Electrical stimulation of the dorsolateral prefrontal cortex improves memory monitoring

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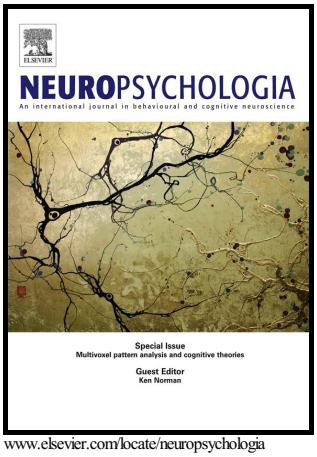

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Electrical stimulation of the dorsolateral prefrontal cortex improves memory monitoring

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Abstract

The ability to accurately monitor one's own memory is an important feature of normal memory function. Converging evidence from neuroimaging and lesion studies have implicated the dorsolateral prefrontal cortex (DLPFC) in memory monitoring. Here we used high definition transcranial direct stimulation (HD-tDCS), a non-invasive form of brain stimulation, to test whether the DLPFC has a causal role in memory monitoring, and the nature of that role. We used a metamemory monitoring task, in which participants first attempted to recall the answer to a general knowledge question, then gave a feeling-of-knowing (FOK) judgment, followed by a forced choice recognition task. When participants received DLPFC stimulation, their feeling-of-knowing judgments were better predictors of memory performance, i.e., they had better memory monitoring accuracy, compared to stimulation of a control site, the anterior temporal lobe (ATL). Effects of DLPFC stimulation were specific to monitoring accuracy, as there was no significant increase in memory performance, and if anything, there was poorer memory performance with DLPFC stimulation. Thus we have demonstrated a causal role for the DLPFC in memory monitoring, and showed that electrically stimulating the left DLPFC led people to more accurately monitor and judge their own memory.

Keywords: tDCS; HD-tDCS; prefrontal; memory; metamemory; feeling-of-knowing

1. Introduction

The ability to accurately monitor one's own memory, is one component of what is referred to as metamemory, and is an important feature of normal memory function (Nelson & Narens, 1990). For example, accurate memory monitoring can lead to better regulation of learning and memory, thereby improving overall performance (Thiede, Anderson, & Therriault, 2003). Furthermore, certain clinical populations have shown impairments in memory monitoring, independent of memory impairments (Stepanie Cosentino, Metcalfe, Butterfield, & Stern, 2007).