Title: CONSCIOUSNESS

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Grants
FET flagship Human Brain Project-SGA2, WP 8.8
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Abstract:
Why are some sensory stimuli consciously detected, whereas others remain subliminal? What is the relation between consciousness and cognition?

We measure the differences between stimuli that do and do not enter into consciousness across brain structures (cortical and subcortical) with electrophysiology comparing the activity between humans (EEG and fMRI) and animal models tested by HBP partners (rodents and monkeys), relying - where possible - on similar tasks and paradigms across species. We will, for the first time, also compare brain structures that are involved in phenomenal awareness and conscious access, which can only be achieved in monkeys and higher species with similar reporting capacities. We will address the question of how sensory stimuli cause special, "resonant" brain states that enable phenomenal awareness and conscious access to the information for longer periods of time, with a strong relationship to the topic of apical dendritic amplification.

In humans undergoing simultaneous LFP and high-density scalp EEG recordings, we will link the phenomenological effects of median nerve stimulation as well as of single pulses and trains of intracortical electrical stimulation of different cortical nodes to the overall spread and complexity of brain responses. We will relate the cortical responses to perturbations of neuronal activity to levels of consciousness and also stimulate the nodes, whose stimulation gives rise to conscious experiences, during sleep.

The brain response to perceived vs unperceived stimuli does not follow an all-or-nothing rule. Unperceived stimuli activate several cortical areas recruited by consciously perceived stimuli, but with a different time course, generally shorter and simpler. By means of intracerebral recordings in humans (stereo-EEG), we will investigate the difference between the cortical processing of consciously perceived vs unperceived tactile stimuli, documenting the fine-grained spatiotemporal dynamics of cortical activity sustaining the conscious access to tactile information. In parallel, by administering tactile stimulation in patients during both wake and sleep, we will further explore the interconnection between specific temporal features and consciousness instantiation. We will also adopt a tactile variant of a no-report paradigm that will allow us to distinguish between brain structures involved in phenomenal awareness and conscious access in human.

Skills/technology: intracranial recordings; modelling; data science; translational neuroscience, psychophysics.
**Publications**


