March 08, 2023

Dear Editor of eLife,

Please find attached a revised version of the paper “**Flexible control of representational dynamics in a disinhibition-based model of decision making**”.

We are delighted to hear that the reviewers and review editor viewed our work as interesting and useful, and greatly appreciate the constructive and insightful comments and suggestions. All reviewer point are addressed extensively in the response letter, however we summarize here the major changes relevant to the essential revisions noted in the previous decision letter:

1. **Competing models**: The reviewers noted concern about comparing the LDDM to standard decision circuit models, which share components with the LDDM, and asked for a conceptual discussion of what LDDM adds over existing models. In the revised Results section, we now include an alternative decision model - the leaky competing accumulator model (LCA) – in qualitative and quantitative model comparisons, showing that the LDDM also outperforms the LCA in fitting behavioral data (RT and choice), and predicts underlying neurophysiological data better than the LCA. The revised manuscript now details the advantages of the LDDM in both the Introduction (highlighting the empirical evidence for structured, selective inhibition, which is exhibited by LDDM but not existing decision models) and the Discussion (highlighting structural and functional differences between the LDDM and existing disinhibition models).
2. **Parameter specificity**: The reviewers asked for a clarification of the necessity, specificity, and interpretation of some of the model parameters in the LDDM, including an examination of optimization surfaces of the fits and parameter recovery analyses. In the revision, we have corrected all of the notation inconsistencies throughout the paper, with revised figures and equations. The revised Results (including new figure supplements) now include visualization of optimization surfaces and parameter recovery analyses. Together, these new analyses support the parsimony and robustness of model fitting used in the paper.
3. **Conceptual framing**: The reviewers suggested a more consistent conceptual framing of the goals of the paper, including a clarification of key aspects of the model that explain its behavior and a better linking of the model to previous work. We have now revised the paper Introduction and Discussion to highlight the importance of inhibition in computational models of decision-making, focusing throughout on two issues in the existing literature: (1) the assumption of non-selective, pooled inhibition in decision models (which is not supported by recent empirical evidence), and (2) widespread empirical evidence for interneuron diversity and complexity in inhibition circuits. Given this framing, the paper is now framed by introducing disinhibition into a circuit model of decision-making. In this framing, the integration of normalized value coding and WTA activity remains essential as a test of the validity of the LDDM. The revised Discussion also addresses specific requests including a discussion of what contributes to LDDM behavior, the relationship between the LDDM and cortical basal ganglia disinhibition models, and how the LDDM relates to previous circuit models with disinhibition.

We believe these and other important revisions detailed in the response letter have greatly improved the scientific merits and clarity of the manuscript. We are extremely grateful to you and the three reviewers for your insightful and constructive comments. Thank you very much for your consideration.

Sincerely,

Bo Shen, Kenway Louie, and Paul Glimcher