

TMS/EEG: from TEP to phase-informed i-TEP

Transcranial magnetic stimulation combined with electroencephalography (TMS/EEG) could potentially probe non-invasively the cortical excitability and connectivity through the TMS-evoked potential (TEP). However, the TEP is not a pure measure of the stimulated cortex: it is a composite signal shaped by stimulation artifacts and a cascade of propagated activity, making it difficult to interpret the cortical response. A further confound arises from the auditory and somatosensory inputs generated by the click and scalp sensation of the coil discharge, which evoke their own EEG responses and can be mistaken for genuine TMS-evoked cortical activity. The recent discovery of the immediate TEP (i-TEP), the very early component of the response, is a candidate for the direct, immediate reaction of the neurons under the stimulating coil. I will discuss how to isolate this early window, and what properties of the i-TEP are known so far. I will then introduce a new method for real-time detection of the phase of ongoing cortical rhythms and show how the phase at the moment of stimulation impacts the i-TEP, revealing a key source of trial-to-trial variability in cortical responses.