Subcortical correlates of first and second order consciousness

How does neuronal activity give rise to our conscious experience of the outside world? One scientific approach to this question is to compare conscious and unconscious brain activity in order to find the so-called neural correlates of consciousness (NCC). During the last 30 years, our understanding of cortical correlates of consciousness has improved, but only few researchers have looked into subcortical structures. This project aims at assessing the causal influence of basal ganglia and thalamus on behaviour and electroencephalography (EEG).

To do so, we will rely on the opportunity to stimulate these structures in neurological or psychiatric patients undergoing deep brain stimulation (DBS), and measure the corresponding changes using EEG. We will compare behaviour and cortical correlates of consciousness (recorded with EEG) while DBS is turned either ON vs. OFF.

We are currently developing a paradigm to systematically compare situations in which a conscious percept occurs with closely matched situations in which it does not (i.e., unconscious processing). Since the clinical targets we have for DBS are sensorimotor territories, we will use a tactile detection task in which participants are presented with weak stimuli around the threshold for detectability. Participants will be prompted to respond whether they perceived the stimulus (i.e., first-order response: yes/no), and how sure they are in their response (i.e., second-order response). Peristimulus neural responses will be grouped in hits (“yes”) and misses (“no”) as well as in high confidence and low confidence. Comparisons of neural activity between hit and miss trials will allow distinguishing conscious. False alarms will allow studying perceptual hallucinations, a case of conscious experience independent from sensory stimulation. In addition, correlation between neural signals and confidence judgments in the second order task will be used to show the contribution of subcortical structures to metacognitive judgments.

The selected candidate will develop experimental paradigms, collect behavioral and electrophysiological data, analyze and interpret data. Applicants should have skills in computer programming, statistics, and/or signal processing (Matlab, R, or Python).

Applicants should speak basic French, or be willing to learn rapidly in order to interact with participants. Applicants with a background in engineering, computer science, or physics are also encouraged to apply.

The work will take place at the Laboratoire de Psychologie et Neurogognition in Grenoble.

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