THE NEUROMODULATION OF SOCIO-COGNITIVE CONFLICTS

Gabriele Fusco[1,2], Biagio Dell'Omo[1,2], Francesca Nobiloni[2], Giorgia Ponsi[1,2], Vanessa Era[1,2] & Salvatore Maria Aglioti[1,2]

[1]Sapienza University of Rome and Center for Life Nano- & Neuro-Science, Italian Institute of Technology, Italy; [2]IRCCS Santa Lucia Foundation, Rome, Italy; [3]School of Advanced Studies, Center for Neuroscience, University of Camerino, Italy

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Background: The anterior cingulate cortex (ACC) detects conflicts and errors in information processing and signals the need for flexible behavioural adjustments through theta-band (4–8 Hz) oscillatory inputs to the dorsolateral prefrontal cortex (DLPFC) that in turn exerts top-down control over task-relevant information. The efficiency of these monitoring and control mechanisms may be shaped by psychological, socio-cultural, and political dispositions, which bias cognitive style and conflict sensitivity.

Aims: By delivering transcranial alternating current stimulation (tACS), we aimed to causally modulate the activity of two key cortical nodes involved in performance monitoring (ACC) and cognitive control (DLPFC) while participants process representational conflicts driven by political or religious cues.

Methods: In two pre-registered, sham-controlled studies (Exp1, Exp2), we applied in-phase and anti-phase theta-tACS to modulate ACC–DLPFC dynamics, leveraging the phase-dependent effects of tACS. Exp1 included a preliminary sample of 42 participants (23 liberals; 18 conservatives; final planned sample: 25 per group), who performed a Gaze Following task involving Italian right- vs left-wing political (e.g., Prime Minister Giorgia Meloni, Elli Schlein leader of opposition) and non-political characters. Exp2 included believers (Catholics, $N = 15$) and non-believers (Atheists, $N = 17$; final planned sample: 25 per group), who completed two Flanker tasks with stimuli representing either sacred faces (e.g., Jesus) or Italian public figures.

Preliminary Results: Preliminary findings indicate that, in Exp1, anti-phase theta-tACS (relative to sham) enhanced oculomotor performance in conservative participants, increasing their accuracy in congruent gaze-following trials involving both right- and left-wing targets. In Exp2, no stimulation-related effects emerged among believers. In contrast, in non-believers, active tACS (relative to sham), irrespective of phase, improved performance in resolving incongruencies, only in the Religious version of the Flanker task.

Conclusions: Our preliminary results suggest that theta-driven neuromodulation affects performance monitoring dynamics and response strategies as a function of individuals' political and religious orientation. However, to date, no clear phase-dependent effects were observed, indicating that the hypothesized modulation of ACC–DLPFC connectivity via in-phase versus anti-phase stimulation remains to be established.

Keywords: Theta Transcranial Alternating Current Stimulation (tACS), Neuropolitics, Neuroreligion

E-mail contact: gabriele.fusco@uniroma1.it