Neural geometry of temporal rescaling during the manipulation of durations

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Main aim: The proposed M2 internship (6 months) will investigate the neural geometry underlying duration comparison. The project is funded by an ERC SyG 101167367 CHRONOLOGY.

Background:

Time perception is a fundamental cognitive function that allows humans to interact efficiently with their environment, yet it does not rely on a dedicated sensory organ. Instead, time is internally constructed by the brain and is highly flexible, being shaped by context, memory, and expectations (Jazayeri & Shadlen, 2010; Matthews & Meck, 2014). Comparing durations requires the encoding and transformation of temporal information. Recent work (Grabot et al., 2026) suggests that, rather than comparing fixed representations, the perceptual system dynamically rescales temporal representations onto a shared internal axis, enabling efficient comparison across stimuli. This highlights a flexible and adaptive mechanism of temporal cognition, whose neural implementation remains largely unknown.

The aim of this internship is to investigate the neural correlates of this temporal rescaling process using an already acquired EEG dataset in which participants performed a duration comparison task. The project will focus on characterizing how temporal information is represented in neural activity and how these representations are transformed during comparison. To this end, neural geometry approaches will be employed (e.g. Meirhaeghe et al. 2021), to reconstruct low-dimensional neural state spaces from multivariate EEG signals. By analyzing the trajectories associated with different durations, the project will test whether neural representations are aligned or rescaled onto a common internal metric.

What is expected of the intern:

- Getting acquainted with the literature with a short-selective review
- Supervised analyses of EEG data using mne-python
- Deep learning network application
- Clean and documented coding
- Reporting of the analytical outcomes in English (article-format)
- Positive and dynamic attitude
- Good team player capable of autonomous thinking and learning

The intern will work closely under the supervision of two postdoctoral fellows and will report directly to the PI on a biweekly basis.

Keywords: duration perception, neural oscillations, autoencoders, neural trajectories
Methods: electroencephalography, MNE-python, deep learning

Requirements:

- Background knowledge in cognitive neuroscience, computational neuroscience.
- Background knowledge in neuroimaging and time-series data analysis.
- Programming experience or data analysis skills with MNE-python or fast-learning.
- Sufficient English ability for scientific reading, writing and oral communication.
- Knowledge in computational modeling or machine learning.
- (Plus) Experience with EEG or MEG experimentation.
- (Plus) Knowledge with deep learning libraries like PyTorch.

References:

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