Neural correlates of State Prediction Errors during reversal learning

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Introduction

During learning, the brain receives a steady stream of information, yet not all information should be learned from.

A large body of literature suggests that P300 ERP component reflects unexpected, surprising outcomes[1-4]. However, recent neuro-computational work points to a more nuanced role of the P300 during learning and indicates that this component may signal so-called state predictions errors (SPEs)[5], which report discrepancies between the current model and the observed state transitions.

In contexts in which learning should occur, and therefore the task representation should be updated, we predict that a larger elicited SPE should result in a greater P300 component.

The aim of the current study was therefore to examine the neural correlates of SPEs during reversal learning in comparison to a condition in which learning is not required.

Method

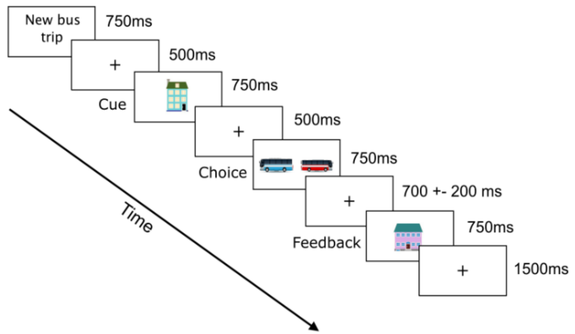
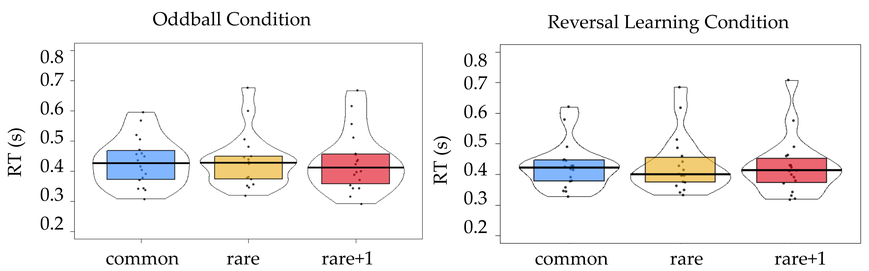


Figure 1. *Schematic of the trial procedure. If the feedback house matched the cued house, participant's bus choice was correct, if not, their choice was incorrect. Reversal Learning Condition: participants had to learn stimulus and action contingences based on state prediction errors. Oddball Condition: perceptually identical stimulus input but no need for learning.*

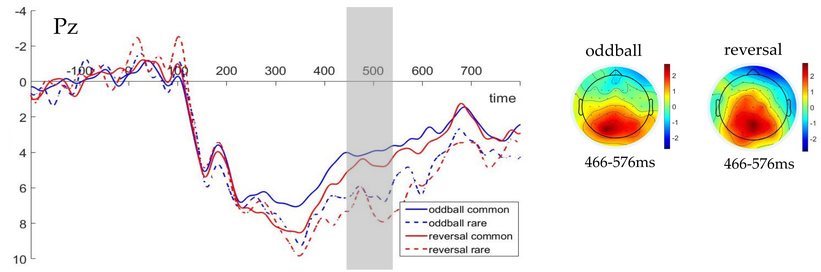
Results



B_{rare} = 9.482e-03, p = 0.694
B_{rare+1} = 9.482e-03, p = 0.931

B_{rare} = 0.0088796, p = 0.489
B_{rare+1} = 0.0088796, p = 0.968

Figure 2. *Average RTs per subject (in seconds) for common, rare and rare +1 trials. Oddball condition (left) and reversal learning condition (right).*



Condition: F(1, 60) = 0.868, p = 0.35526
*Trial type: F(1, 60) = 7.222, p = 0.00931 ***
*Trial type * Condition: F(1, 60) = 0.092, p = 0.76272*

Figure 3. *ERPs elicited by feedback stimuli at electrode Pz displayed separately for the oddball condition (blue) and reversal condition (red), as well as the common (solid lines) and rare (dashed lines) trials. The topographical map displays the difference between common and rare trials.*

Discussion

- Preliminary results suggest that the P300 may reflect SPEs but does not seem to be sensitive to changes across contexts that must be learned from and those in which no learning is required.
- Future analyses will combine computational analyses and further electrophysiological analyses to provide a more mechanistic interpretation of mechanistic interpretation of changes task representation during learning.

References

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