## *UNIL PhD fellowship, PhD topic proposition*

**Title: Encoding of global auditory regularities in unconscious states**

Background

After listening to regular auditory sequences, unexpected sounds elicits a neural response as measured by electroencephalographic (EEG) recordings. Neural correlates of regularity violation detection can occur in unconscious states and typically, when it consists of single sound repetition. In regularities based on the repetition sounds sequences (i.e. AAAAB), 'global' regularity encoding implies a memory trace over the temporal scale of the group. Research on global regularity encoding in comatose and disorders of consciousness patients leaves unresolved whether it requires conscious access to auditory stimuli.

Objective

We aim at measuring the neural correlates of global regularity encoding in comatose patients to evaluate whether it can occur in the absence of consciousness. The second aim is to assess the sensitivity of high versus low-density EEG setup.

Method

We hypothesize that global violation detection can occur in comatose patients i.e. with no conscious access to auditory stimuli. Following our study (Tzovara et al & De Lucia Brain 2015) based on low-density EEG recordings, we estimated a sample size of thirty patients, for detecting evidence of global detection in one third of patients. We will recruit patients after cardiac arrest during the first day of coma, deep unconscious patients as estimated by clinical scales. While recording 63 channels EEG, we will administer auditory sequences following the 'local-global' paradigm. In an exemplar sequence, global standard and global deviant sounds will consist of the group AAAAB and AAAAA respectively, with A and B being short and long duration tones.

We will assess global regularity encoding at the single patient level though a multivariate decoding analysis using 63 channel data and 19 channel downsampled data. We expect significant decoding accuracy when classifying single-trial EEG responses to global standard and global deviant sounds in at least one third of our patients and potentially more with the 63-channel dataset. Throughout the process, we will follow open research and registered reports guidelines.

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