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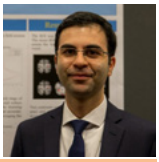

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Functional connectivity analysis of brain networks to study neural substrates of sensorimotor learning

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Abstract

There is substantial conjecture about how neural processes underlying sensorimotor learning are realized in the brain. It has been demonstrated that resting-state fMRI, as a functional neuroimaging technique, and functional connectivity analysis in brain networks can provide new insight into the roles of different brain regions in learning a new motor skill. Using resting-state fMRI, robotic interfaces, electromyography and Behavioural experiments we comprehensively investigated the neural mechanisms by which the central nervous system adapts motor commands and modifies sensorimotor transformations at distinct phases of motor learning. In this talk, we will present a distributed cerebellar-parietal- frontal network involved in the control of muscle co-contraction, which plays a significant role in regulating mechanical impedance of a limb and is a fundamental element of motor learning. We will also discuss how we identified the neural correlates of distinct control mechanisms that the central nervous system recruits to adapt to a novel physical environment and distinguished between regions of the brain involved in impedance control and those involved in learning to adapt to novel dynamics. Furthermore, we conducted a study to elucidate how the brain extracts information from tactile signals during dexterous hand movements. We will present our findings on the brain networks involved in sensorimotor transformations during learning of novel haptic tasks and changes in functional connectivity in the sensorimotor brain networks related to the task performance. Overall, a profound understanding of the neural substrates underlying sensorimotor learning can pave the road for more efficient rehabilitation strategies.

Biography

Saeed Babadi will receive his PhD from the Neuromuscular Control Lab at McGill University (Montreal, Canada) in the winter 2020 under supervision of Dr. Theodore Milner. He holds a bachelor's and a master's degree in biomedical engineering and electrical engineering, respectively. His current research is predominantly concerned with the resting-state fMRI and analysis of functional connectivity in brain networks to investigate the functions of specific regions of the sensorimotor network during different stages of motor learning. He also has a keen interest in the applications of functional brain imaging to computational and sensorimotor neuroscience and how to translate knowledge to develop medical devices and neural prosthetics.

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