

Objectives:

- Induce behavioral changes upon working memory tasks (WMT) in a double-blind crossover trial using tDCS of the frontoparietal network
- **Explore both online and offline behavioral tDCS effects and neural underpinnings of** induced changes by resting-state fMRI (rs-fMRI).

Methods:

- study design and WM tasks.



• **tDCS** active: 2mA; 20min; **Anode**: rMFC (MNI = 44 40 -10), **Cathode**: rPPC (MNI = 30 -55 52) see fig. 4 ; frameless stereotactic neuro-navigation of electrodes (5x5 cm2)



Fig 4 tDCS montage with rMFG – anode, rPPC - cathode and an example of current flow model in one participant

Modulation of working memory and resting state fMRI by tDCS of the right fronto-parietal network

Pupikova M.^{1,2}, Simko P.^{1,2}, Gajdoš M.^{1,2}, Rektorova I.^{1,2}

¹Central European Institute of Technology – CEITEC, Masaryk University, Brno,, ²Faculty of Medicine, Masaryk university, Brno, Czech Republic

Press the YES button, if the two objects are the same. First two rows – conventional view, last two rows – unconventional view

- **Behavioral data analysis: :** Online WMT learning curves (β RT) and offline WMT changes (ΔRT) compared between active and sham conditions.
- fMRI data analysis: Functional connectivity changes (Δ FC) between the ROI seeds (rMFG-anode) and the default mode network (DMN), Fig 5

Results – behavioral data

- **ONLINE WMT**: No sig. difference in β RT (p=0.326).
- (Fig 6b).







PCC=posterior cingulate cortex, l/rIPL=left/right posterior inferior parietal lobule



OFFLINE WMT: A sig. difference in \triangle RT **for unconventional view of objects**

condition (p=0.049) \rightarrow shortening of RT after real vs. sham stimulation, Fig 6a.

Positive correlation of online and offline WMT for real tDCS, r=0.501, p=0.018

Fig 6a Behavioral results from offline WMT. Mean ± SE *p<0.05

Fig 7 Correlation of behavioral results in offline WMT with rMFC – DMN functional connectivity during active tDCS

Conclusion:

Targeting the right fronto-parietal network by tDCS leads to improved WMT with higher cognitive load in young healthy subjects.

Changes in cognitive outcomes are associated with changes in resting state functional connectivity between the task-positive (fronto-parietal) and the task-negative (DMN) networks.

Offline effects are related to online behavioral changes, although the latter result was not significant.

Contact person

Monika Pupikova, M.A. pupikovam@gmail.com e-mail +420 549 49 8313 phone

Fig 6b Correlation of behavioral results from online and offline WMT during active tDCS



Results – fMRI data:

No sig. changes of rMFG-DMN connectivity induced by tDCS

• Positive correlation between the rMFG-DMN FC with tDCS-induced changes in offline WMT (r=0.391; p=0.009, Fig 7): decreased RT correlates with decreased functional connectivity between rMFG-DMN



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