Maastricht University

Faculty of Psychology and Neuroscience

Project title: From virtual patients to real treatment

Project leader: Dr. Felix Duecker

Function: Assistant Professor

Collaborators: Prof. Dr. Alexander T Sack, Dr. Tom de Graaf

Proposal (250 words):

Introduction: A stroke in a local brain area can cause specific impairments. For instance, a right-hemisphere parietal stroke can cause hemi-neglect. Neglect patients are no longer able to attend to the left visual field, causing small practical problems, such as failing to notice food on the left side of their plates, or threatening situations, such as failing to detect a car approaching from the left. Brain stimulation can be used to treat such disorders, but much research is needed to test and develop this therapeutic technique. This research is difficult and slow, because there is currently no patient model, limiting research to actual stroke patients.
Hypothesis/Objectives: In this project, we create such a patient model using healthy volunteers. We use brain stimulation to induce a 'virtual lesion'. Creating 'virtual patients' in this way will allow us to test and compare different treatments with a wide range of brain stimulation treatments.
Setting/Methods: TMS will be used to disrupt right parietal cortex, creating a 'virtual neglect patient'. Then, in an innovative new approach, we will use electrical (transcranial alternating current; tACS) or magnetic (theta burst stimulation; TBS) brain stimulation protocols over different brain areas to try and 'cure' our newly created virtual patient.
Impact: It is by now clear that brain stimulation is promising and useful, and indeed already applied, to treat a range of neurological and neuro-psychiatric disorders, including but not limited to neglect syndrome. To create a patient model, and then use it to test treatments, would accelerate clinical research enormously.

Requirements candidate: Highly motivated student with good English communication skills and proactive and resolute attitude.

Keywords: stroke, brain stimulation, neuromodulation, life science, mental health, technological innovation

Top 5 relevant selected publications (of proposed research team, citations as of Oct 2017):

1. Duecker, F., Formisano, E., & Sack, A. T. (2013). Hemispheric differences in the voluntary control of spatial attention: direct evidence for a right-hemispheric dominance within frontal cortex. *Journal of Cognitive Neuroscience, 25*(8), 1332-1342. doi: 10.1162/jocn_a_00402
2. Duecker, F., & Sack, A. T. (2015). The hybrid model of attentional control: New insights into hemispheric asymmetries inferred from TMS research. *Neuropsychologia, 74*, 21-29. doi: 10.1016/j.neuropsychologia.2014.11.023
3. Duecker, F., Schuhmann, T., Bien, N., Jacobs, C., & Sack, A. T. (2017). Moving Beyond Attentional Biases: Shifting the Interhemispheric Balance between Left and Right Posterior Parietal Cortex Modulates Attentional Control Processes. *Journal of Cognitive Neuroscience*, 1-12. doi: 10.1162/jocn_a_01119
4. Sack, A. T. (2010). Using non-invasive brain interference as a tool for mimicking spatial neglect in healthy volunteers. *Restorative Neurology and Neuroscience, 28*(4), 485-497. doi: 10.3233/Rnn-2010-0568
5. Duecker, F., de Graaf, T. A., & Sack, A. T. (2014). Thinking caps for everyone? The role of neuro-enhancement by non-invasive brain stimulation in neuroscience and beyond. *Frontiers in System Neuroscience, 8*, 71. doi: 10.3389/fnsys.2014.00071