

## **An investigation into the causal role of alpha oscillations in attention**

### **ABSTRACT:**

#### **Background**

Using electroencephalography (EEG) an event-related change in alpha activity has been observed over primary sensory cortices during the allocation of spatial attention. Whether these changes in alpha oscillatory activity are causally related to attentional resources, or to perceptual processes, or are simply epiphenomenal, is unknown. Moreover, research suggests that the individual peak frequency (IPF) may vary as a function of the task participants perform.

#### **Aims**

This project uses EEG to investigate differences in alpha IPF as they relate to different attentional tasks. Moreover, using transcranial alternating current stimulation (tACS), we tested whether somatosensory alpha oscillations are causally related to endogenous and exogenous attention.

#### **Method**

The project consists of three full length studies. Participants were presented with tactile or visual stimuli and instructed to attend to or ignore stimulation. In two studies we recorded EEG and in a third study we presented tACS and investigate changes in behaviour.

#### **Results**

The EEG studies demonstrated that alpha oscillations are influenced by task instructions. Passive perceptual and endogenous orienting of attention results in the largest alpha desynchronization whilst exogenous orienting modulated alpha less. The IPF in the different tasks differed in the time onset whilst not in frequency. The large scale tACS study resulted showed lateralised alpha tACS targeting sensorimotor cortex has no effect on exogenous or endogenous tactile attentional mechanisms.

#### **Conclusions**

This project adds novel neuroscientific methods in terms of data collection and analysis, open science procedures, as well as presents results advancing theoretical knowledge of perception and attention. Interestingly, we observe alpha changes using EEG in different tasks, associated with behaviour. However, applying the same oscillations to the brain using tACS does not alter behaviour. This contributes to the ongoing debate about the role of alpha in attentional processes and suggests that these findings support an account of alpha power not being casually involved in attention.

#### **Keywords**

tACS, Attention, Pre-registration, Alpha oscillations

Os textos são da exclusiva responsabilidade dos autores  
All texts are of the exclusive responsibility of the authors

### **Published Work:**

Silas, J., Jones, A., Yarrow, K. & Anderson, W. (2023). Spatial attention is not affected by alpha or beta transcranial Alternating Current Stimulation: A registered report. *Cortex*, Registered report: In Principle Accepted. doi: 10.17605/OSF.IO/P7AME

Silas, J., Tipple, A., & Jones, A. (2019). Event-related alpha desynchronization in touch - Comparing attention and perception. *Neuroscience Letters*, 705, 131-137. doi: 10.1016/j.neulet.2019.04.058

### **Researcher's Contacts:**

Alexander Jones  
Psychology Department  
Middlesex University London  
NW4 4BT  
Phone: +44 (0)208 411 6328  
Email: [a.j.jones@mdx.ac.uk](mailto:a.j.jones@mdx.ac.uk)  
[www.jones-silas-lab.com](http://www.jones-silas-lab.com)  
Twitter: @jones\_silas\_lab