“When It's the Thought That Counts: Cognitive States and Their Impact on Noninvasive Neuromodulation.”

Recent years have seen an explosion of interest in the use of noninvasive neuromodulation techniques such as transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS), both to explore questions in cognitive neuroscience and to develop novel interventions for a variety of central nervous system disorders. However, in parallel with increasing use of these techniques, there has been a growing realization that many factors can influence the neurophysiologic and behavioral consequences of noninvasive brain stimulation in complex ways. These include device parameters that are often controlled in studies, such as stimulation location, intensity, and duration, but may also include other aspects of stimulation that are frequently overlooked as potentially influencing outcomes. Identifying these unrealized determinative factors could prove especially relevant to tDCS research, where heterogeneous stimulation approaches and variable results have raised questions about the overall reliability of the technique. This talk will therefore focus on research involving tDCS, and will present a body of evidence indicating that cognitive states at or around the time of tDCS administration directly influence the behavioral effects of stimulation. Topics discussed will include the impact of behavioral tasks performed in conjunction with stimulation as well the role of baseline cognitive abilities on tDCS outcomes. Taken together, the data presented will comprise an argument that cognitive states can and should be employed as a category of stimulation parameter, with the goal of enhancing the “cognitive resolution” of tDCS for selectively engaging brain networks that mediate specific mental operations. Such an approach may serve to minimize unintended cognitive consequences of stimulation and may also enhance the reliability of tDCS studies of cognition.