Investigation of the influence of 2× alpha transcranial alternating current stimulation on endogenous alpha oscillation

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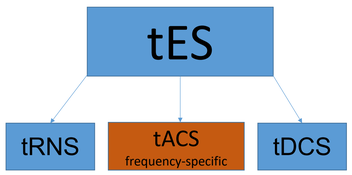
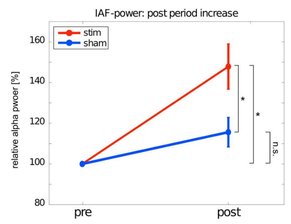
BACKGROUND

There are many oscillations in the brain representing different behavioral states, in which alpha oscillation (around 10 Hz) is most frequently investigated. Alpha oscillation is in relation to diverse brain functions comprising sensory, motor and memory processes. However, whether the relationship between oscillations and behavior is causal is not yet clear. Therefore transcranial electric stimulations (tES) provides an approach to study the causality by modulating oscillations and observing the changes of behavior.
tES has the property to modulate brain rhythms in either amplitude or frequency.





Transcranial alternating current stimulation (tACS) of alpha frequency can enhance the amplitude of endogenous individual alpha frequency (IAF) after stimulation. But the ongoing alpha enhancement during tACS process can not be detected, due to the artifact induced by stimulation.

MOTIVATION & GOALS

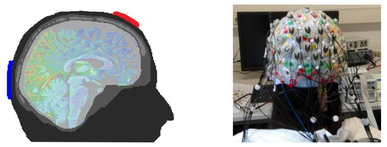
Previous modeling and animal studies have suggested that 2x alpha tACS is able to enhance harmonic alpha oscillation (8Hz to 12 Hz) at a low amplitude.

In the present study, we use 2×alpha tACS to attamp to enhance the alpha oscillation in human brain, which enable us to filter the electric noise of 2×alpha and reveal the enhancement of alpha during stimulation.

METHODS

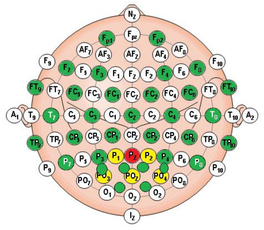
Experiment Design

EEG and tACS Setting

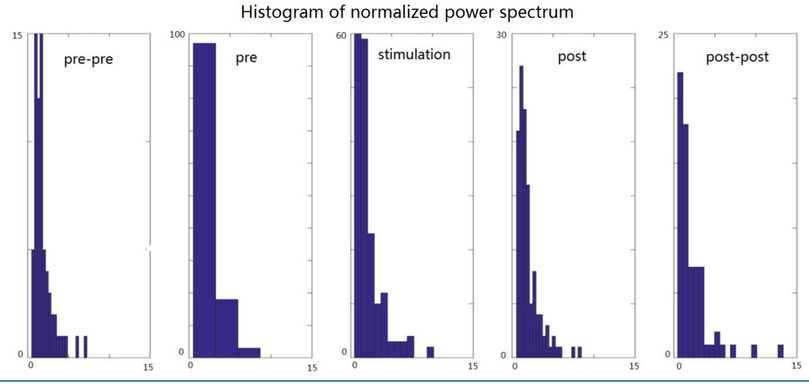


Date pre-process

- Quality control: eye-tracking (subject attention monitoring)
  In present study, I collected 7 subjects data and all of them have short closed-eye time. All their data enter EEG data analysis.

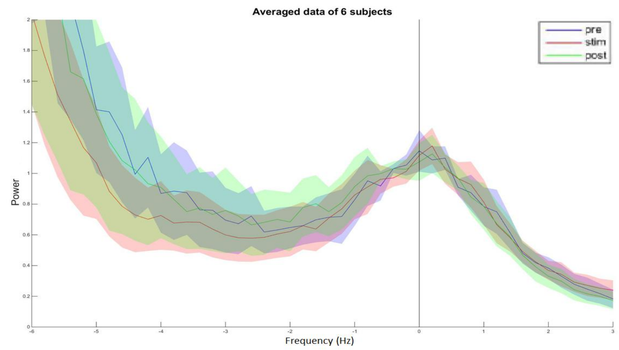


- Channel selection (reference: nose tip, channel of interest: Pz)
- Resampling into windows (5 sec/window)
- Fast Fourier Transformation (FFT)
- artifact removal: eye blinks
  We normalized power spectrum and removed extreme values which might be artifact brought by eye blinks.



RESULTS: tACS and alpha enhancement

After artifact removal, we build a powerspectrum over frequency to reveal whether there is a frequency dependent change in power at specific frequency (average IAF is 10 Hz). Dataset from one subject was excluded for absence of clear alpha peak.



We compared the differences between pre-stim, pre-post at IAF and pre-post at stimulation frequency for each subject. Wilcoxon signed rank test showed there are no significant differences for now.

SUMMARY

In the present study, we used 2 x alpha tACS in an attempt to modulate the endogenous individual alpha frequency, which may be visible by using EEG.
However, due to the limited amount of subjects and diversity among subjects, present data don't support the hypothesis yet.

REFERENCES

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