

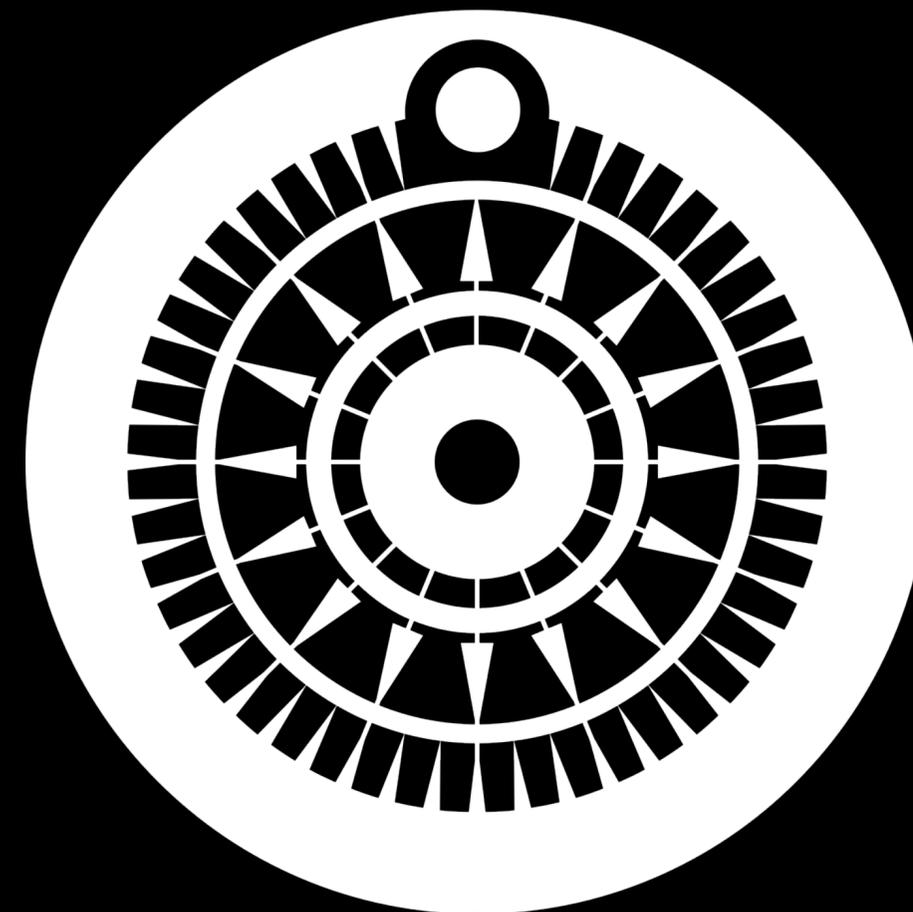


INTERNATIONAL SYMPOSIUM
"INVENTING THE FUTURE"

Neuro-enhancement by Non Invasive
Brain Stimulation: Can we really
boost brain functions?

MATTEO FEURRA

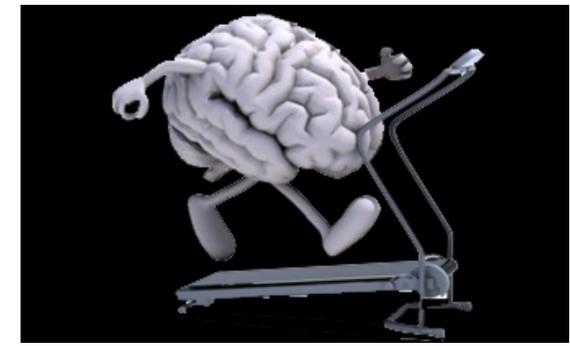
ASSOCIATE PROFESSOR, CENTRE FOR
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UNIVERSITY, HIGHER SCHOOL OF
ECONOMICS



EVOLUTION OF THE BRAIN:
HOW DOES THE WORLD
CHANGE US?



What is Neuroenhancement?

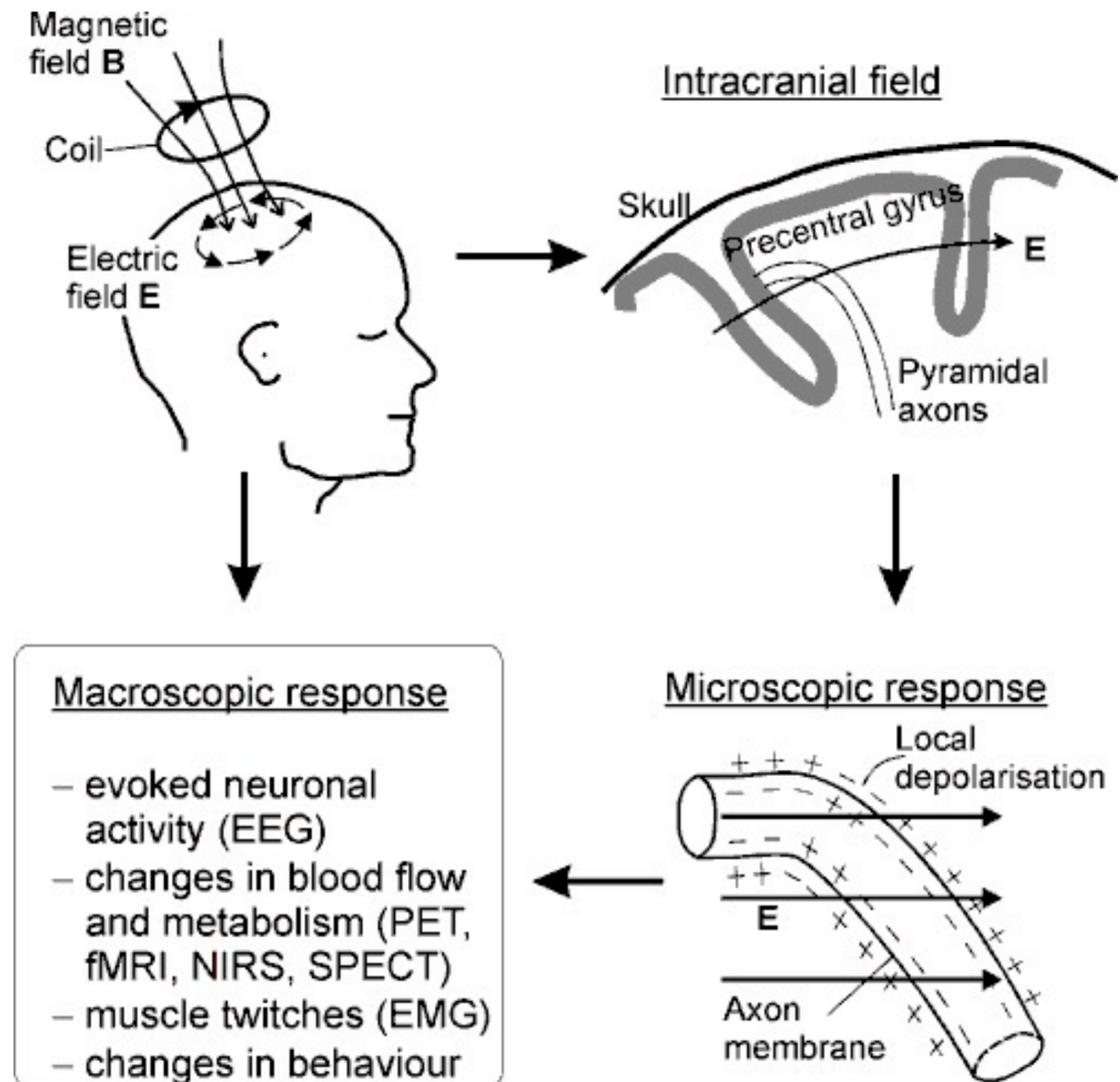
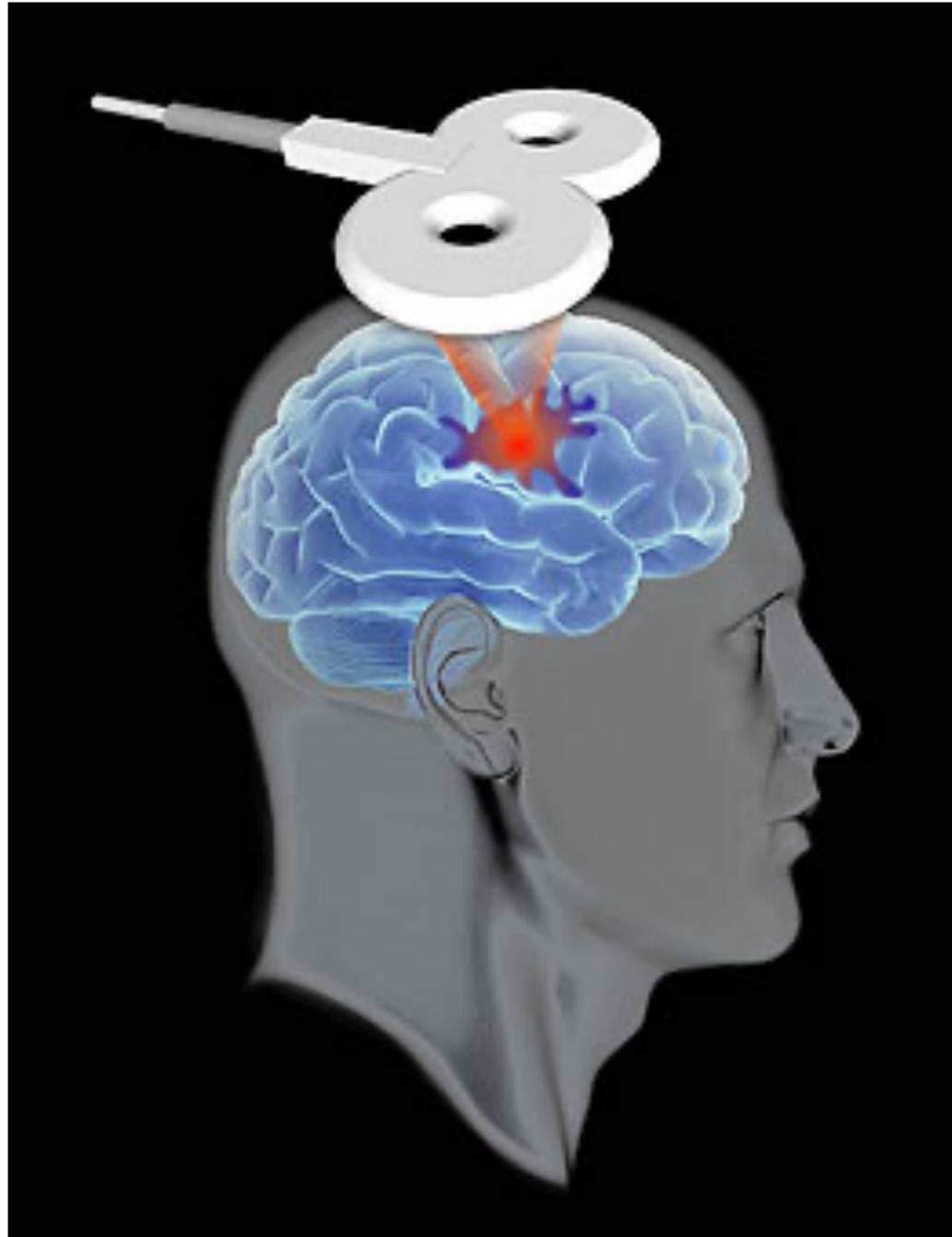


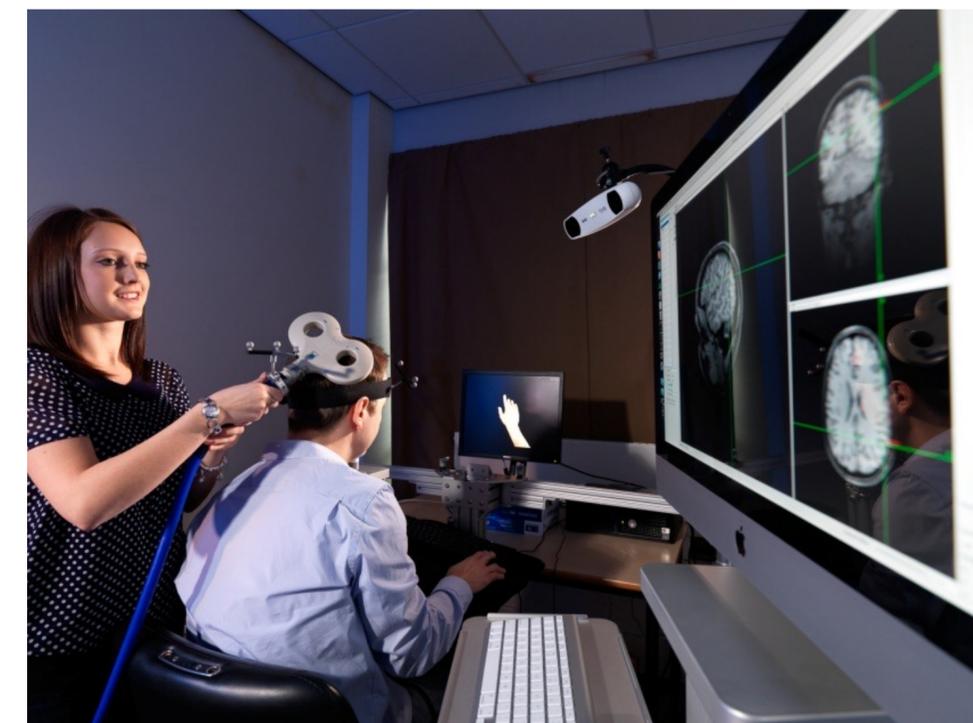
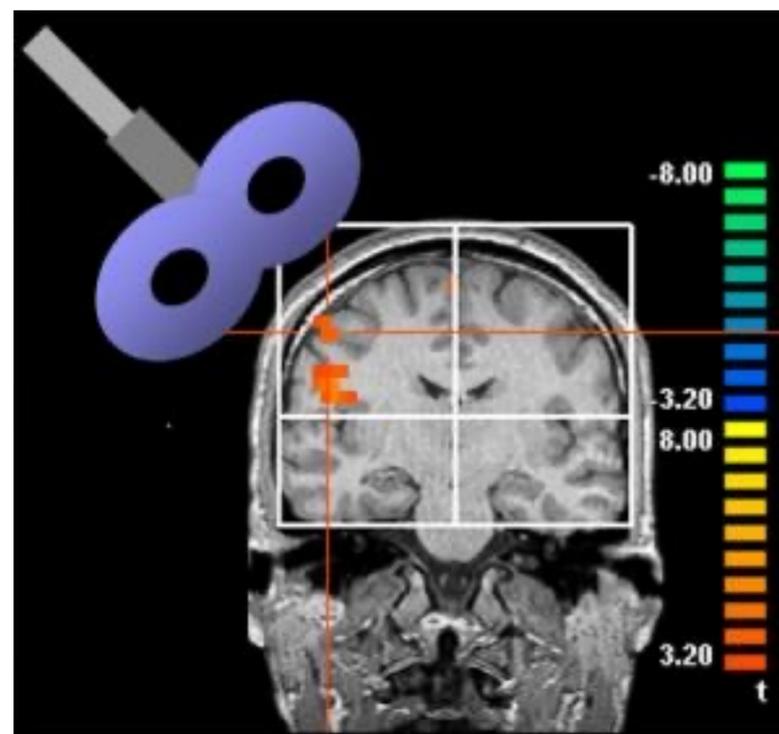
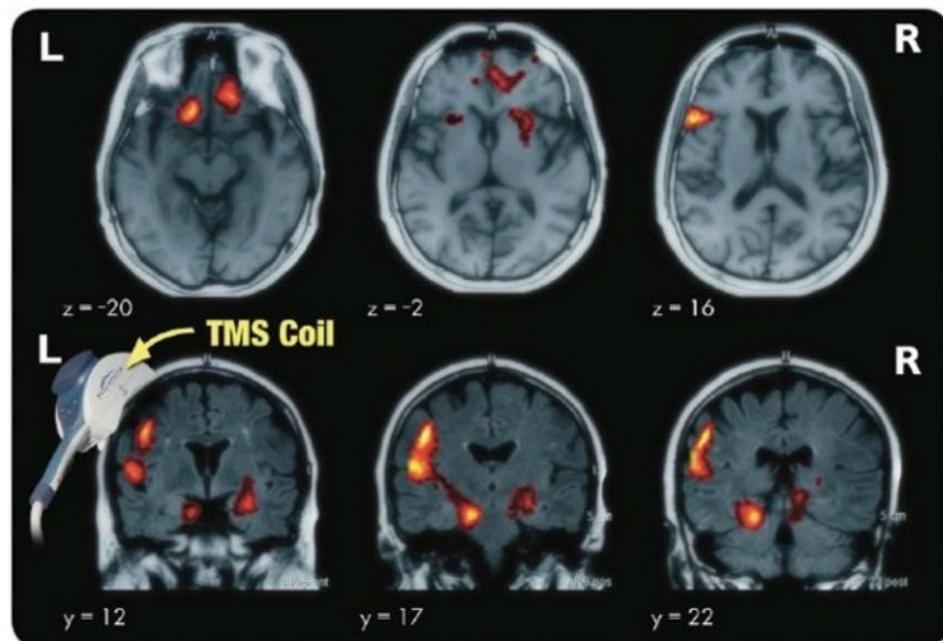
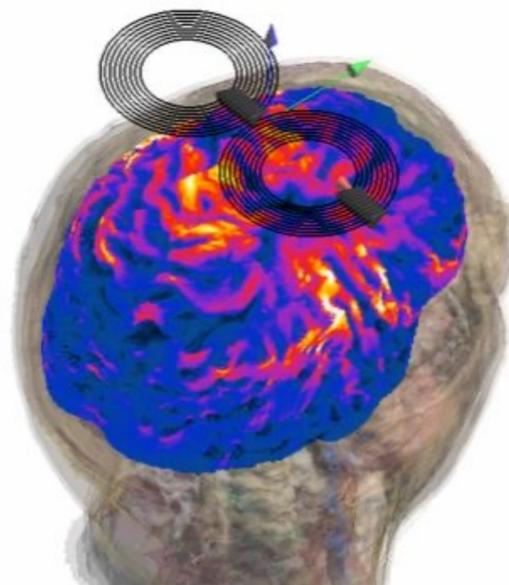
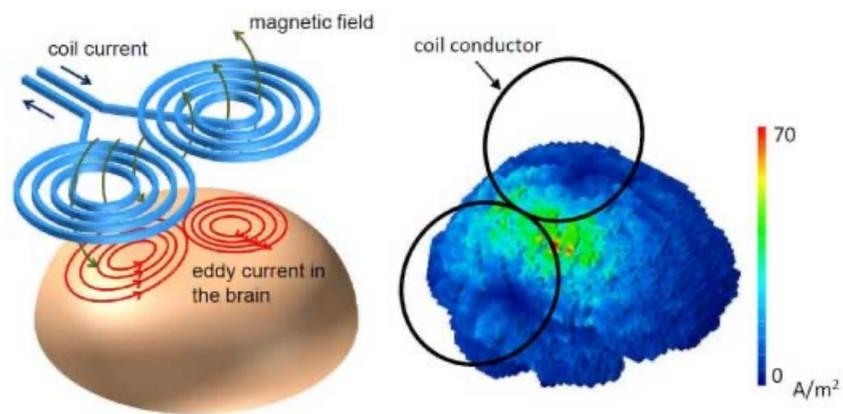
- It refers to a potential improvement ranging from perceptual to motor, cognitive and social abilities, which rely on the underlying brain activity and more specifically neural activity.
- Represents the ability to facilitate state transitions within and between networks (Schutter, 2014)
- Non Invasive Brain Stimulation (NIBS) induces brain plasticity changes.

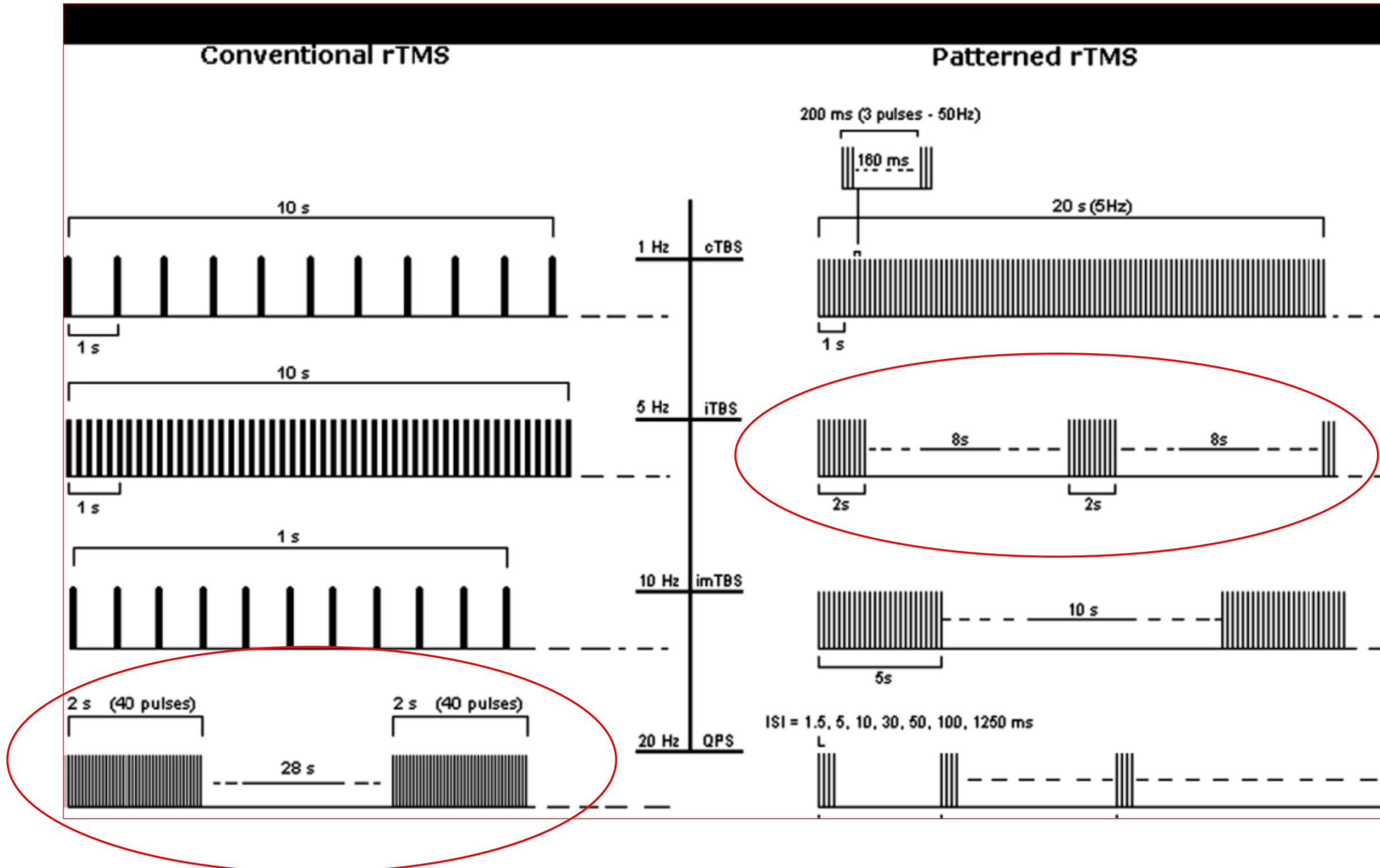
Better to say that induce short-term synaptic plasticity (neuroplasticity), which refers to changes in how neurons connect to each other.

Neuroplasticity refers to the potential that the brain has to reorganize by creating new neural pathways to adapt, as it needs.

Transcranial Magnetic Stimulation



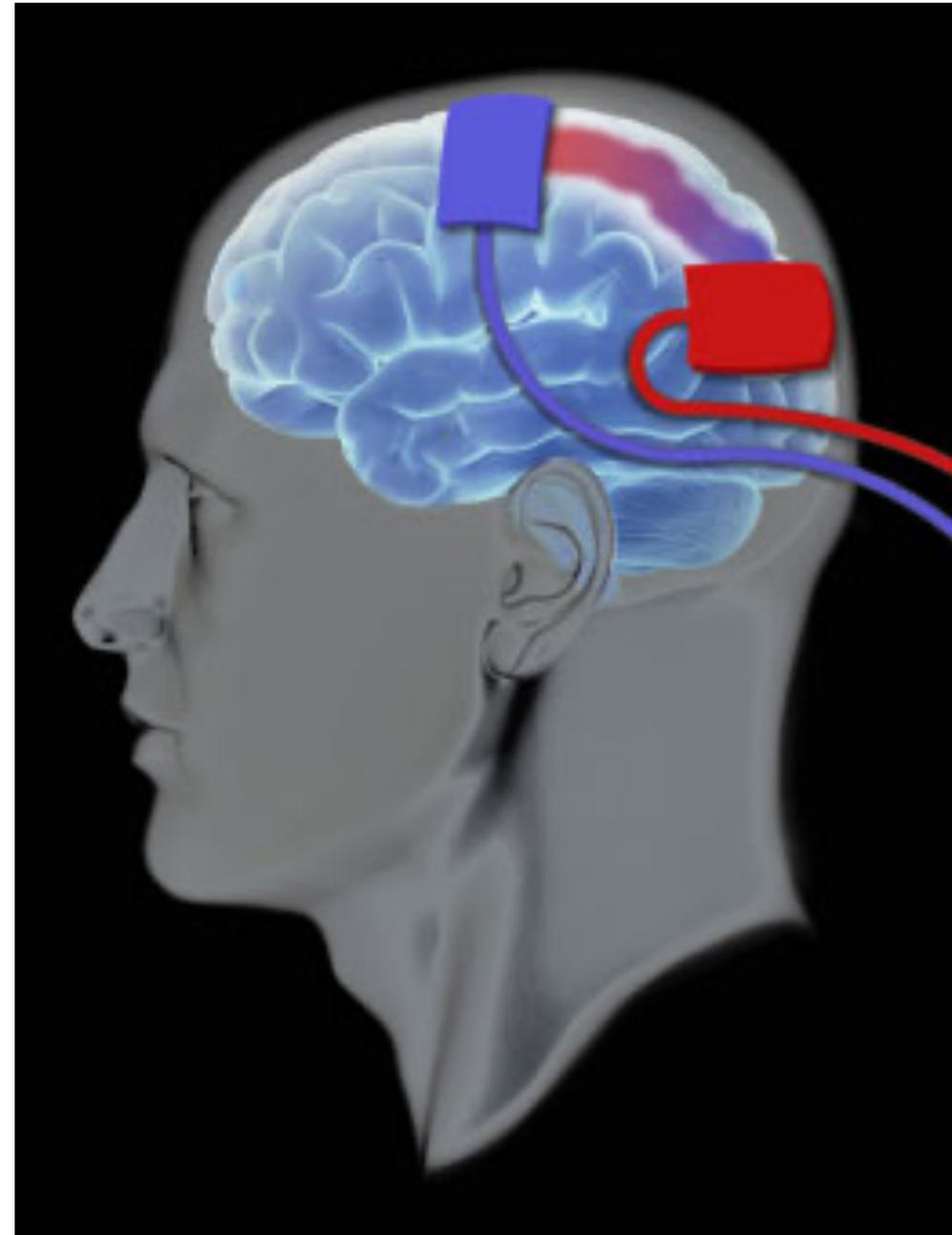




Rossi et al., 2009

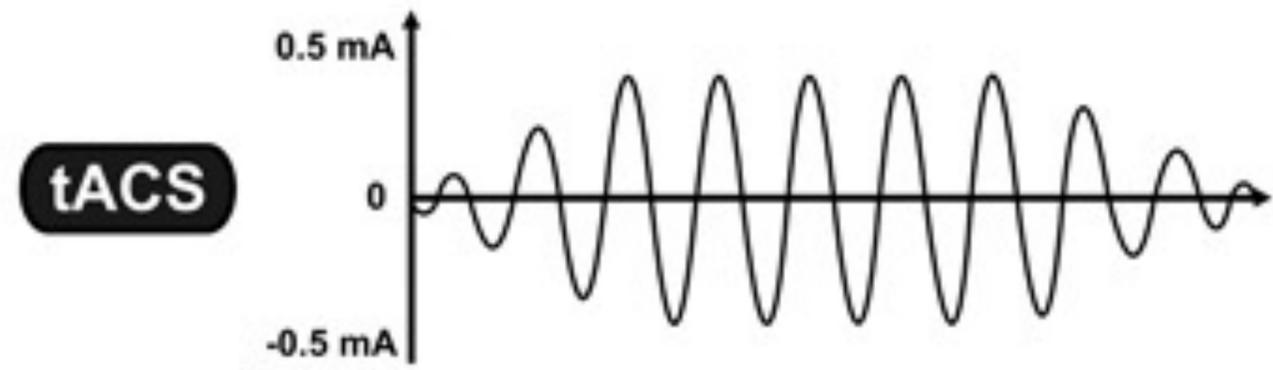
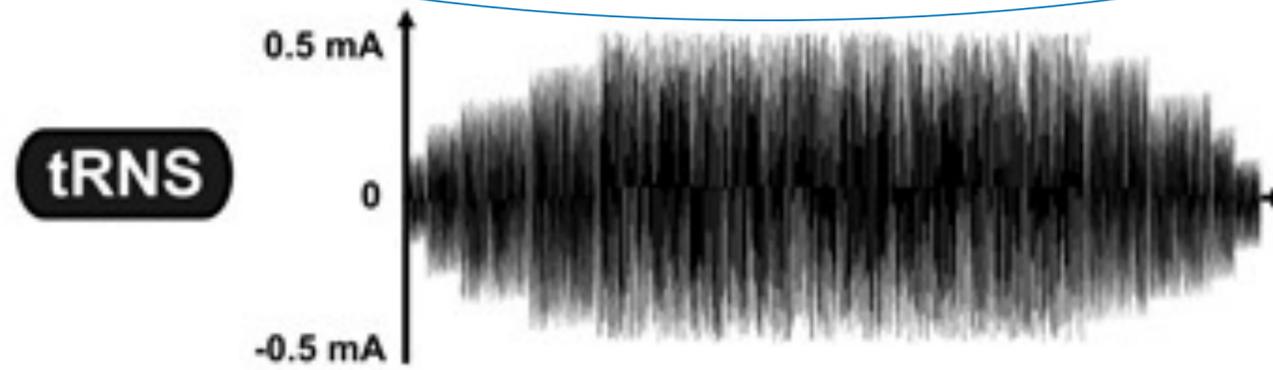
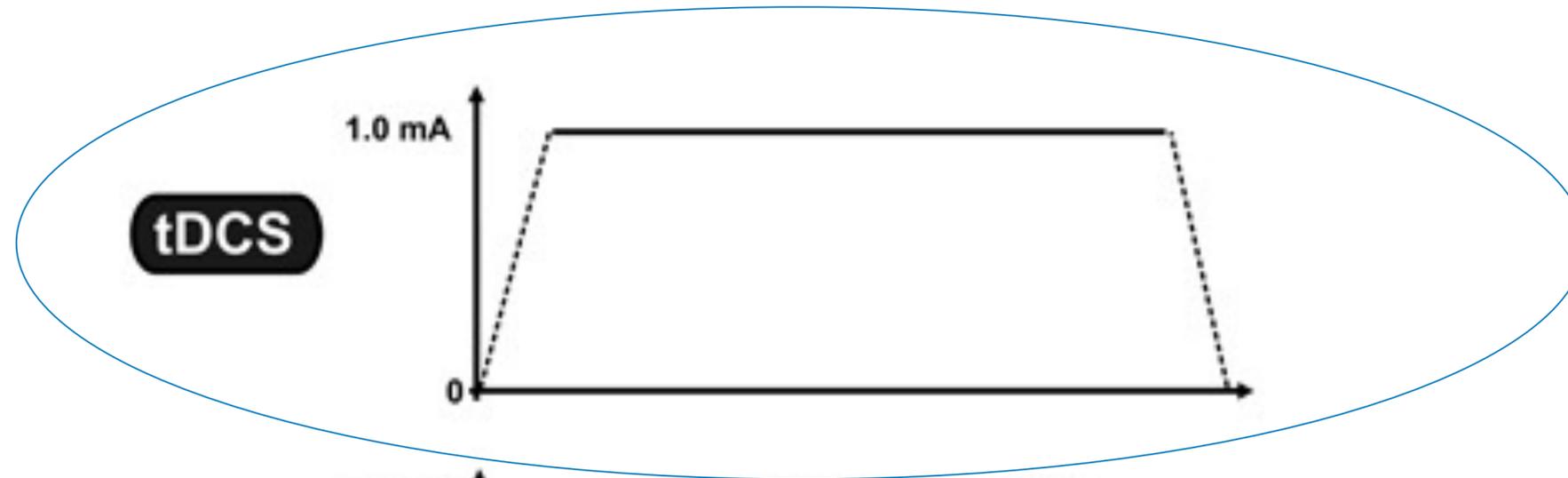


Transcranial Electrical Stimulation (TES)



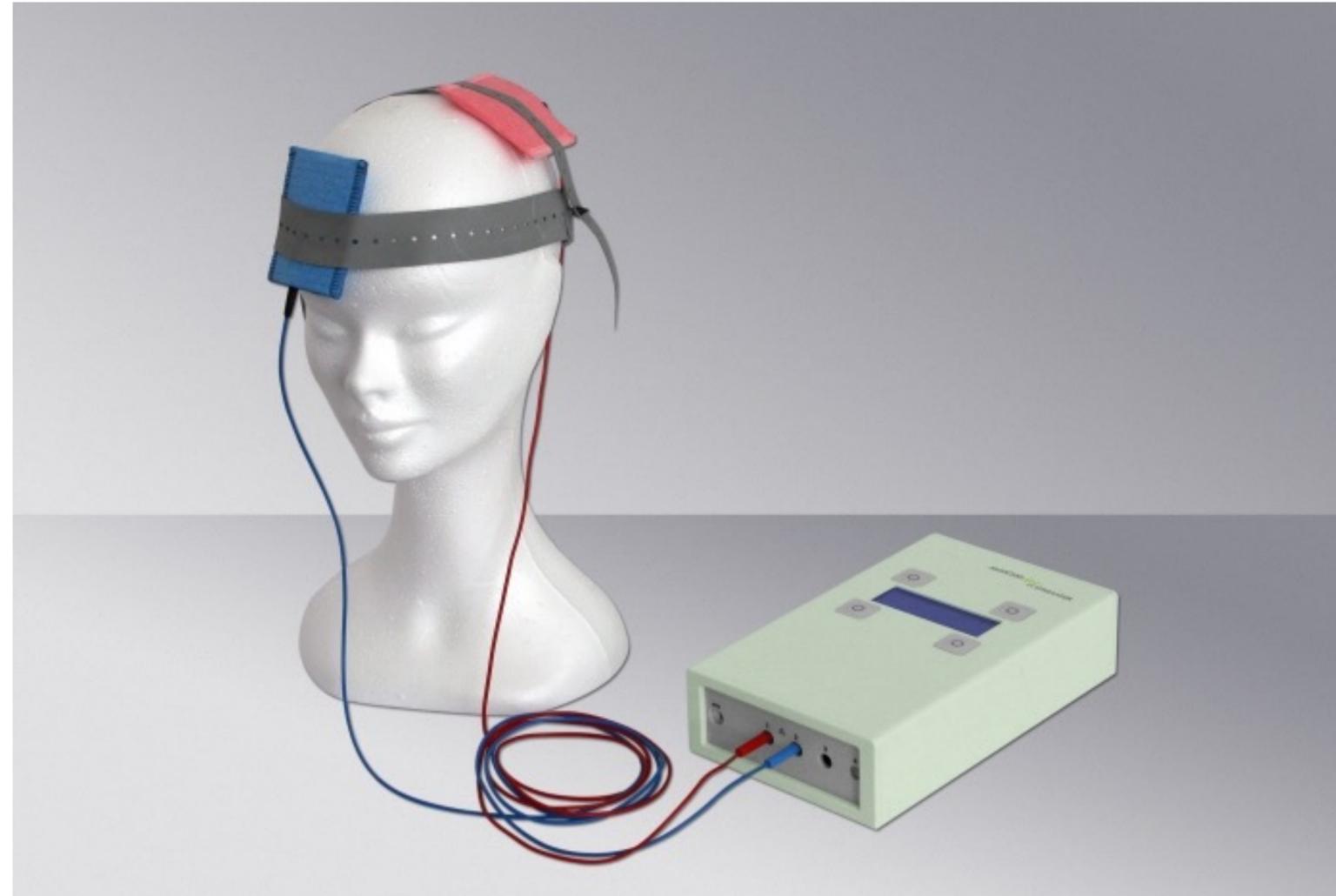


TES

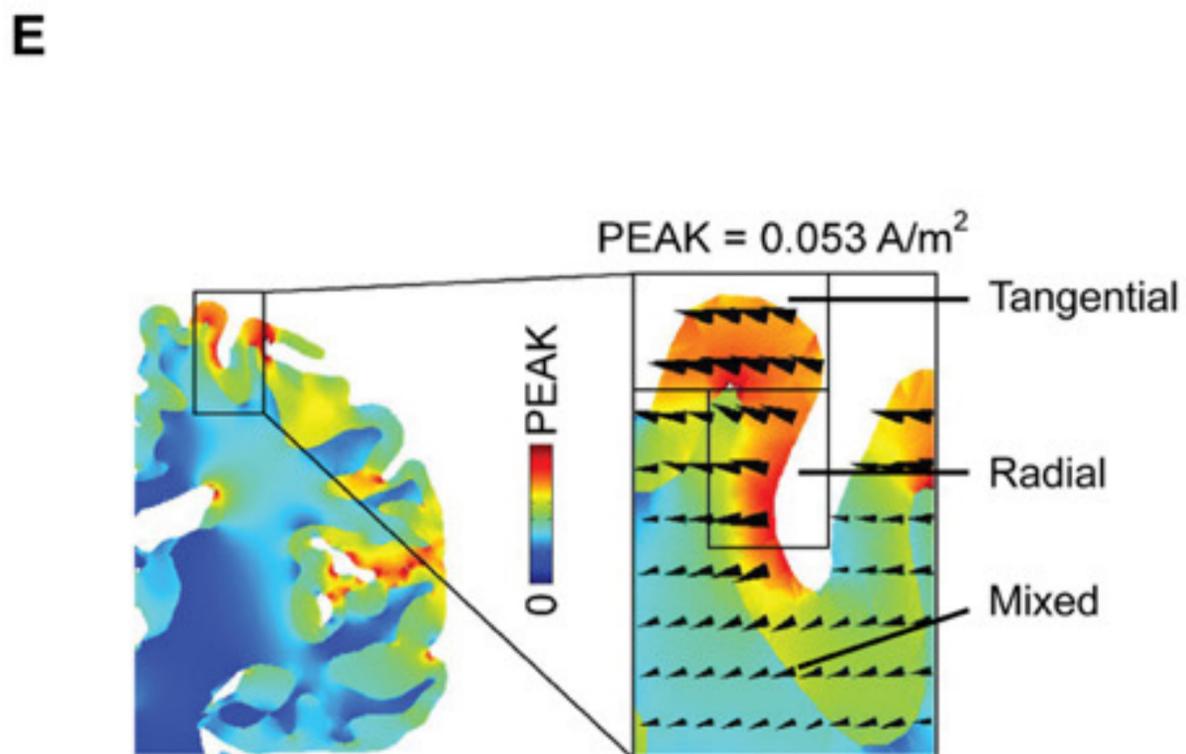
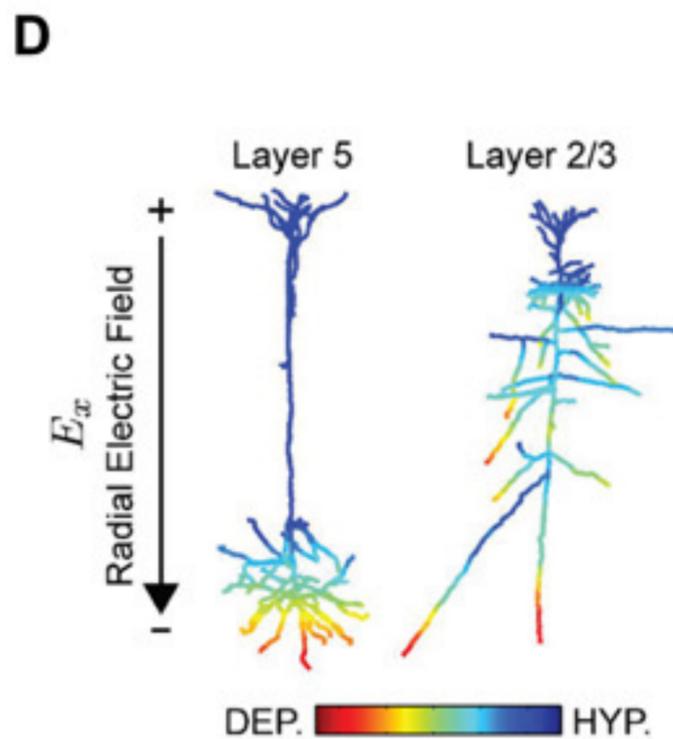
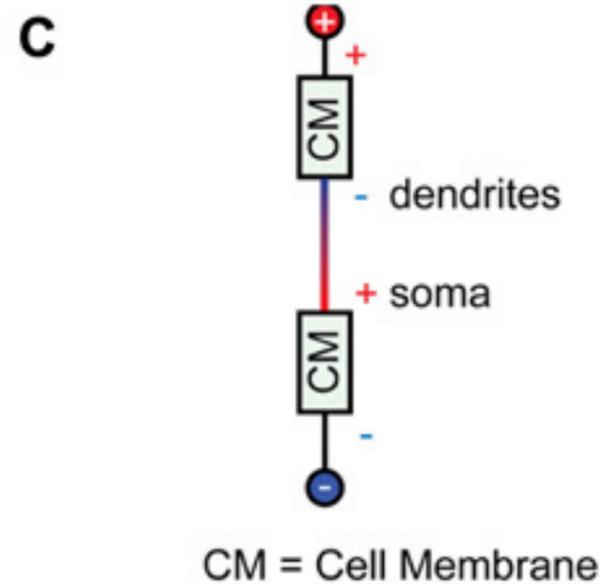
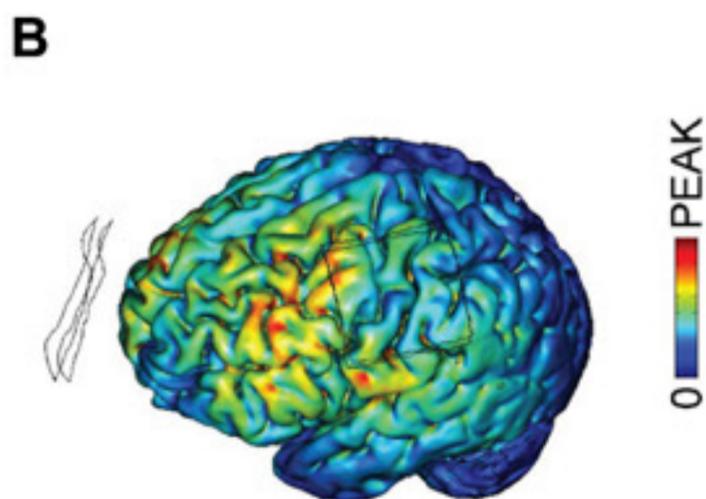
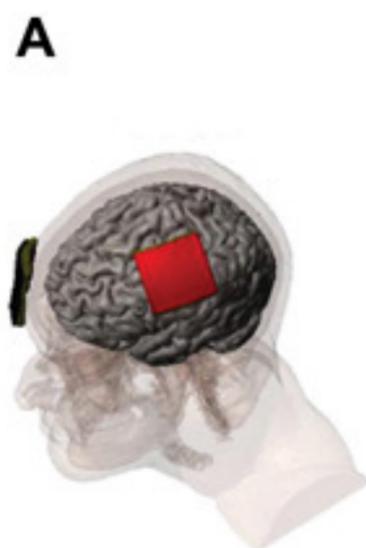




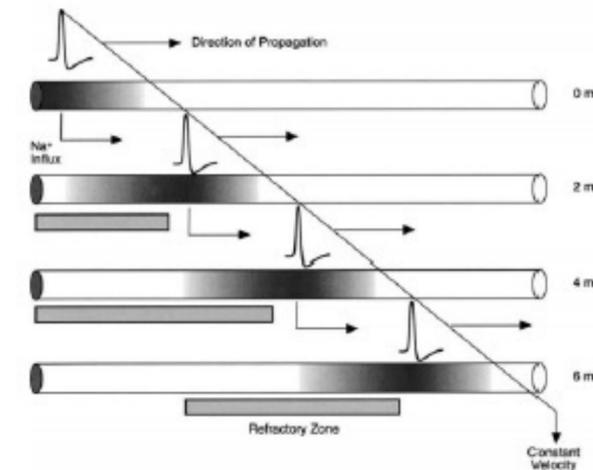
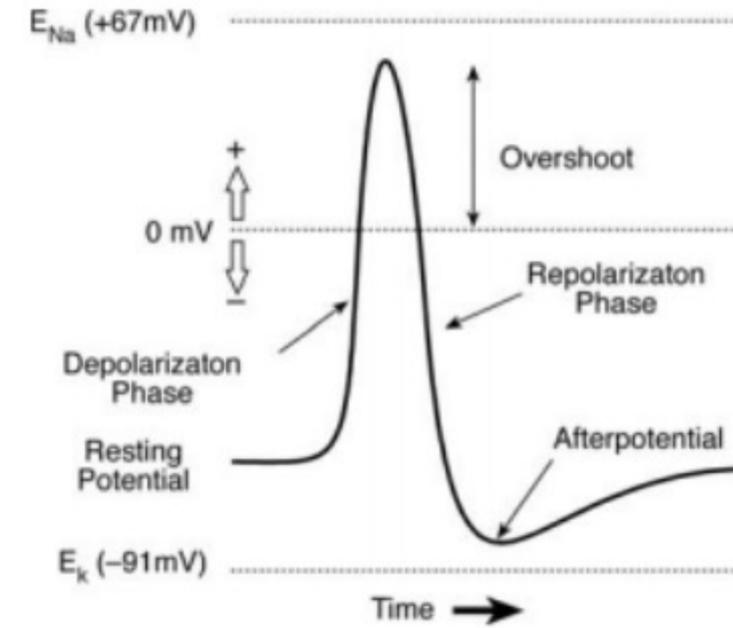
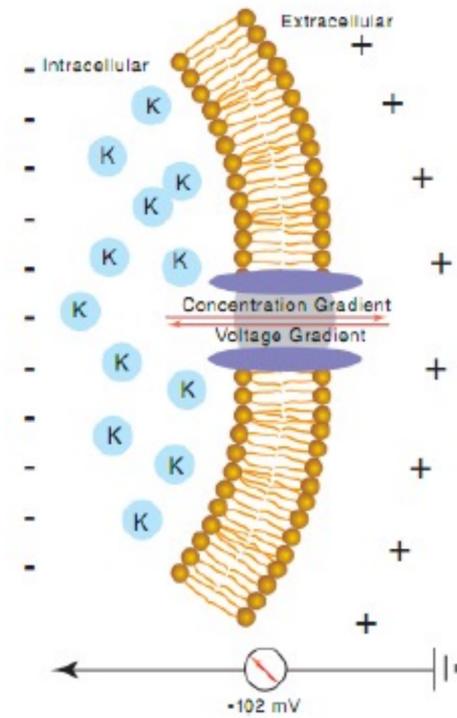
Transcranial Electrical Stimulator (TES)



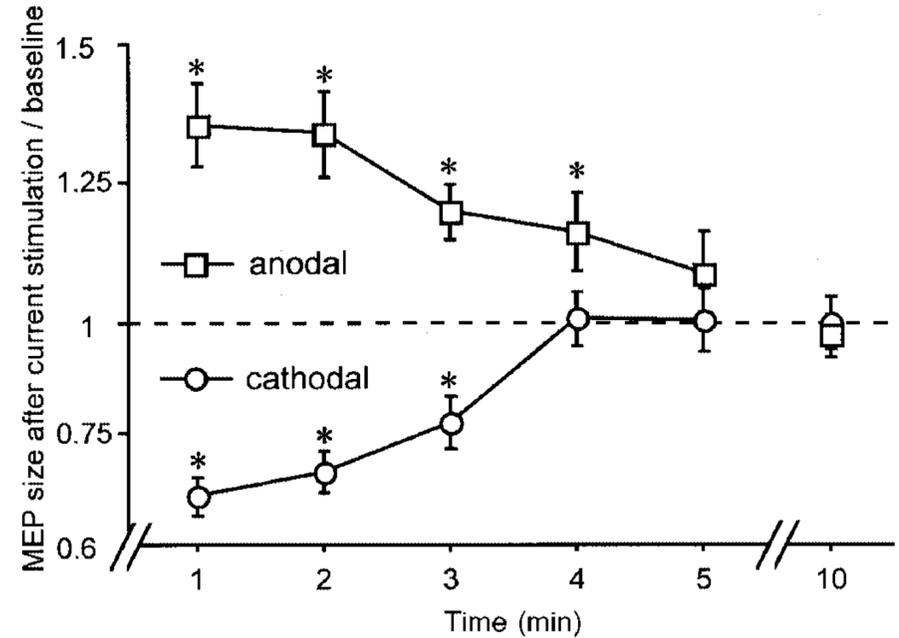
tDCS



Changing membrane resting potential

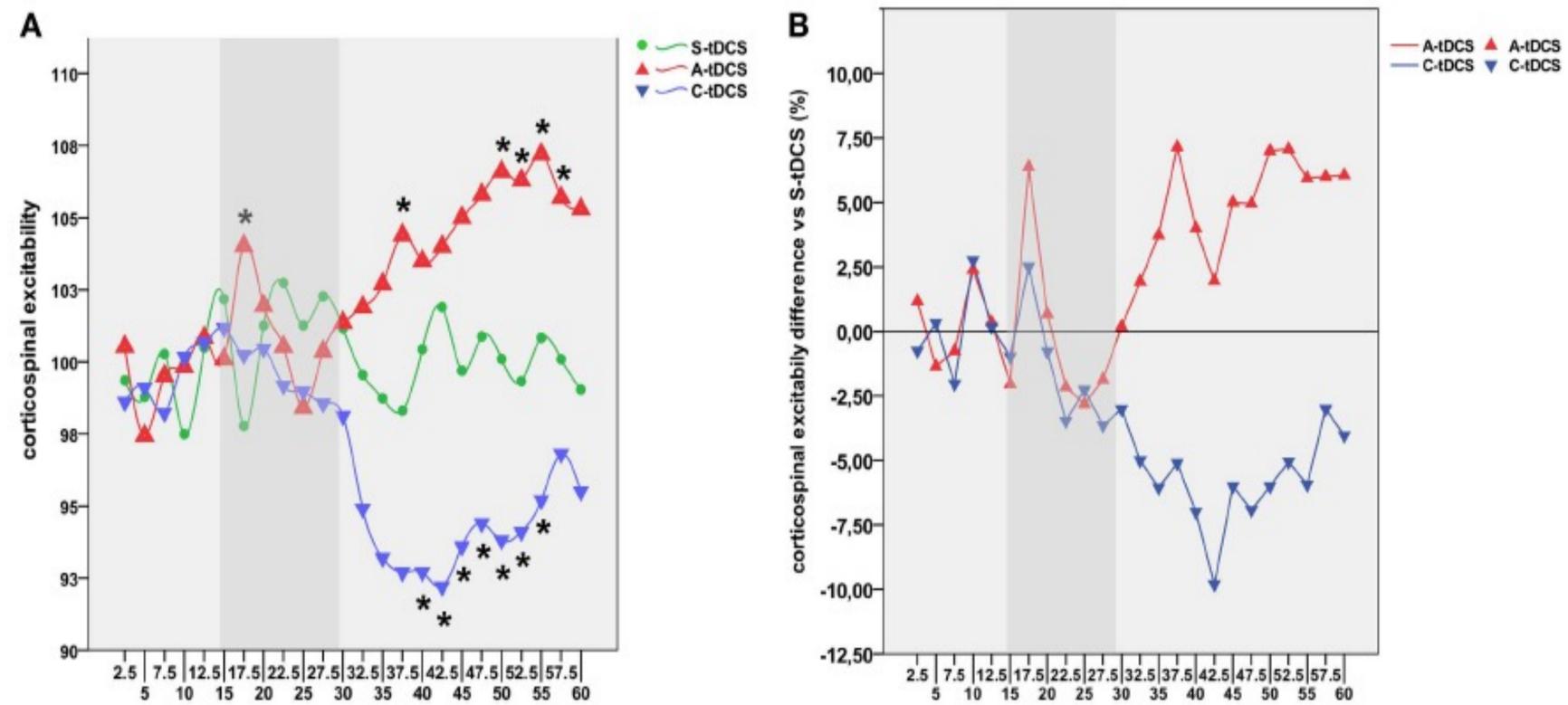


Offline effects

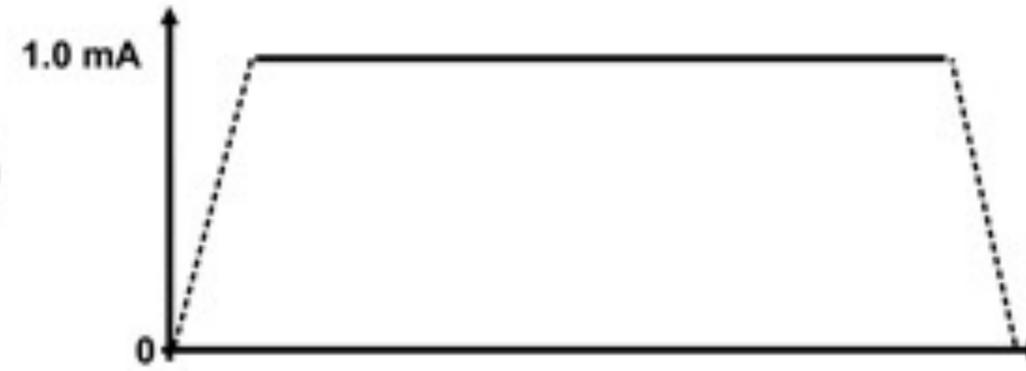


Nitsche and Paulus, 2000

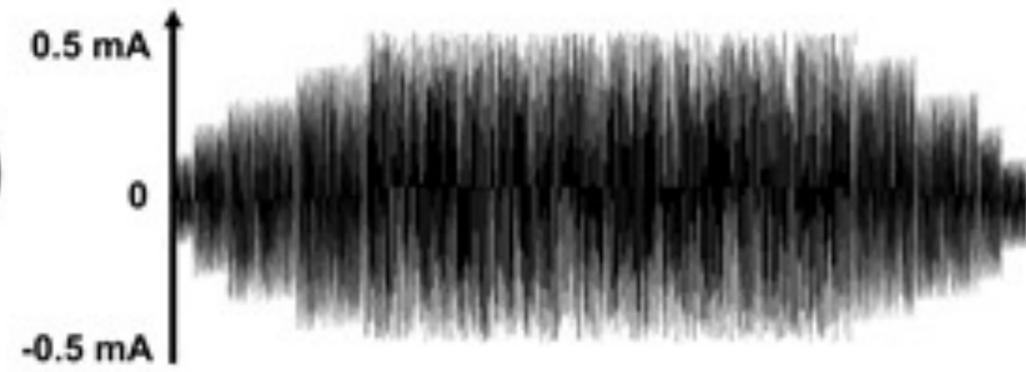
Santarnecki et al., 2014



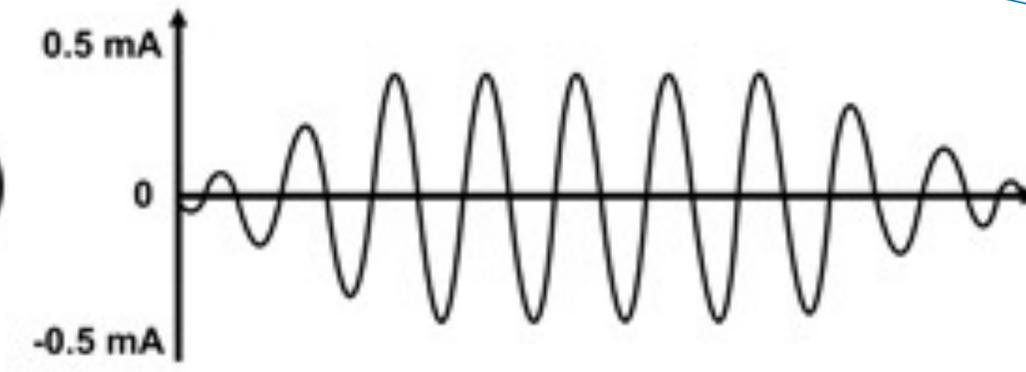
tDCS



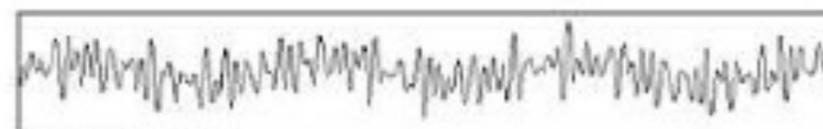
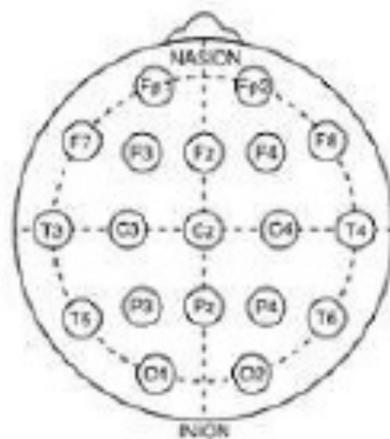
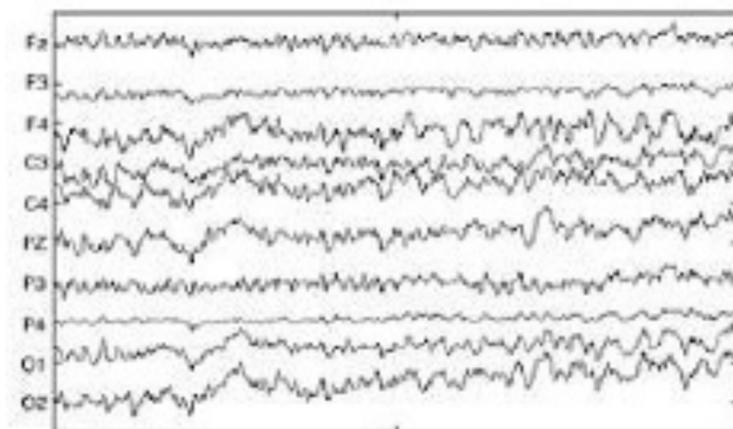
tRNS



tACS



Courtesy of Ruairidh McLennan Battleday



Gamma (30 - 100 Hz)



Beta (12 - 30 Hz)



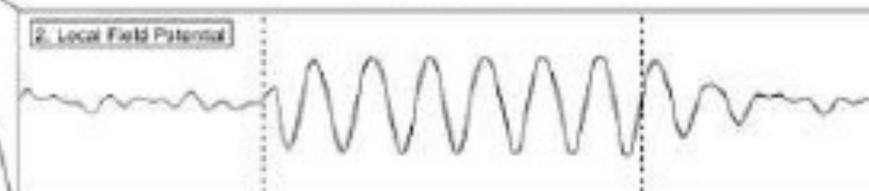
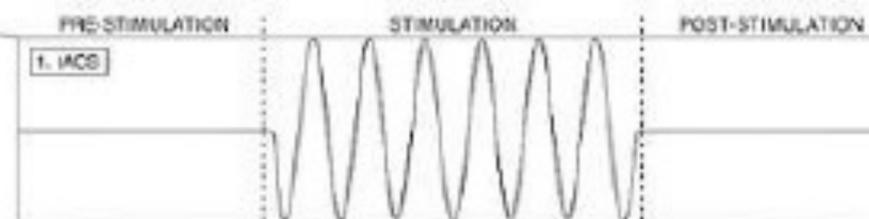
Alpha (8 - 12 Hz)

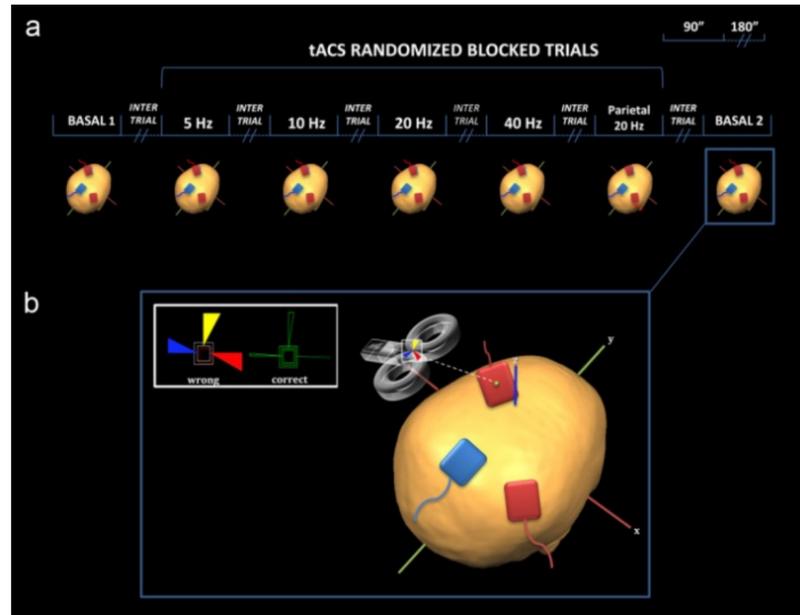


Theta (4 - 8 Hz)



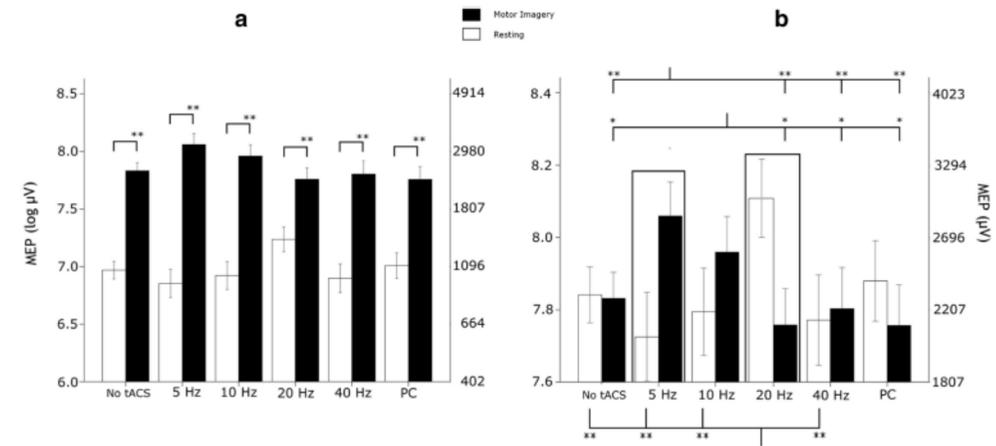
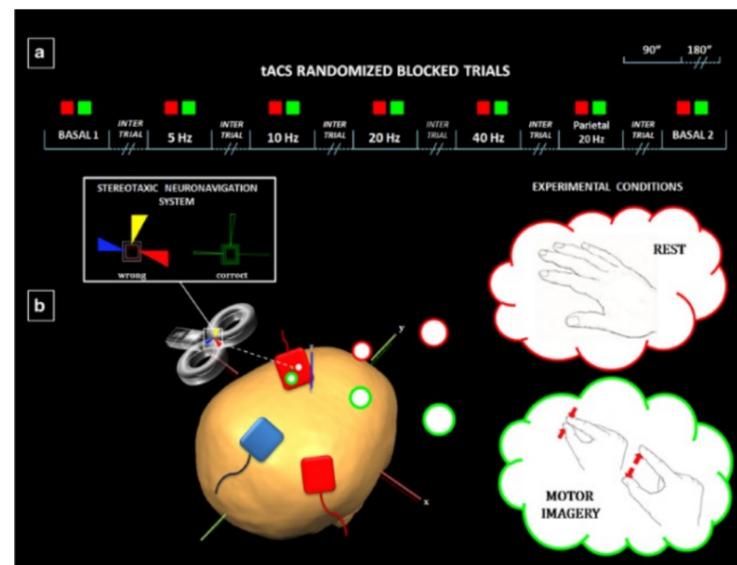
Delta (0.5 - 4 Hz)



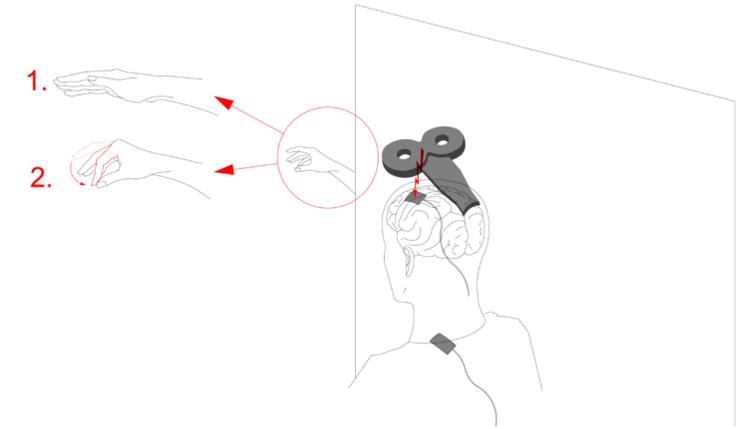


Feurra et al., 2011.

Shpektor et al., 2017.

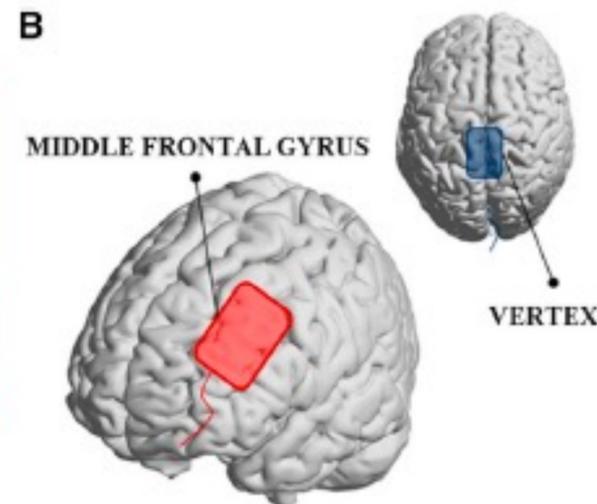
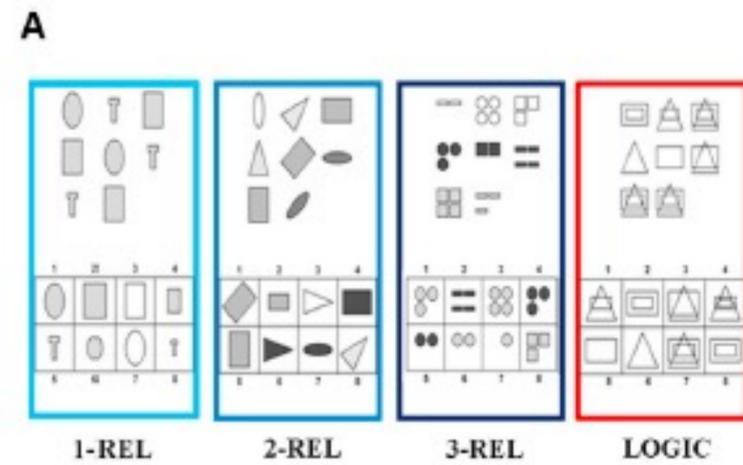


Feurra et al., 2013.

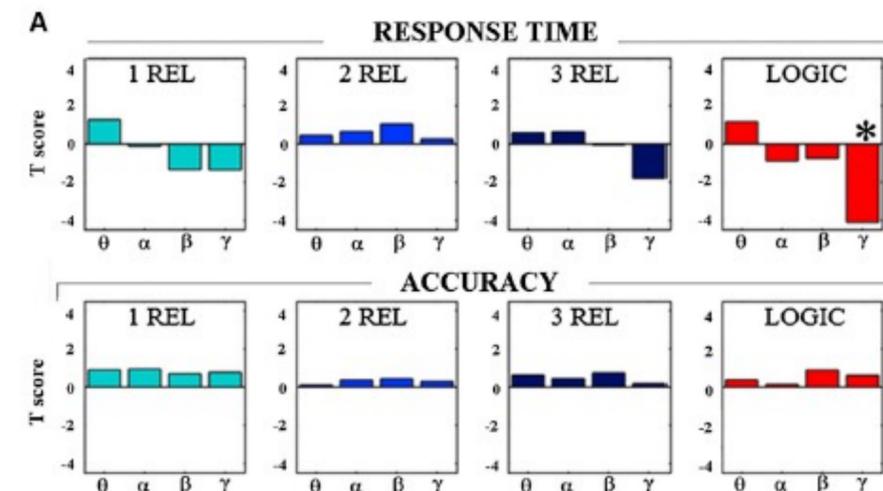


Feurra et al. 2019

	θ	α	β	γ	S
AO					
R					

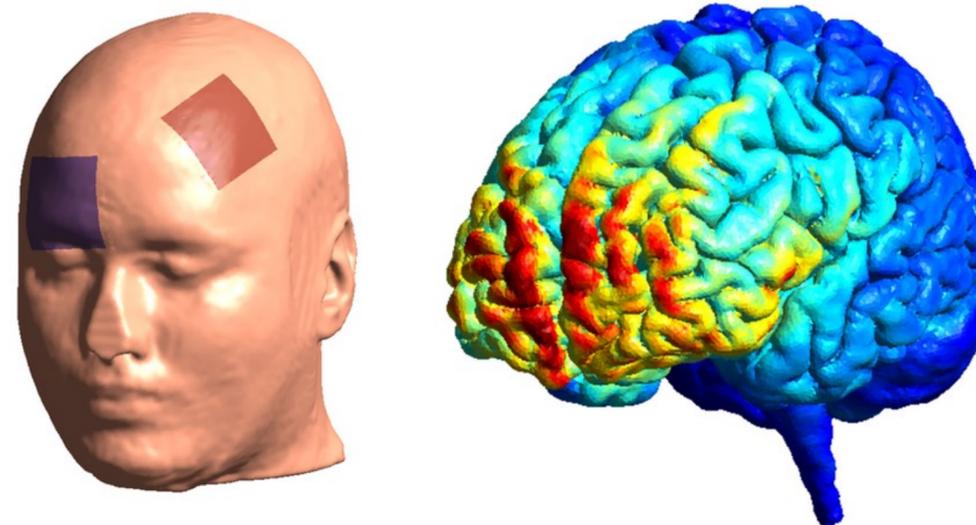


Santaracchi et al., 2013.

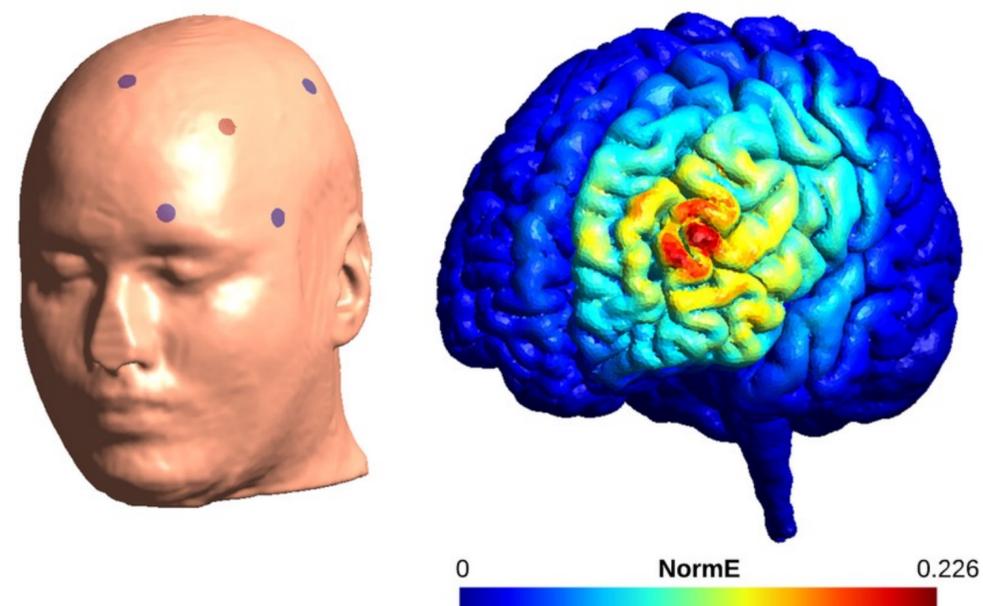


High Definition VS Conventional tDCS

Conventional tDCS



HD-tDCS

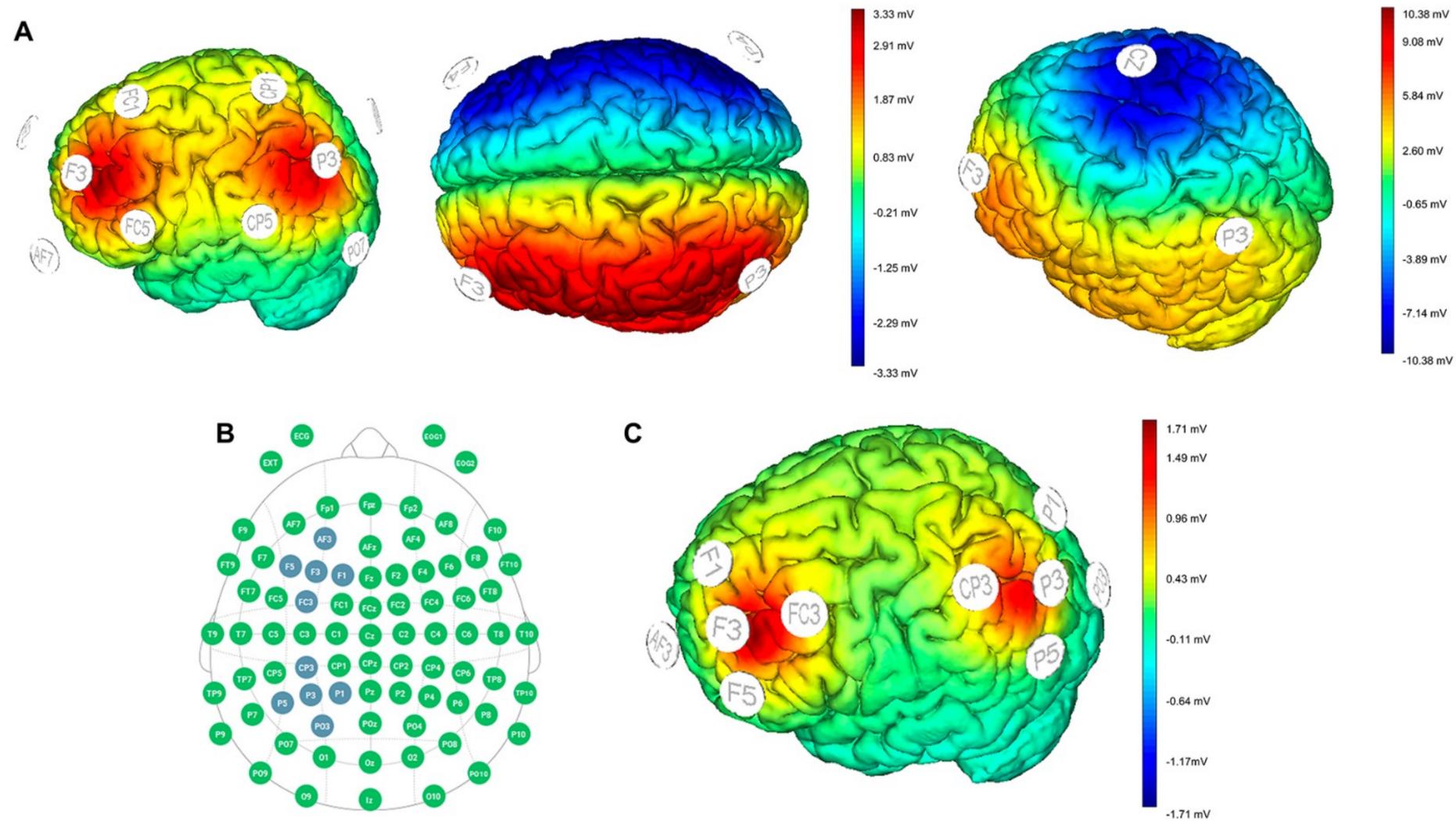




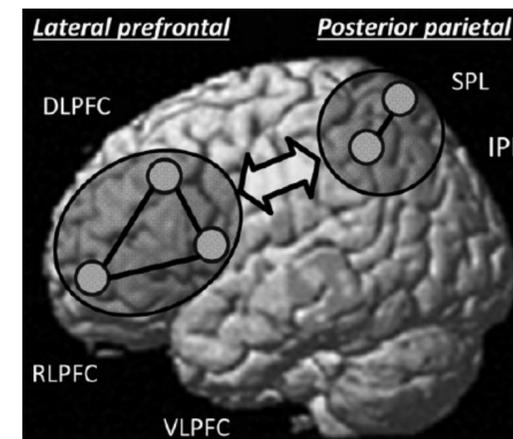
Fronto-parietal brain network plays a crucial role in working memory capacity during complex cognitive task

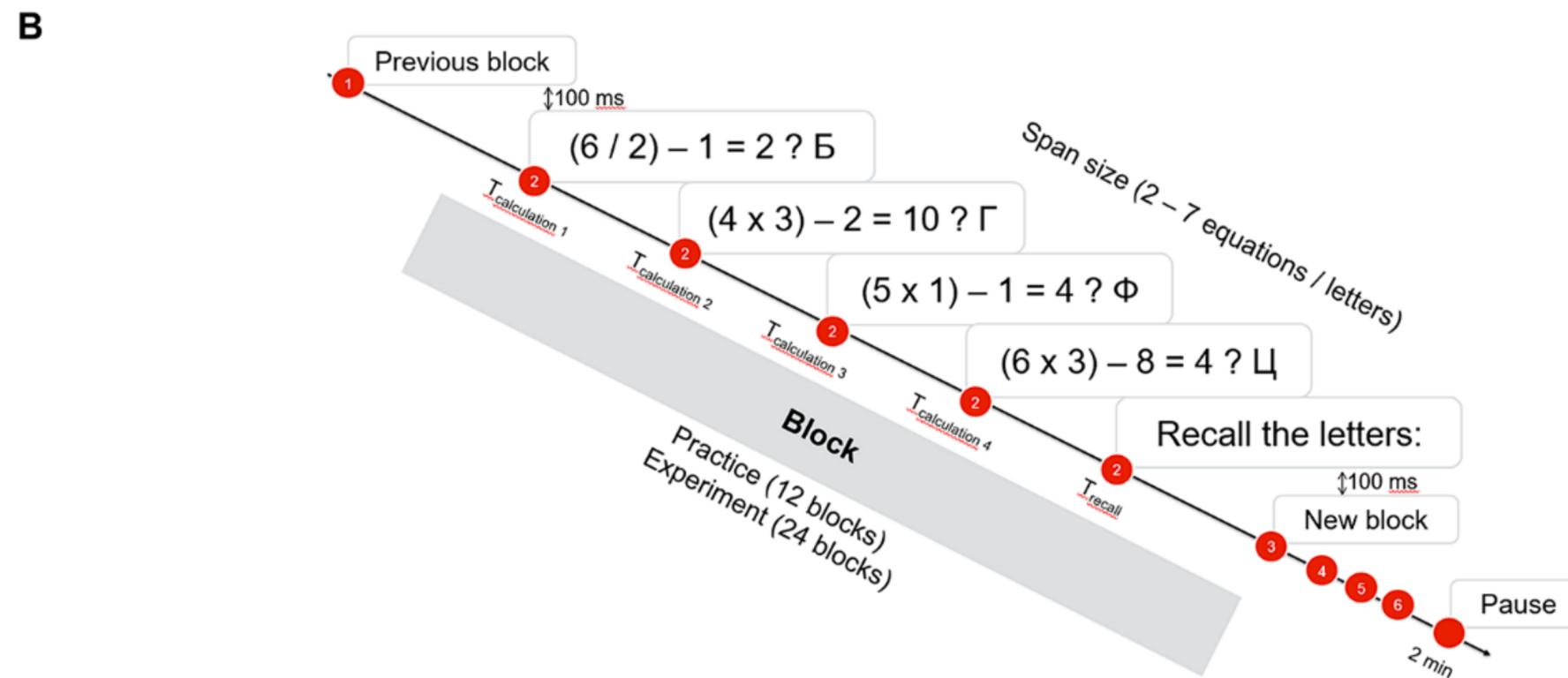
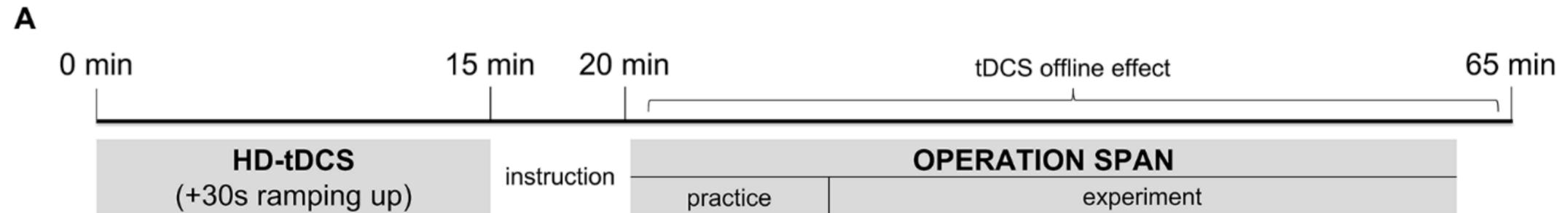


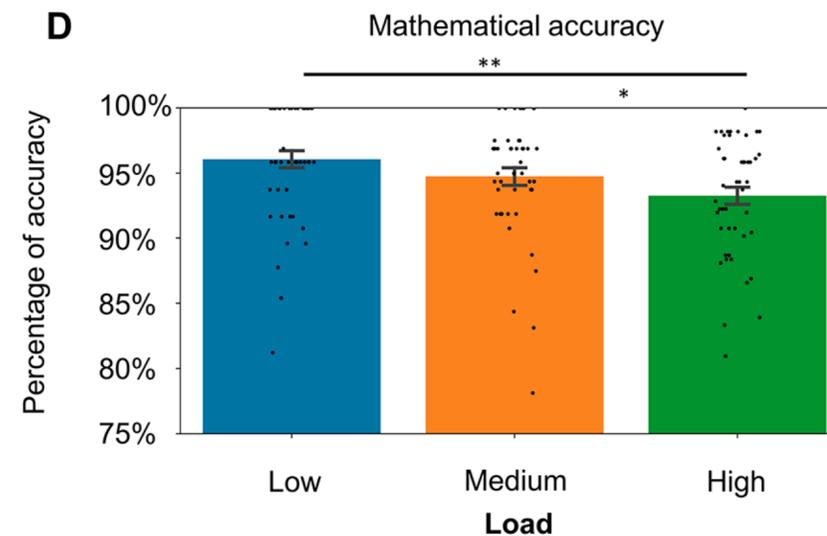
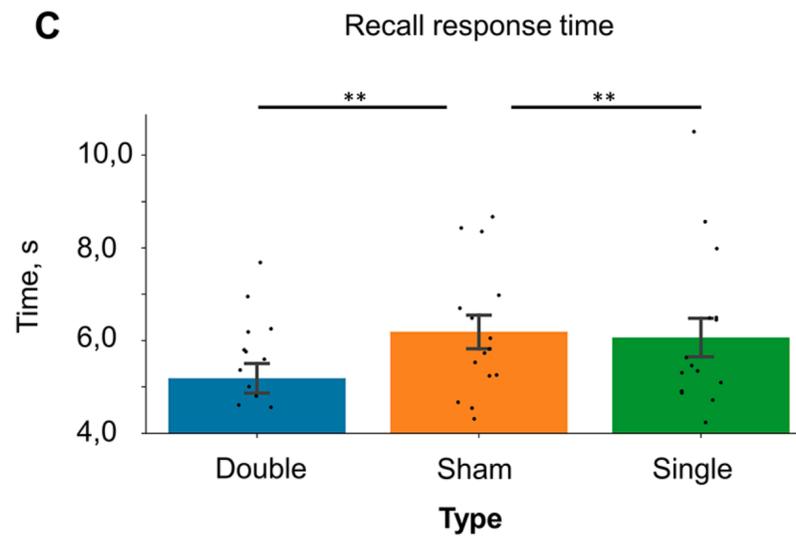
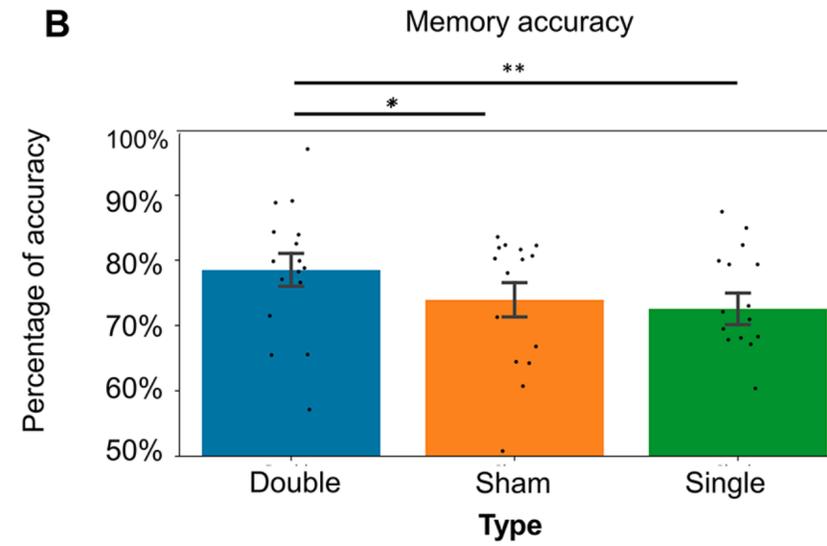
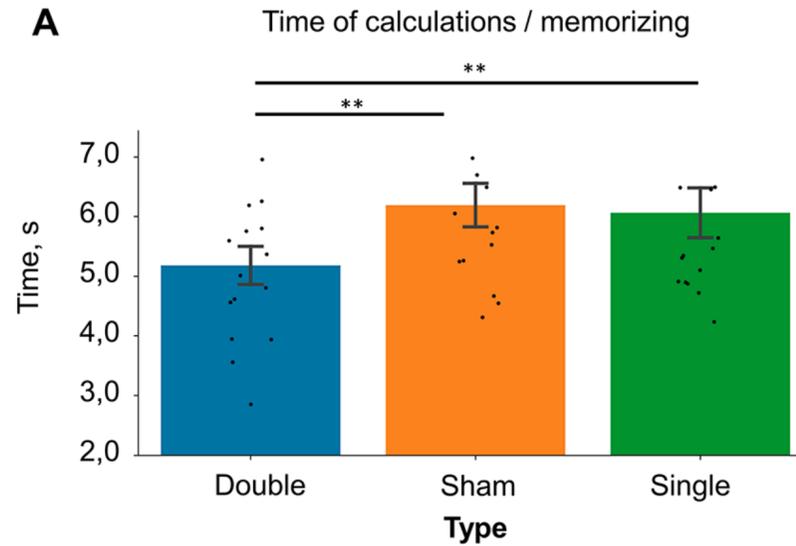
NATIONAL RESEARCH UNIVERSITY



Otstanov et al. 2024







The results emphasize the differential contributions of the Frontal Parietal Network (FPN) and underscore the significance of boosting network synchronization for Working Memory (WM) performance during complex WM tasks.

Overall, this study highlights the novelty and effectiveness of concomitant stimulation of the FPN in enhancing WM performance.



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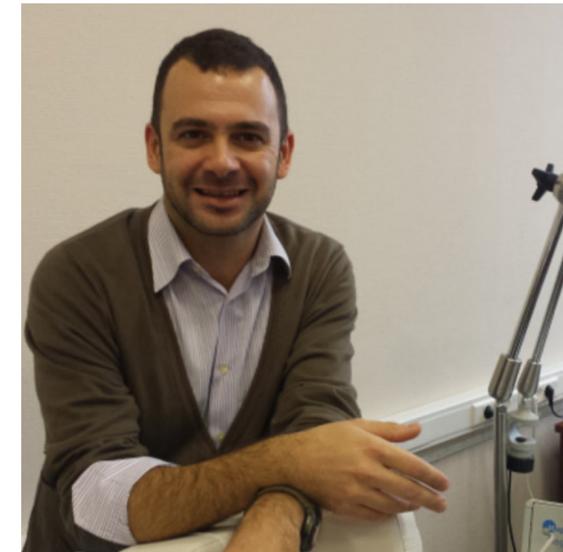
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Thanks for your attention

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