Neural dynamics underlying discrete versus continuous perceptual decisions

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Perceptual decision making relies on the accumulation of sensory evidence before committing to a choice. Its most common paradigm in neuroscience is the visual binary categorization of noisy stimuli (e.g. discriminate left vs. rightward motion) (Gold and Shadlen, 2007), modeled with discrete attractor neural networks (Wang, 2002;)Prat – Ortega et al., 2021). We have recently extended this framework to continuous estimation tasks (e.g. estimating average stimulus direction) showing that continuous attractor models can perform optimal stimulus estimation in a certain parameter range whereas outside of it they show changes in their temporal weighting similar to those observed in humans (Esnaola – Acebes et al., 2022). Experimentally, however, little is known about the differences in the accumulation process towards a continuous versus a categorical estimation.

To shed light on this question, we have designed a psychophysical task that requires human participants to either perform a categorical or a continuous decision based on the same visual stimuli. We aim to (i) study under which conditions the integration of sensory information in humans is better described by discrete or continuous attractor dynamics, and (ii) whether those two classes of models may be realized using the same underlying neural mechanisms. To this end, we collected a number of behavioral and electrophysiological data (EEG) from participants performing both a categorical and a continuous estimation task.

The undergoing data analysis will test the hypothesis that well known EEG neural signatures (e.g. CPP, P300) will be different between the two task conditions , and their amplitude and timing will vary with the collected behavioral data (psychophysical kernels).

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