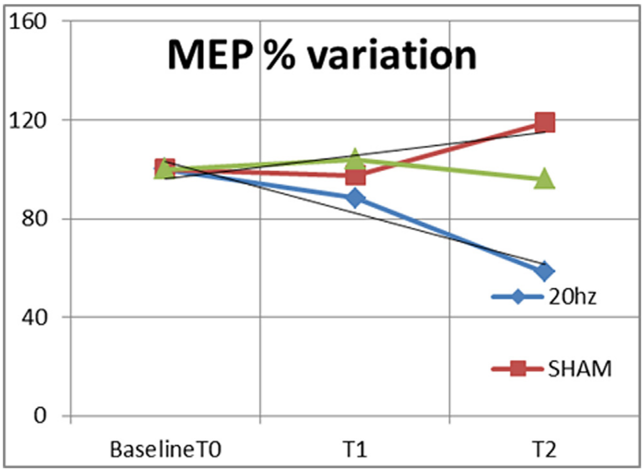

Graphic2: Normalized changes in FDI MEPs for the three experimental conditions.

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TMS assessed cortical representation scales with stimulation intensity and muscle activation

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Transcranial magnetic stimulation (TMS) is routinely used to construct a map of corticospinal excitability (CSE). TMS elicited motor evoked potentials (MEPs) are known to increase both with stimulation intensity and muscle activation. Whilst a wide variety of stimulation intensities and levels of muscle activation are used to generate TMS maps, their effect on the cortical representation has yet to be systematically explored. Two experiments were performed to describe the effect of stimulation intensities (Experiment 1) and muscle activation (Experiment 2) on the map outcome measures: aspect ratio, centre of gravity (COG), map area and map volume.

Twelve participants were recruited for each experiment. TMS maps were acquired from the first dorsal interosseous (FDI). Maps were acquired using 80 stimuli pseudorandomly across a 6x6 cm area with a 1.5 s interstimulus interval, allowing the maps to be acquired in two minutes. In Experiment 1 maps were compared at 5, 10, 20 and 40% of the maximum voluntary contraction. All maps were acquired with a stimulation intensity of 120% of the resting motor threshold (RMT). In Experiment 2 maps were compared at the stimulation intensities of 110, 120 and 130% of RMT, whilst the muscle was at rest.

A significant increase in map area and map volume were observed with stimulation intensity and level of muscle activation as would be expected. Neither the COG nor the aspect ratio were changed with either increased stimulation intensity or muscle activation. This study demonstrates that the cortical representation scales with stimulation intensity and level of muscle activation, but the shape of the map does not change.

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“I-wave” recruitment predicts response to tDCS in the upper limb, but only so far

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Anodal transcranial direct current stimulation (a-tDCS) of primary motor cortex (M1) facilitates motor evoked potentials (MEPs) in hand muscles. Recent evidence highlighted substantial inter-individual variability after tDCS based on the difference in MEP latency between latero-medial (LM) and anterior-posterior (AP) directed transcranial magnetic stimulation (TMS) (Hamada 2013; Wiethoff 2014). This difference in MEP latency is presumed to reflect the balance of early versus late I-wave recruitment to TMS. The present study examined whether AP-LM MEP latency difference could predict an individual’s MEP facilitation to a-tDCS or dual-hemisphere tDCS in the muscles of the forearm (Extensor Carpi Radialis; ECR) and proximal upper limb (Biceps Brachii; BB). We conducted a randomised double-blind study with 18 healthy adults. Each received anodal, dual-hemisphere, or sham tDCS in separate sessions (tDCS, 1 mA for 15 min). The anode was positioned over right M1 and the cathode over left supraorbit for a-tDCS or left M1 for dual-hemisphere tDCS (both 27 cm^2). MEPs in BB and ECR were collected before and immediately after tDCS with posterior-anterior induced cortical current. tDCS effect on MEP size was measured (Post-Pre)/Pre. Linear regression analyses showed a-tDCS modulated MEP size dependent on AP-LM MEP latency for ECR only ($p=0.01$). Individuals with small MEP latency difference showed the expected facilitation of MEPs after a-tDCS, whereas those with large MEP latency difference had suppressed MEPs after a-tDCS. No association was found between AP-LM MEP latency difference and BB MEP modulation after a-tDCS. There was no observed association between AP-LM MEP latency difference after dual-hemisphere tDCS or sham in either muscle ($p>0.1$). These results support previous findings that a-tDCS modulates corticomotor excitability depending on I-wave recruitment, for more distal muscles of the hand, and the present results extend these finding to the forearm. These findings may inform how to individualise a-tDCS in future applications.

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The effects of hormonal changes during menstrual cycle on brain excitability and hand dexterity (A pilot study)

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This study was designed to investigate whether hormonal fluctuations during menstrual cycle affect corticospinal excitability, intracortical inhibition (ICI) and facilitation (ICF) in primary motor cortex (M1), and also whether it has any effect on hand dexterity in neurologically intact women.

This study is in progress and so far, sixteen volunteers (7 Female, 9 Male) participated in this study. The levels of progesterone and estrogen were measured from saliva during the following phases of the women’s menstrual cycle: 1- follicular phase; 2- ovulation phase and 3- mid-luteal phase.

Motor evoked potentials (MEPs) were recorded from the right first dorsal interosseous (FDI) muscle. Single and paired-pulse transcranial magnetic stimulation (TMS) were delivered in a block of 20 stimuli with participants at rest. With paired-pulse technique, 3ms and 10ms inter-stimulus intervals were used to assess ICI and ICF respectively. The size of the conditioned MEP was expressed as a percentage of the unconditioned test MEP to assess the effectiveness of ICI or ICF. The Grooved Pegboard Test (GPT) was completed in each session before the TMS assessments. Male