



Graduate Seminar – PhD Oral Defence

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Supervisor : Prof. TONG Kai Yu Raymond
Date : 3 August 2022 (Wednesday)
Time : 9:00 pm (Hong Kong time)
Zoom Link : <https://cuhk.zoom.us/j/2250385452?pwd=MExVNytZNVVhZEOwd1p2OStaVURZdz09>
Meeting ID : 225 038 5452
Password : 12345

Title: **Effect of Transcranial Direct Current Stimulation and Transcranial Alternating Current Stimulation on Interference Control Mechanisms in Human Subjects**

Cognitive control mechanisms are at the core of human cognition and are essential for goal-directed behavior in various cognitive domains. Studies on humans and non-human primates have repeatedly demonstrated that different areas of the prefrontal cortex, notably the Anterior Cingulate Cortex located in the medial prefrontal cortex (MPC) and Dorsolateral Prefrontal cortex (DLPFC), play a crucial role in implementing cognitive control in the brain. The literature on cognitive control is dominated by correlational studies, which do not provide information about the causal association of specific brain regions with behavior. Transcranial Electrical Stimulation offers a unique methodology to study the causal functions of these brain regions by externally stimulating them with an electrical current and studying associated behaviors. It further provides an avenue for the possibility of enhancing cognitive functions.

Our research investigated if stimulation of critical cognitive processing regions in the prefrontal cortex can modulate the activity of the stimulated region and if it can influence cognitive control mechanisms in the attention and memory domain. The studies on attention control demonstrated that the stimulation of MPC with conventional transcranial direct current stimulation (C-tDCS) and high-definition transcranial direct current stimulation (HD-tDCS) influence the functioning of the stimulated region and further modulates attention control processes in the brain. The study on memory control, which was conducted in collaboration with the MRC Cognition and Brain Sciences Unit, University of Cambridge, investigated if stimulation of MPC can modulate retrieval-induced forgetting (RIF). RIF is a memory phenomenon that suggests that forgetting of memories is a consequence of recalling of some other memories that engage cognitive control processes similar to attention tasks. Stimulation of MPC reduced the amount of forgetting as indexed in RIF and resulted in a stronger desynchronization in alpha and beta frequency electrophysiological activity during memory retrieval. Finally, we studied if the effect of transcranial alternating current stimulation (TACS) on DLPFC is long-lasting. The study was conducted in collaboration with the Department of Psychology at the University of Graz in Austria, and we discovered that repeated stimulation has a long-lasting impact on resting-state functional brain networks.

The findings from the studies extend our understanding of the neural mechanisms of cognitive control and provide behavioral and neuroimaging evidence that stimulation of critical cognitive processing regions can influence cognitive control processes in attention and memory contexts.

*** ALL ARE WELCOME ***

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