Understanding the Default Mode Network's Computational Role in Decision-Making

Team Name: Eternal Minds

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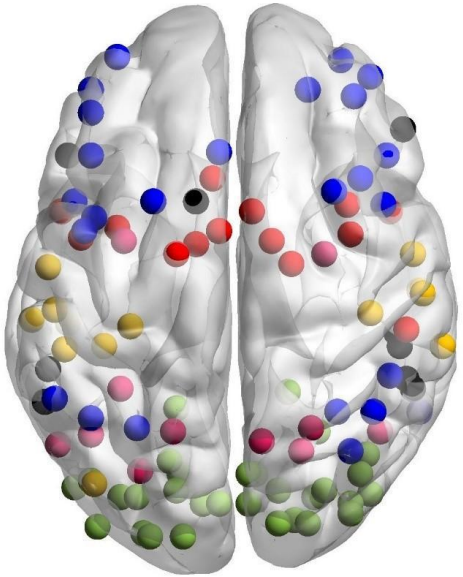
neuromatch academy

Impact Scholars Program

Background

- The decisions we make are often under uncertainty and risks, therefore, understanding the neurobiological basis of these decisions is a key challenge in cognitive neuroscience.
- Our previous study investigated the role of the DMN in risky decision-making. In the present study, we aim to build on these findings by exploring how individuals make decisions based on their past experiences.
- Reinforcement learning (RL) models provide a framework for understanding how individuals learn from past rewards and choices to guide future behavior.



Methods

1 Used a curated HCP Dataset from Neuromatch.

339 subjects - Gambling task assessing decision-making under uncertainty.

2 Applied the EWA model, a RL model, to simulate participant behavior.

Struggled to mimic real subject behavior.

3 Used logistic regression as an alternative model which predicts choices based on past rewards and choices.

Outperformed the EWA model in capturing real subject behavior.

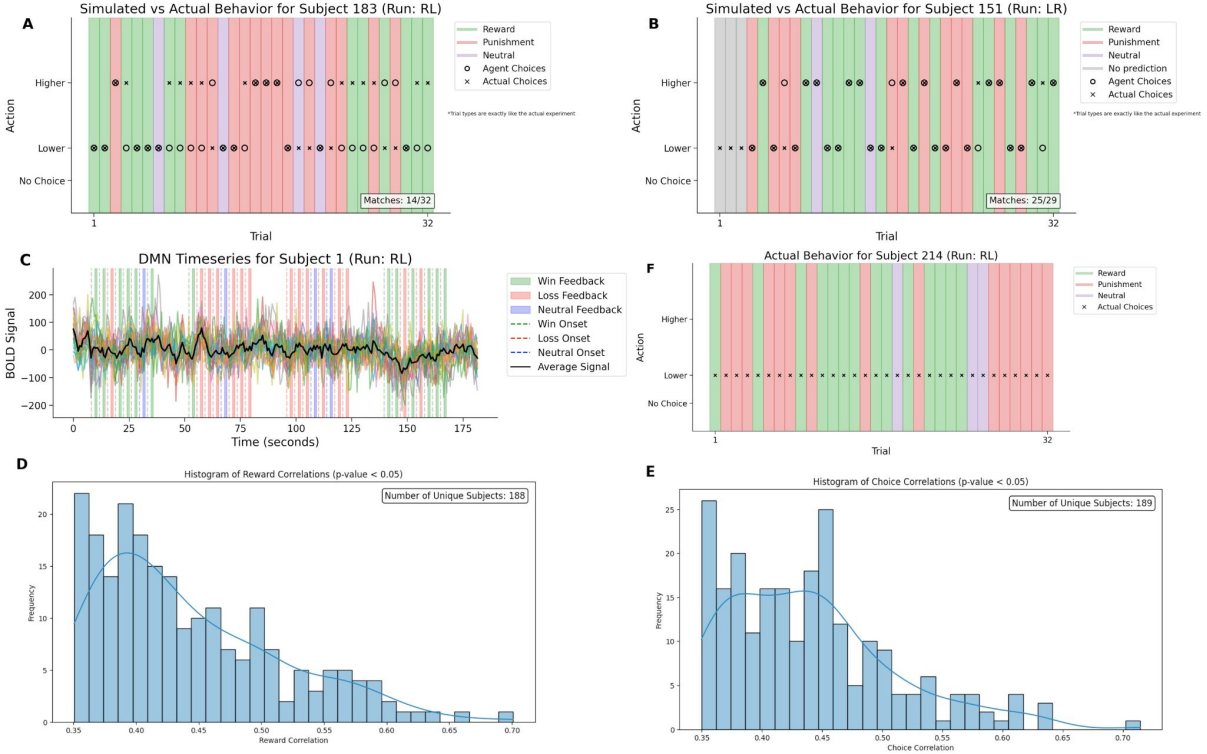
4 Analyzed average DMN activity during the pre-feedback period to study decision-related brain activity.

Regressed DMN signals against reward and choice coefficients from the logistic regression model.

5 Calculated correlations between predicted DMN activities (from regression) and real DMN activities.

Assessed how well past rewards and choices explain DMN activity during pre-feedback periods.

Results



A. The EWA model struggled to accurately capture the real subject's response patterns, so failed to mimic the subject's decision-making.

B. The logistic regression model shows a better ability to simulate the subject's choices.

C. The activity from multiple regions within the DMN, along with the average DMN signal across all parcels during the pre-feedback periods.

D, E. Positive correlations between DMN activity and feedback/choices Potential role of the DMN in processing outcome-related information.

F. Repetitive choice pattern by one of the subjects.

Limitations & Future Direction

Limitations

- The HCP gambling task may not induce meaningful decision-making due to repetitive choice patterns.
- Use of average DMN signal, potentially overlooking distinct regional contributions.
- Small number of trials, makes it difficult for the models to capture beha

Future Direction

- Future research could examine each region separately to refine our understanding and improve the model accuracy.
- Utilize Probabilistic reversal learning tasks to better capture the adaptive decision-making processes.
- Develop more refined models to better account for the dynamic changes in decision-making observed in tasks like probabilistic reversal learning.

Meet Our Team

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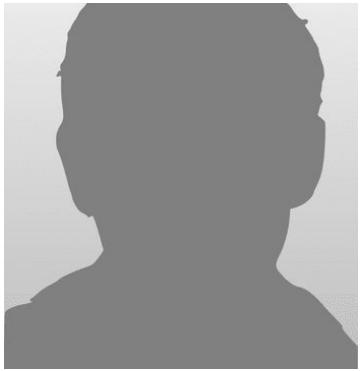

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