Increasing propensity to mind-wander by transcranial direct current stimulation? A registered report

Transcranial direct current stimulation (tDCS) has been proposed to be able to modulate different cognitive functions. However, recent meta-analyses conclude that its efficacy is still in question. Recently, an increase in subjects' propensity to mind-wander has been reported as a consequence of anodal stimulation of the left dorsolateral prefrontal cortex (Axelrod et al., Proceedings of the National Academy of Sciences of the United States of America, 112, 2015). In addition, an independent group found a decrease in mind wandering after cathodal stimulation of the same region. These findings seem to indicate that high-level cognitive processes such as mind wandering can reliably be influenced by non-invasive brain stimulation. However, these previous studies used low sample sizes and are as such subject to concerns regarding the replicability of their findings. In this registered report, we implement a high-powered replication of Axelrod et al. (2015) finding that mind-wandering propensity can be increased by anodal tDCS. We used Bayesian statistics and a preregistered sequential-sampling design resulting in a total sample size of N = 192 participants collected across three different laboratories. Our findings show support against a stimulation effect on self-reported mind-wandering scores. The effect was small, in the opposite direction as predicted and not reliably different from zero. Using a Bayes Factor specifically designed to test for replication success, we found strong evidence against a successful replication of the original study. Finally, even when combining data from both the original and replication studies, we could not find evidence for an effect of anodal stimulation. Our results underline the importance of designing studies with sufficient power to detect evidence for or against behavioural effects of non-invasive brain stimulation techniques, preferentially using robust Bayesian statistics in preregistered reports.

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