Transcranial Alternating Current Stimulation highlights the role of midfrontal theta oscillations in performance monitoring during human-avatar motor interactions

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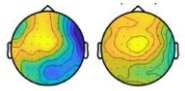
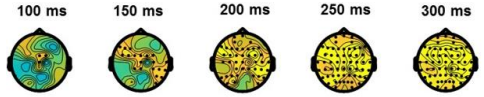
Objective: investigating the causal role of **midfrontal theta power** enhancement related to **performance monitoring** observed in previous EEG studies on human-avatar motor interactions.

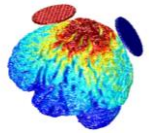
Moreau et al., 2020 *Cortex*



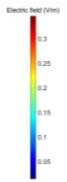
Moreau et al., 2021



Methods



Modelling of electric fields using ROAST (Huang et al., 2019)

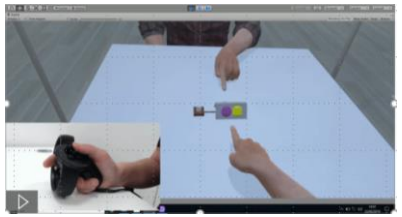


Extraction of individual theta and beta frequency from resting-state EEG

EEG-informed tACS

Immersive VR motor interaction task

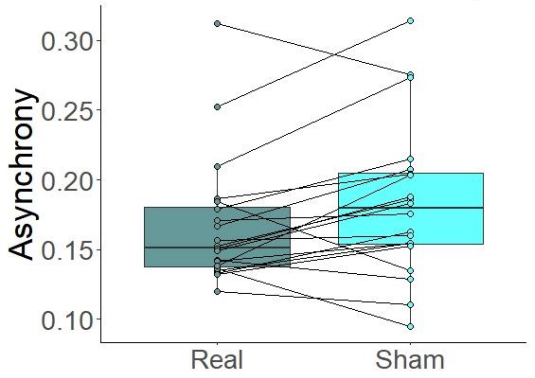
Experiment 1	Experiment 2
20 participants	20 participants
Theta tACS (mean Hz = 5.5 ± 0.65) + Sham	**Beta** tACS (mean Hz = 17.6 ± 2.5) + Sham
Intensity: 2 mA – FCz-Pz Duration: 9 minutes per block (4 blocks)	



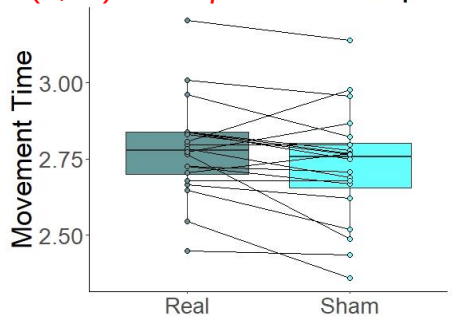
Motor Interaction task: **touch the target as synchronously as possible with the virtual partner.**
Conditions: Interactive/Cued, Imitative/Complementary, Correction/NoCorrection

Results

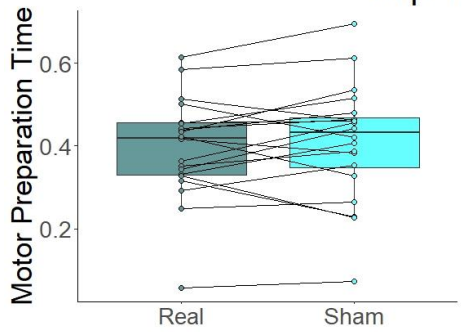
F(1,19) = 5.99 p = .024 Exp 1



F (1,19)= 5.76 *p* = .027 Exp 1



F (1,19) = 4.86, *p* = .040 Exp 1



No significant effect of **beta** tACS in Exp 2

theta tACS (Exp 1)

- **asynchrony**
+ **movement times**
- **reaction times**

Discussion: Theta tACS **improved task performance**, possibly by hyperactivating the performance monitoring system and promoting proactive cognitive control. The entrainment of midfrontal theta oscillations by means of individualized theta tACS might thus represent a viable tool for facilitating dyadic motor interactions in healthy (e.g. sports, videogames) and clinical (e.g. apraxia) groups.

References: Midline frontal and occipito-temporal activity during error monitoring in dyadic motor Interactions (Moreau et al., 2020, Cortex); The monitoring system is attuned to others' actions during dyadic motor interactions (Moreau et al., 2021, BioarXiv). Contact: sarah.boukarras@uniroma1.it