50 individual brain scans taken from the Human Connectome Project, for fixed-dose tDCS (1mA & 2mA) and individualised dose-controlled tDCS targeting left M1.

Results: With a fixed-dose (1mA & 2mA), E-field intensity in left M1 varied by more than 100% across individuals, with substantial variation observed throughout the brain as well. Individualised dose-controlled ensured the same E-field intensity was delivered to left M1 in all individuals. Its variance in other regions of interest (right M1 and area underneath the electrodes) was comparable with fixed- and individualised- dose.

Conclusion: Individualised dose-control can eliminate the variance in electric field intensities at a cortical target site. Assuming that the current delivered to the brain directly determines its physiological and behavioural consequences, this approach may allow for reducing the known variability of tDCS effects.

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P51 Effect of stimulus orientation and intensity on short-interval intracortical inhibition (SICI) and facilitation (SICF)—**S. Tugin [a,b,*], V. Souza [a,b], M. Nazarova [c,d], J. Nieminen [a,b], P. Novikov [c], A. Tervo [a,b], P. Lioumis [a,b], V. Nikulin [c,e], R.J. Ilmoniemi [a,b] ([a] Aalto University School of Science, Department of Neuroscience and Biomedical Engineering, Espoo, Finland, [b] University of Helsinki and Helsinki University Hospital, HUS Medical Imaging Center, BioMag Laboratory, Helsinki, Finland, [c] National Research University Higher School of Economics, Institute for Cognitive Neuroscience, Center for Cognition and Decision Making, Moscow, Russian Federation, [d] The Ministry of Healthcare of the Russian Federation, Federal State Budget Institution, Federal Center for Cerebrovascular Pathology and Stroke, Moscow, Russian Federation, [e] Max Planck Institute for Human Cognitive and Brain Sciences, Department of Neurology, Leipzig, Germany)**

Paired-pulse transcranial magnetic stimulation (TMS) allows investigating inhibitory and excitatory interactions in the human motor cortex noninvasively. Short-interval intracortical inhibition (SICI) and facilitation (SICF) are used to measure cortico–cortical excitability in patients with, *e.g.*, stroke, dystonia, and Parkinson's disease. However, the role of the induced electric field (E-field) orientation remains partly unclear. Posterior–anterior (PA)-oriented E-field elicits motor evoked potentials (MEPs) with the lowest stimulus intensities due to the recruitment of corticospinal neurons, indirectly via excitatory synaptic inputs to corticospinal axons (indirect (I-) waves). Stimulation in the lateral–medial (LM) orientation directly activates corticospinal axons, which leads to the generation of both direct (D-) and I-waves. Conditioning stimulus (CS) with an intensity between 50% and 90% of resting motor threshold (RMT) induces activation of GABAA inhibitory mechanisms observed as the SICI (inhibitory) effect on MEP amplitude. In contrast, if the CS intensity is above RMT, the SICF (excitatory) phenomenon can be present due to the superposition of D- and I-waves. Our aim was to investigate the dependence of inhibitory and facilitatory mechanisms on the orientation of the induced E-field of CS and TS. We developed a multi-locus TMS (mTMS) transducer, which allowed us to control the E-field orientation independently for CS and TS at a millisecond inter-pair interval (IPI). Eight healthy subjects (five males; mean age 29, range 21–35 years) participated in the study. mTMS was applied to the hotspot of the abductor pollicis brevis (APB) muscle in the left primary motor cortex. The stimulus intensities were based on the individual RMT of APB for PA and LM orientations. TS and single pulses were administered at 110% RMT. Twenty single pulses were applied for each TS orientation and for each of the 32 paired-pulse conditions. CS and TS stimuli were applied in every combination of the PA and LM orientations with four CS intensities (50, 70, 90, and 110% RMT) and two IPIs (1.5 and 2.7 ms) in a random order. Interaction between CS orientation, IPI, and CS intensity significantly affected TS MEP amplitudes. We observed no statistically significant difference between the responses induced by PA- and LM-oriented TS. CS at 70% RMT for SICI and at 110% RMT for SICF induced similar effects regardless of the TS orientation. We established that LM-oriented CS at 90% RMT produced a greater inhibition than stimuli at the same intensity in the PA orientation. Our results emphasize the minimal influence of the CS E-field dorientation on the test pulse. Additionally, we demonstrate the pivotal role of the stimulus intensity for any CS orientation. SICI and SICF evoked using perpendicular CS and TS directions indicate that we stimulated overlapping neuronal populations with both pulses.

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P52 Towards a first-in-human acute evaluation of epicranial cortical stimulation in patients undergoing deep brain stimulation surgery—**A. Khatoun [*], B. Asamoah, M. Mc Laughlin (KU Leuven, Leuven, Belgium)**

Introduction: Cortical stimulation techniques have been shown to treat a number of pathological and psychiatric diseases. While direct cortical stimulation induces strong electric fields in the brain, and thus strong neuromodulation effects, this technique is associated with risks due to its highly invasive nature. On the other hand, non-invasive neuromodulation techniques are hampered either by the weak neuromodulation effects such as transcranial electric stimulation, or by the inability to deliver continuous stimulation such as transcranial magnetic stimulation. Recently, a novel minimally invasive neuromodulation technique, epicranial cortical stimulation (ECS), has been proposed to overcome these limitations. This technique works by placing the stimulating electrodes subcutaneously under the skin and directly over the skull. Animal experiments and human computational modelling studies have shown that this technique can deliver strong electric fields to the brain while preserving low level of invasiveness. However, no human experiments have been conducted to confirm these findings.

Objectives: A first-in-human acute evaluation of ECS could be performed in movement disorder patients who are undergoing invasive deep brain stimulation (DBS). During DBS a craniotomy is made which allows for both the acute implantation of ECS electrodes under the scalp and measurement electrodes in the cortex to quantify electric field strength and neural response. The objective here was to develop an electro-anatomical model of this experiment to explore the potential and limitation of this setup.

Materials and methods: A detailed human head computational model was used to estimate the electric field distribution during the planned acute ECS in humans. Two stimulation electrodes arrays were modeled over the skull and were separated by 16 mm. The model included an invasive measurement electrode inserted through a burr hole located between the stimulation electrodes. Then, the cortical electric field distribution was calculated by solving Laplace equation.

Results: The results show that using the modeled electrodes arrays, a 1 mA of stimulation current induces an electric field with a maximum of 2.5 V/m in the cortex. The magnitudes of the cortical fields in the area close to the measurement electrode were in the same range as those of other cortical areas under the stimulation electrodes. Adding a conductive layer over the skull, representing