Decomposition of EEG reveals a diversity of beta-band responses to a single pulse of TMS

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In two-item visual working memory with prioritization cues, a single pulse of transcranial magnetic stimulation (TMS) reinstates multivariate decodability of the unprioritized memory item (UMI) from concurrently measured electroencephalogram (EEG), and increases false alarm rates to the UMI. Although this effect has been isolated to the beta band (16-24 Hz; Rose et al., 2016), it is unknown whether it is due to “induced” activity in networks that were active prior to TMS, or to evoked activity akin to endogenous reactivation (Spitzer & Haegens, 2017). Moreover, it is unknown whether beta-band oscillations mediate behavioral consequences of TMS. To address these questions, we carried out a decomposition of EEG signals from Rose et al. (2016) using a Spatially distributed PhAse Coupling Extraction with Frequency Specific Phases Model (SPACE-FSP; van der Meij et al., 2015; 2016). This allowed us to disentangle oscillatory components with differing temporospatial profiles, which remain intermixed with conventional methods. We extracted ~350 components in the 1-40 Hz band, 90 of which were prominent in beta. Comparison of components post- versus pre-TMS revealed an even split between stronger and weaker loading of beta components after TMS was delivered, further emphasizing the value of this fine-grained analysis in disentangling contributions from different sources. Some of these beta components were also negatively correlated with behavior. These results are consistent with the idea that dynamics in the beta band accompany transitions between activation states in working memory and support the ability of TMS to reactivate UMIs through diverse responses in those dynamics.