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## **ENTRAINING AND MEASURING CORTICOCORTICAL PLASTICITY IN ACTION CONTROL AND INHIBITION**

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**Background:** Among human prefrontal cortex regions, the ventral pre-motor cortex (PMv) and adjacent premotor areas plays a pre-eminent and crucial role in action selection and inhibition.

#### **Aims:**

- a) Characterise the causal relationship between PMv and the primary motor cortex (M1) in action control and inhibition by means of transcranial magnetic stimulation (TMS)
- b) Examine the possibility of potentiating the effects of PMv over M1 during action control as measured by electroencephalography (EEG), and to explore bidirectional relationships between M1 and rPMv.

**Method:** Participants performed a go/no-go task in two task blocks while measuring the cortical excitability of M1 with electromyography (EMG – studies 1 and 2), and neural responses with EEG (study 3). Between the two task blocks we manipulated and entrained the PMv-M1 corticocortical pathway by delivering noninvasive repetitive paired associative transcranial stimulation (rPAS) near PMv and M1. We then measured the effect of the cortico-cortical entrainment in M1 cortical excitability (study 1 and 2) as well as motor oscillatory dynamics (study 3)

**Results:** the entraining of PMv-M1 cortical connectivity leads to a state-dependent modulation of the causal influence of prefrontal over motor cortex, as reflected in (a) increased M1 cortical excitability in Go trials, and (b) enhanced beta and theta rhythms in Go and No-Go trials, respectively. Additionally, the plasticity effect was dependent on stimulation order. rPAS of PMv before M1 led to augmented beta and theta oscillations reflecting an enhanced top-down influence of PMv on M1, whereas the opposite results were observed after the reversed M1-PMv stimulation.

**Conclusions:** These results show that PMv exerts a state-dependent effect over M1, and that PMv-M1 cortico-cortical connectivity can be artificially manipulated leading to functional changes in the spectral fingerprints of the motor circuit

**Keywords:** Action control, Ventral premotor cortex, EEG, rPAS, Cortico-cortical plasticity

#### **Publications:**

*Directly related to the grant*

Sel, Angerer, David, Klein-Flüge, Verhagen, Rushworth. Entraining and measuring corticocortical plasticity in action control and inhibition (ready for submission to *Current biology*).

Sel, Shepherd. Inhibitory control and self-control (book chapter – accepted for publication).

*Other publications*

Gentsch, Sel, Marshall, Schütz-Bosbach (2018) Affective interoceptive inference: evidence from heart-beat evoked brain potentials. *Human Brain Mapping*.

Sel, A., Sui, J., Sheppard, J. and Humphreys, G., Self-Association and Attentional Processing Regarding Perceptually Salient Items. *Review of Philosophy and Psychology*.

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