How does consciousness work in real life?

ABSTRACT:

Background
It takes a fraction of a second to recognize a person or an object even when seen under strikingly different conditions. However, how such a robust, high-level representation is achieved by neurons in the human brain is still unclear. In particular, the way that neurons encode different percepts is one of the most intriguing questions in neuroscience.

Aims
In this project, we aim to investigate the activity of neural populations in humans during conscious perception tasks involving realistic stimuli. More specifically, we aim to characterize the differences between the brain responses to static and time-varying (and thus more realistic) visual representations of consciously perceived concepts.

Method
We designed task paradigms and developed a methodological pipeline based on human intracranial recordings to localize and quantify brain time course responses to consciously perceived stimuli (human faces) of static and dynamic modality.

Results
We found significant brain responses in regions from occipital, temporo-parietal and frontal lobe in 3 subjects, which characterized the visual processing pathway as a function of time during static face recognition. Moreover, we identified a depression of the neural population activity (mostly correlated with high-frequency broadband responses) in regions of the medial temporal lobe when faces were viewed within a dynamic context.

Conclusions
This work systematizes existing methodology to localize neural population activity measured with intracranial EEG during cognitive tasks and explores the specificities of these neural activations when conscious recognition takes place under a more realistic setting than static object viewing.

Keywords

Consciousness, Perception, Intracranial recordings, Dynamic stimuli

Published Work:

Tauste Campo, A. (2020). Inferring neural information flow from spiking data. *Computational and Structural Biotechnology Journal*, 18, 2699-2708. doi: 10.1016/j.csbj.2020.09.007

Vila-Vidal, M., Khawaja, M., Carreño, M., Roldán, P., Rumià, J., Donaire, A., Deco, G., & Tauste Campo, A. (2022). Assessing the coupling between local neural activity and global connectivity fluctuations: Application to human intracranial electroencephalography during a cognitive task. *Human Brain Mapping*, 10.1002/hbm.26150. Advance online publication. doi: 10.1002/hbm.26150

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