MODELING APPROACHES TO THE BIFURCATION DYNAMICS CHARACTERIZING CONSCIOUS ACCESS

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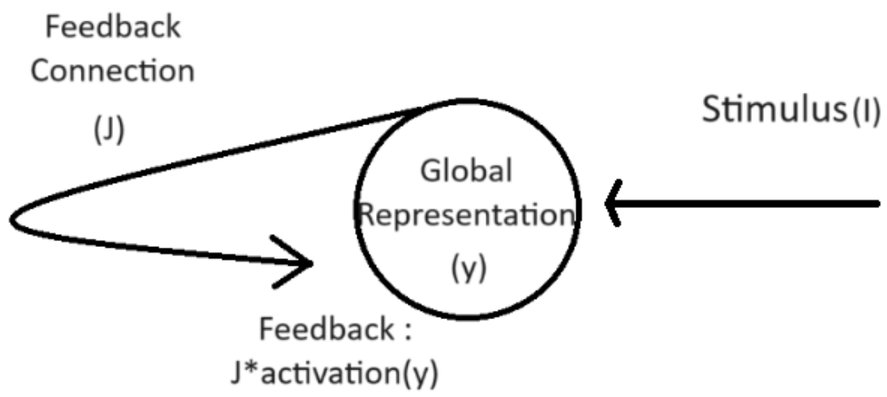
INTRODUCTION

*According to the **Global Workspace** Theory, sensory representations compete for the access to consciousness through a **winner-takes-all process**, ruling out the possibility of partial awareness. There is some empirical evidence for this hypothesis (1,2,3), but the debate is still open (4). Here, we plan on testing this idea with a dynamical systems framework, inspired from **mean field potential models**. Our model should : 1, be fitable to neuroimaging data, 2, distinguish between bifurcation and non-bifurcation dynamics, and 3, accurately predict conscious perception based only on pre-stimulus measures. Another important focus of the project will be the development of a measure for the strength of the representations of interest, based on neuroimaging data.*

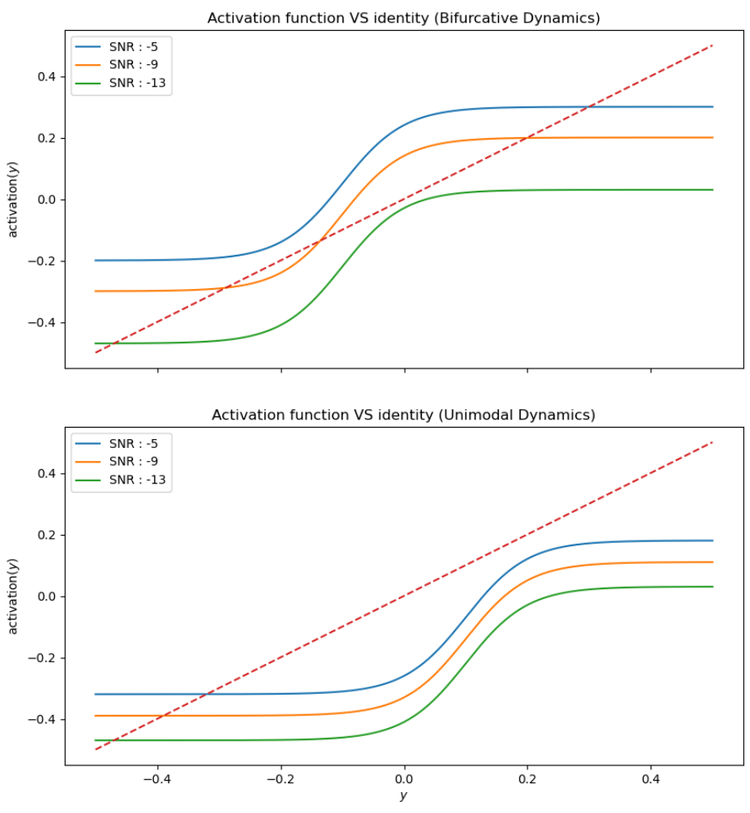
MODEL



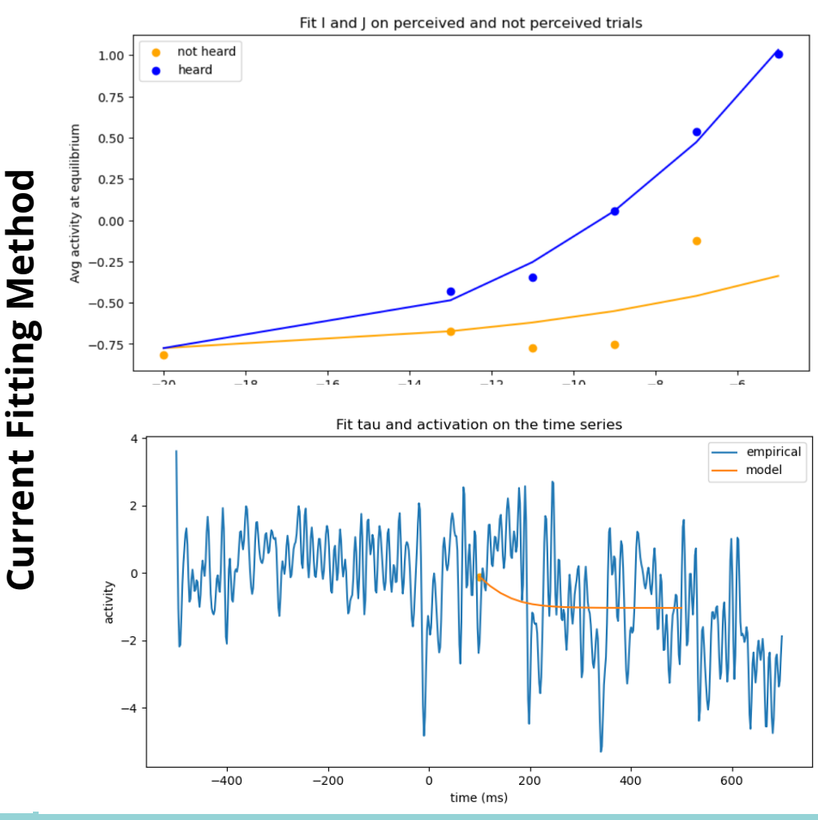
*The strength of the neural representation, **y**, evolves based on the strength of the stimulus **I**, but also on its own activity via leak currents (**-y**) and a feedback loop of weight **J**. More precisely :*

$$\tau \frac{dy}{dt} = I - y + J \times activation(y)$$

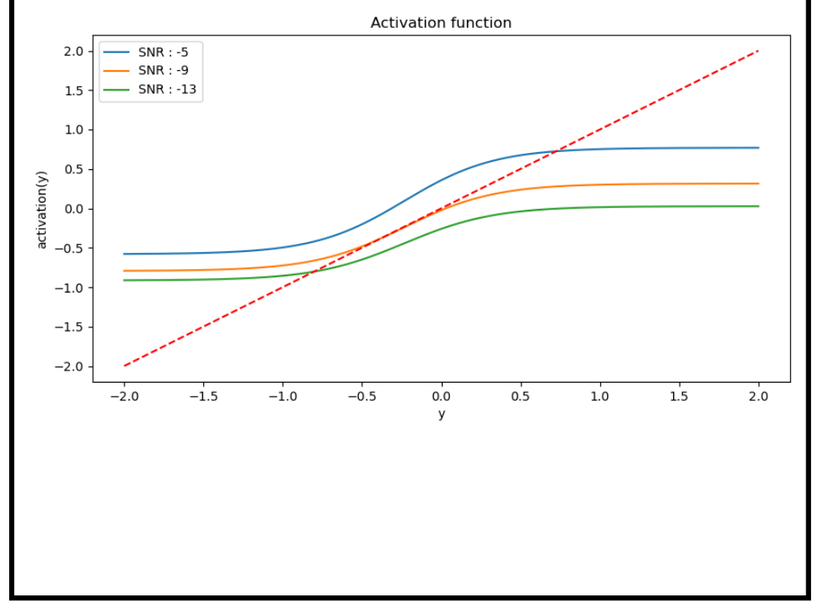
Predictions for bifurcation VS unimodal



Current Fitting Method

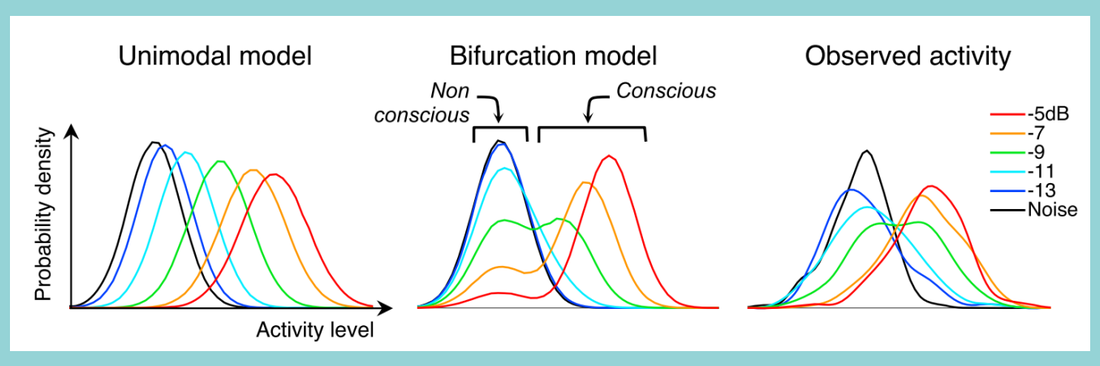


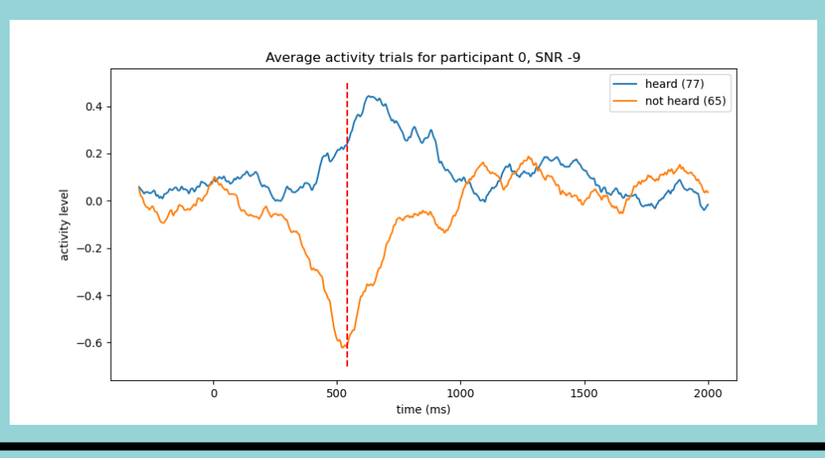
Initial Results



DATA AND DATA PROCESSING

An important challenge in this project is to find a good measure for the strength of the neural representation of interest. For the moment, the data used in this work comes from Sergent et al., 2021 (5). It is the signed distance to the hyperplan separating trials with clearly perceived stimulus and no stimulus at all. This measure seems to display the patterns we are interested in, as shown in this study.





In the future, neural signals such as time-frequency decomposition, functional connectivity, or trial by trial neural trajectories in space and time will be leveraged as complementary inputs for the decoding method. Moreover, a new experimental paradigm allowing better decoding of the stimuli will be used.

REFERENCES

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