STIMULATION ON VISUO-SPATIAL LEARNING FORMATION: BEHAVIORAL AND ELECTROPHYSIOLOGICAL COMPONENTS

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**Background:** Acquired visuo-spatial relationships between objects in a visual scene can produce more accurate and faster responses in the identification of a target. This process is thought to be mediated by the activity of frontal and parietal cortical regions through a memory-mediated guidance of visuo-spatial attention.

**Aims:** In the present project we used transcranial electrical stimulation (tES) to investigate whether visuo-spatial contextual learning (VSCL) could be reliably modulated by an external stimulation and what are the neural mechanisms subtending its formation.

**Method:** In the first part of the project, we tested the effects produced by different tES protocols on behavioral measures of VSCL. In the second part, we used electroencephalogram (EEG) to investigate the neural markers subtending tES-mediated modification of VSCL measures.

**Results:** In our first work, we showed that anodal transcranial direct current stimulation (AtDCS) applied over the posterior parietal cortex (PPC) produced a significant decrease in VSCL <sup>[1]</sup> and this result was also confirmed by behavioral data obtained in our second work <sup>[2]</sup>. EEG measures revealed a significant increase in the early N1 component in response to repeated contexts presentation in both the Real- and the Sham-tDCS group, together with an increase of the P2 component in the group receiving Real-tDCS.

**Conclusions:** The AtDCS-induced reduction of VSCL could have been produced by homeostatic regulatory mechanisms put in place by the system to control from an excessive increase of PPC activity. Interestingly, EEG measures revealed that VSCL reduction was not associated with changes in early attentional mechanisms but could rather reflect cortical modulation within a later processing stage. The reported tDCS-induced increase in the amplitude of P2 component could represent the electrophysiological marker of a stimulation dependent reduction of perceived saliency associated with the presentation of the visual search arrays, a phenomenon that could have hindered the acquisition of visuo-spatial regularities associated with contexts repetition.

**Keywords:** Cognitive plasticity, Visuo-spatial learning, Transcranial electrical stimulation

### Publications:

Grasso P. A., Tonolli E. & Miniussi C. (2020). Effects of different transcranial direct current stimulation protocols on visuo-spatial contextual learning formation: evidence of homeostatic regulatory mechanisms. *Scientific Reports*, 10(1), 1-14

Grasso P. A., Tonolli E., Bortoletto M. & Miniussi C. (2021) tDCS over posterior parietal cortex increases cortical excitability but decreases learning: an ERP and TMS-EEG study. *Brain Research*, 1753, 147227

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