AN INVESTIGATION INTO THE CAUSAL ROLE OF ALPHA OSCILLATIONS IN ATTENTION

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Background: Using Electroencephalography (EEG) an event-related change in alpha activity has been observed over primary sensory cortices during the allocation of spatial attention. This is most prominent during top-down, or endogenous, attention, and nearly absent in bottom-up, or exogenous orienting. These changes are highly lateralised, such that an increase in alpha power is seen ipsilateral to the attended region of space and a decrease is seen contralaterally. It is unknown whether peak alpha differs across these tasks and whether changes in alpha oscillatory activity are causally related to attentional resources.

Aims: This grant had two aims: 1. To test for differences in peak alpha amplitude and frequency during tactile attention and perception tasks. 2. To test the causal role of alpha in tactile attention.

Method: We explored individualized alpha in EEG during three well established tactile attention and perception tasks. In these experiments, participants completed a tactile endogenous and exogenous attention tasks and a perceptual task while EEG was recorded. We implemented a novel approach to exploring the data to look for differences in individual alpha frequencies and alpha amplitude. To explore the causal role of alpha in tactile attention we are conducting a study that is still ongoing. Specifically, we are using transcranial Alternating Current Stimulation (tACS) to modulate alpha activity in the somatosensory cortex whilst measuring performance on tactile attention paradigms. All participants complete an endogenous and exogenous tactile attention task in three stimulation conditions; alpha, sham and beta. During experimentation alpha tACS stimulation is administered at individualised alpha frequency.

Results: For the EEG study on individualized alpha we used a data driven approach to compare alpha changes and we show that alpha decreases differ only between exogenous and endogenous attention tasks for only a short time window, 500–600 ms after cue onset. Findings for the tACS experiment have been pre-registered in Cortex but data collection is not yet completed.

Conclusions: On the basis of our EEG study we suggest that alpha amplitude modulations play a specific role in both in voluntary orientating and stimulus predictability. Furthermore, we demonstrate that there are no key differences in peak alpha frequencies compared across different tactile attentional tasks.

Keywords: Alpha, Attention, tACS, EEG, Somatosensory

Publications:

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