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Talk Title:

Probing corticospinal excitability with transcranial magnetic stimulation to identify mechanisms underlying action preparation in humans.

Abstract:

My talk will focus on the work we have performed in the lab over the last years using transcranial magnetic stimulation (TMS) to uncover the corticospinal correlates of mechanisms underlying action preparation. When applied over primary motor cortex, TMS elicits motor-evoked potentials (MEPs) that represent global markers of corticospinal excitability at the time of stimulation. By recording MEPs to TMS at specific time points and in specific experimental conditions, we have been able to show that action preparation involves a strong suppression of corticospinal excitability, so-called preparatory suppression, which likely reflects the joint impact of processes related to behavioral inhibition and gain modulation. Moreover, another important focus of our TMS work has been to understand how changes in the level of urgency translate into specific adjustments of corticospinal excitability during action preparation. We found that decision urgency induces a suppression of neural activity (i.e. MEPs) in finger muscles surrounding the prime mover, an effect reminiscent of greater surround inhibition. On the other side, concurrent to this local effect on finger MEPs, we found larger MEPs in leg muscles, an effect suggestive of a broad upward modulation of motor activity by urgency. Hence, based on these effects, it is plausible that urgency emerges from multiple sources that jointly determine its ultimate characteristics, including its well-known relation to movement vigor. In summary, my presentation will be mostly organized in two parts, one focusing on the phenomenon of preparatory suppression and another describing urgency-dependent variations in corticospinal excitability.

Biographical Information:

I completed my PhD in Neuroscience in 2006 at the Université catholique Louvain (UCLouvain, Belgium) under the supervision of Prof. E. Olivier. My PhD training also included a 2-year

fellowship (2002-2003) at the National Institute of Neurological Disorders and Stroke (NIH, Bethesda, USA) with Prof. L.G. Cohen (PhD co-supervisor). At that time, I characterized interactions occurring between motor areas of both hemispheres using transcranial magnetic stimulation (TMS) in healthy subjects and in patients suffering from a unilateral stroke. One primary finding was the occurrence of an abnormally strong interhemispheric inhibition of the lesioned hemisphere in these patients, altering paretic hand movements

After my PhD, I joined the lab of Prof. R.B. Ivry (UC Berkeley, USA) as a BAEF and Fulbright postdoctoral scholar, with the goal to further my understanding of the role of inhibitory processes in the control of hand movements (2006-2008). I then continued this research line at the UCLouvain on a FNRS postdoctoral position and worked for a year (2008-2009) with Prof. M. Rushworth at the University of Oxford (UK). I now hold a professorship at the UCLouvain (since 2010, now tenured), where I have established my lab (Cognition and Actions Lab - <https://www.coactionslab.com/>) in the Institute of Neurosciences (IoNS). Research in my lab broadly explores a range of questions pertaining to the cognitive neuroscience of human behavior. We conduct experiments to explore the interaction between cognition and action during decision making, movement preparation and motor learning, in neurologically healthy and impaired individuals. We use a variety of techniques to characterize the functional role of different parts of the motor system including TMS, electroencephalography (EEG) and magnetic resonance imaging (MRI).