Imaging transcranial Direct Current Stimulation (tDCS) of the Prefrontal Cortex – Correlation or Causality in Stimulation Mediated Effects?

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The prefrontal cortex (PFC) as target for tDCS in psychiatric disorders

Aim: Overview on tDCS studies of the PFC that used neuroimaging and neurophysiological techniques

PFC associated with higher-order cognitive processes, such as memory and attention

→ The PFC is a potential target for a therapeutic application of tDCS in neurocognitive and psychiatric disorders.

Problem
Combination of tDCS and certain outcome measures is mostly of correlative nature.

→ Straightforward interpretations of tDCS effects may be difficult.

Increasing Specificity of Action & Explanatory power of tDCS studies

Specificity in time:
• Online: during stimulation
• Offline: pre and post stimulation
• Combined: pre, during and post stimulation

Specificity in Function:
• Behavioural
• Neurophysiological: spectral EEG, ERSP and ERP
• Neuroimaging: resting-state and task fMRI
• Combined: resting and task-related brain activity

Specificity in Space ← depend on the tDCS method:
• Active / sham
• Targets: electrode montage (bilateral, unilateral, extracephalic)
• Polarity (anodal/cathodal) / frequency

For each single outcome variable (i.e. behavioural or neurophysiological) specificity theoretically needs to be demonstrated.
In contrast, combining monitoring levels does not improve specificity as such, but may clearly increase the explanatory power of the experiment.