



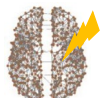
Focal brain stimulation induces frequency-resolved changes in cortical network activity

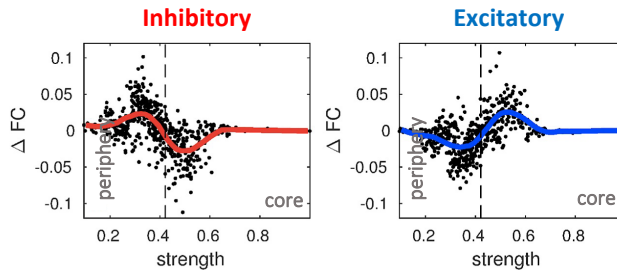
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1. Motivation

Transcranial magnetic stimulation (TMS) is a neurostimulation technique that modifies local neural activity.

Recent computational-modelling work suggest the periphery-to-core hierarchy of the brain can determine the effect of local stimulation on whole-brain dynamics.


$$\omega_0^i = a - (a - b) \left(\frac{s_i - s_a}{s_b - s_a} \right)^2,$$



Modelled change in whole-brain functional connectivity following inhibitory and excitatory stimulation. Modified from Leonardo L. Gollo, James A. Roberts, Luca Cocchi (2017). Mapping how local perturbations influence systems-level brain dynamics (NeuroImage)

To empirically test this relationship, we combined repetitive TMS with electroencephalography (EEG) to modulate neural activity of a peripheral brain region and study variations in canonical brain rhythms.

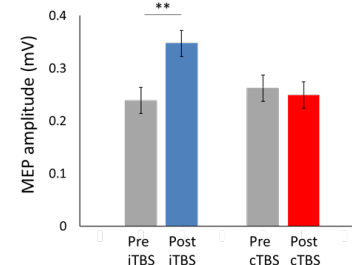
2. Methods

Twenty-one healthy volunteers participated (10 female, aged 18-35yrs).

Changes in resting state EEG cortical activity were recorded 10 minutes before and after excitatory (iTBS) and inhibitory (cTBS) paradigms.



Stimulation was delivered at 70% of resting motor threshold for 600 pulses using a figure-of-eight coil.



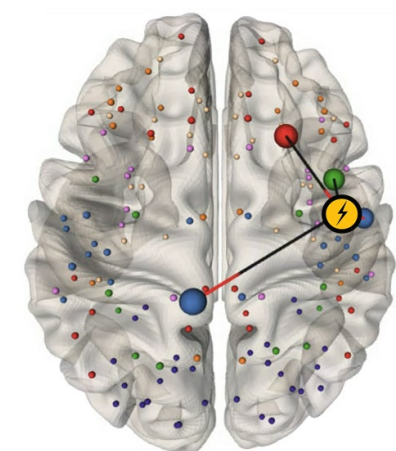
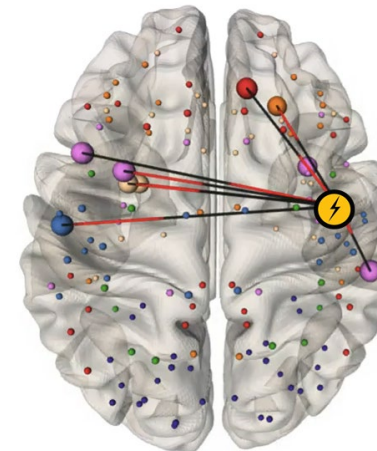
Induction of local neural plasticity were measured as a change in MEP amplitude 10 minutes following TBS protocols. Increased plasticity was observed following iTBS (n = 20). No statistically significant effects were observed after cTBS (n = 18). **Significance p < 0.01, uncorrected. Error bars depict the standard error of the mean (SEM) across subjects.

3. Results

Theta burst stimulation on the motor cortex induces frequency-resolved changes in cortical network activity

Excitation **hampers** beta-rhythmic synchronisation

Inhibition **enhances** alpha-rhythmic synchronisation



Frequency-resolved functional connectivity changes measured by extracting the amplitude-envelope correlation between the primary motor cortex and disparate brain areas. Threshold = 2.5, 5000 permutations.

4. Conclusion

These findings demonstrate a novel insight into the complex effects of brain stimulation paradigms and their ability to modulate local brain activity.

Here we demonstrate that specific patterns of TMS can induce opposing oscillatory activity in the brain.

5. References

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