Characterizing metacognitive processes using EEG and psychophysics

How do we know whether our cognitive representations correctly depict the outside world? This question refers to metacognition, that is, the cognitive ability to monitor one's mental processes, or more broadly cognition about cognition. One scientific approach to address this question is to compare first-order judgments – related the external world (e.g. Have you seen something?) – and second-order judgments – related to internal processes (e.g. How confident are you about your previous judgment?). Metacognition can thus be assessed by quantifying how well second-order judgements match with first-order judgments, from which we derive a meta-performance index.
However, mechanistic accounts of metacognition are still under debate. Metacognition can be conceived as a unique process which receives inputs from each cognitive module (i.e. the domain-general hypothesis), or instead conceived as multiple distinct processes which operate locally within each cognitive module (i.e. the domain-specificity hypothesis).

In this project, we aim at providing further evidence to clarify this debate. We are currently developing a paradigm to systematically compare meta-performance among two distinct cognitive domains, namely perception and memory. Participants are presented with visual stimuli (human faces) endowed with varying signal amplitude. In the perception task, the signal amplitude is the intensity of the stimulus relative to a noisy background, whereas in the memory task the signal amplitude is derived from the lag between the first presentation of the target stimulus during encoding and the second presentation of it during the test phase. In the perception (resp. memory) task, participants are then prompted to respond whether they perceived (resp. recognized) the stimulus (i.e., first-order response: yes/no), and how sure they are in their response (i.e., second-order response).

At the behavioural level, we will compute correlations between meta-performance indices in the memory and perceptual domains. At the neurophysiological level, we will use EEG to identify the cortical areas encoding confidence in perception and memory similarly (domain-general hypothesis), or distinctively (domain-specificity hypothesis).

The selected candidate will fine-tune the experimental paradigm, collect behavioural and electrophysiological data, analyse and interpret data. Applicants should have skills in computer programming, statistics, and/or signal processing (Matlab, R).

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 Neurocognition in Grenoble.
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