Title: Decreased spontaneous but increased evoked alpha power in consciousness connected to the environment

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Abstract: 1.9

Recent findings indicate that evoked alpha power is reduced in posterior cortical areas in disconnected states of consciousness (i.e. REM sleep and ketamine anesthesia) as compared to connected states of consciousness (i.e. wakefulness) (Darracq et al. 2018). Here we further contrasted TMS evoked responses during wakefulness in different levels of connectedness to the environment. We applied single-pulse TMS over parieto-occipital cortex to collect evoked TMS-EEG responses during four conditions: watching a movie (high connectedness), imagining the same movie (low connectedness) and two control passive conditions (resting state eyes open and eyes closed). Spontaneous EEG activity was also collected for the four conditions. Eight healthy right-handed participants (four female; 27 ± 3.7 years old) completed the experiment.

Paired-sample T-tests focused on the alpha band (8-13Hz) in spontaneous EEG and TMS-evoked EEG responses and were thresholded at p<0.05 corrected for multiple comparisons using threshold-free cluster enhancement. Spontaneous EEG activity revealed decreased alpha power over posterior electrodes when contrasting connected (‘watching a movie’) vs. disconnected consciousness (‘imagining the movie’). In contrast, TMS-evoked EEG responses displayed higher evoked alpha power in posterior electrodes in connected vs. disconnected consciousness during a period 20-80ms after TMS pulse. Such effects were confirmed for both spontaneous and evoked EEG activity when the eyes opening status was considered (e.g. ‘watching a movie’ condition displayed significantly higher evoked alpha power as compared to ‘imagining the movie’, when ‘resting state eyes open’ and ‘resting state eyes closed’ were respectively subtracted).

Although high connection to the environment in the spontaneous EEG is associated with alpha suppression in posterior areas, our results suggest that consciousness connected to the environment is accompanied by increased evoked alpha power in a posterior parieto-occipital cluster. These results are consistent with previous findings in anesthesia studies and bring further insights about the neural correlates of connected consciousness.