of neurological disorders and induces lasting changes in cognitive function. The long-term effects of tDCS imply that it has some influence on plasticity in the neural networks that underlie the studied cognitive function. However, it is not well understood exactly how tDCS exerts this influence and leads to long-term changes. tDCS is generally applied during cognitive tasks, which are likely associated with some ongoing endogenous synaptic plasticity. While a few in vitro brain slice studies have looked at direct current stimulation (DCS) and synaptic plasticity, none have examined the effect of DCS when applied during activity that produces plasticity on its own (e.g. during high frequency tetanus). Thus, the ability of applied DCS to modulate ongoing synaptic plasticity induction paradigms is likely a very relevant topic for understanding the long-term effects of tDCS. To address this issue, we studied the frequency response function of synaptic plasticity in the Schaffer collateral pathway of rat hippocampal slices. DCS was applied to the hippocampal slices during plasticity inducing tetanus protocols of varying frequency (0.5, 1, 5, 20 Hz). This led to a significant modification of the frequency response function, shifting it towards long-term potentiation (LTP). Given the role of LTP in the storage of memories and behaviors, these results shed light on how tDCS interacts with ongoing synaptic plasticity to produce long-term effects on cognitive function.

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DIRECT EXPERIMENTAL VALIDATION OF COMPUTATIONAL CURRENT FLOW MODELS WITH INTRA-CRANIAL RECORDINGS IN HUMAN AND NON-HUMAN PRIMATES

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Computational models of Transcranial Electric Stimulation (TES) have been used extensively to predict the precise intensity and distribution of electric fields across the brain. The goal of such modeling is to guide the targeting of particular brain areas for clinical trials and research studies. While computational models have increased in sophistication and detail, to date there has been limited empirical evaluation of their precision. Previous efforts have been limited to comparing model predictions with voltage recordings on the scalp surface. To address the uncertainty of model accuracy inside the head, we recorded intra-cranial electric fields generated by TES in patients undergoing invasive monitoring for epilepsy surgery. High-resolution finite element models were constructed from patient's MRIs at 1 mm^3 resolution, and voltage distribution inside the head were simulated for 1 mA currents. Preliminary analysis shows a general correspondence of model predictions and trans-cranial recordings (in over 150 cortical and subcortical electrodes for each of two patients). To determine specific conductivity values *in-vivo* for different tissues we are in the process of recording from depth electrodes also in rhesus macaque monkey leveraging ongoing neurophysiology experiments with TES. We have already segmented the macaque head anatomy for one subject at 1 mm^3 resolution and completed current flow modeling. These combined human and non-human primate recordings should provide strong constraints for future modeling efforts and will establish a firm empirical foundation for future clinical studies with TES that aim to target specific cortical and sub-cortical brain regions.

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TRANSCRANIAL DIRECT CURRENT STIMULATION AND ATTENTIONAL PROCESSING IN HEALTHY INDIVIDUALS

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Previous research has posited that transcranial direct current stimulation (tDCS), applied to healthy and disordered populations, may have non-specific effects on attentional processing. Additionally, evidence from electrical current density models suggests that one of the most common montage configurations in language research (active electrode: F5 over Broca's area; reference electrode: contralateral supraorbital region) results in relatively higher electrical current density in the bilateral prefrontal cortex compared to the region surrounding Broca's area. The literature robustly indicates that the prefrontal cortex is involved in cognitive functioning. To date, however, no study has systematically examined the influence of tDCS on different types of attention. The purpose of the present crossover, double-blind, sham-controlled study is to examine the effect, if any, of tDCS on selective, sustained, and divided attention in healthy adults. The results of this research could inform our understanding of the cognitive mechanisms underlying gains made in language research involving tDCS, and also if stimulation has an influence on one type of attention more so than another.

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CONSIDERATIONS FOR RESEARCH TREATMENT OF APHASIA COMBINING NEUROMODULATION AND SPEECH-LANGUAGE INTERVENTION

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Aphasia, commonly defined as impairment or loss of language functions, is a frequent and often chronic consequence of left-hemispheric stroke. The effects of aphasia on patient independence and quality of life are often lifelong. Although beneficial in some cases, the effectiveness of behavioral speech-language therapy is often limited. Therefore, in these last decades, new treatment designs combining speech-language therapy and noninvasive brain stimulation techniques such as transcranial direct current stimulation (tDCS) have been developed with the goal of maximizing the recovery process. While the first report of using tDCS for aphasia was described in 2008 (Monti et al.), several studies since then have implemented a speech-language therapy protocol in conjunction with tDCS. Yet, specific guidelines for adopting this approach are not universal. Research highligting the optimal time to administer tDCS as well as