Neurophysiological and Behavioral Signatures of Reward Learning and Responsiveness are Conserved across Humans and Rats

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Background

Reward learning and responsiveness are transdiagnostic constructs of interest for psychopathology and have been most notably investigated in depression.

As such these reward constructs are often targeted in relevant preclinical models. However, such models often suffer from limited translational validity and use different tasks across species.

- EEG can readily index reward processing and be applied across species.
  - Hence, it may be useful for overcoming such challenges and reducing the translational gap.

Study Aims

1. Evaluate and compare EEG/ERP signals of reward learning and responsiveness in humans and rats.
2. Examine if methylphenidate (a dopamine reuptake inhibitor; MPH) modulates EEG/ERP signals of reward in a similar manner across species.

Design and Methods

Participants

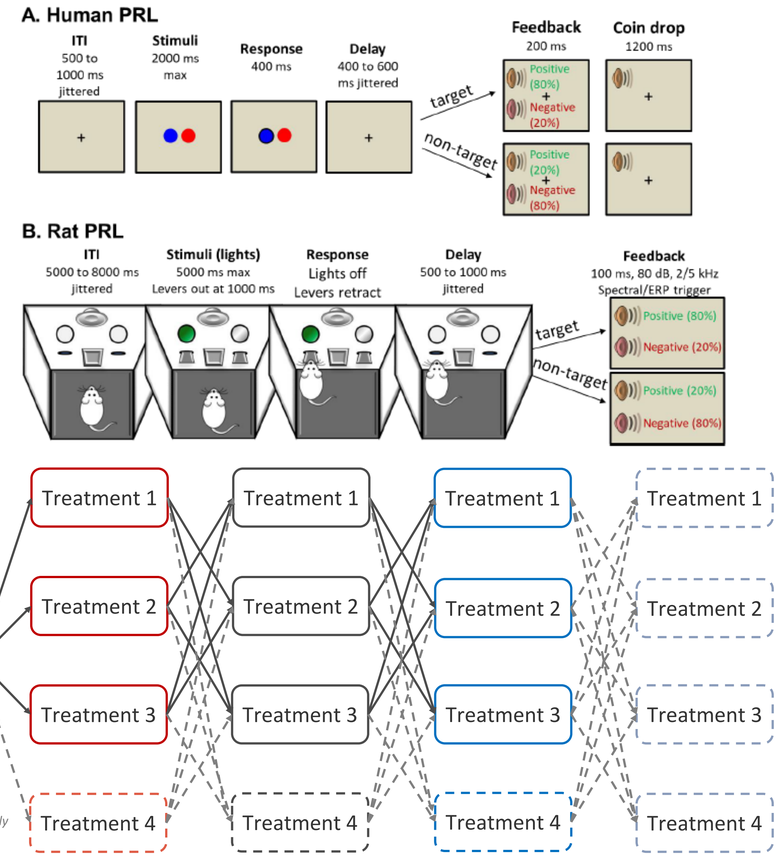
- 25 healthy adults
  - 14 female; aged 27.40 ± 5.60 years
- 22 Long-Evans rats
  - 8 female 176-200g; 14 males, 226–250g

Probabilistic Reversal Learning (PRL) Task

Both species completed the PRL task at least 3 times, after different doses of methylphenidate (MPH).

- Placebo / Vehicle
- Low-dose MPH (15mg / 0.5 mg/kg)
- Medium-dose MPH (30mg / 1mg/kg)
- High-dose MPH (2 mg/kg)

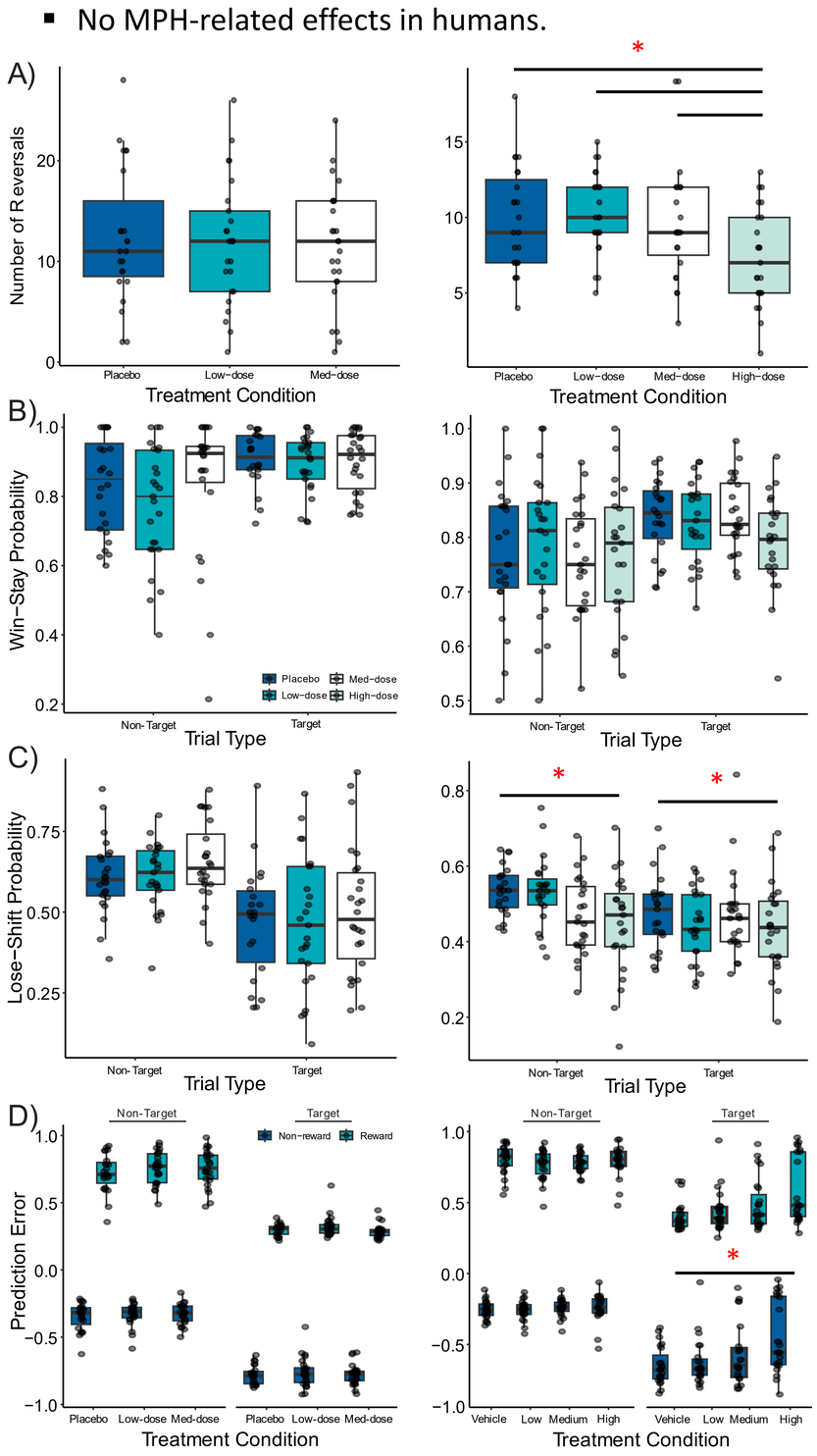
Note: Only rats completed the medium-dose condition



Results

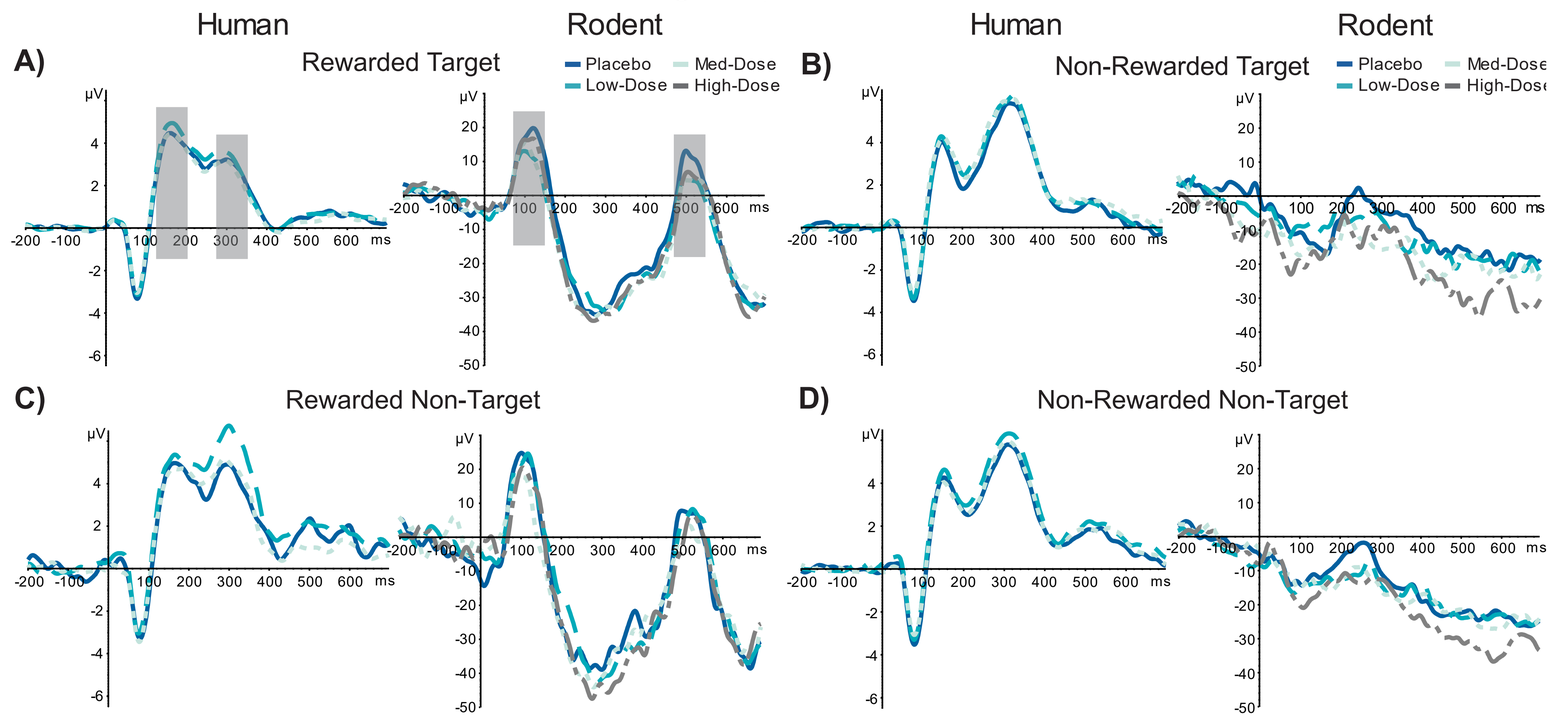
Behavioral performance on the PRL task was comparable across species.

- MPH affected rodent performance at highest dose.
- No MPH-related effects in humans.

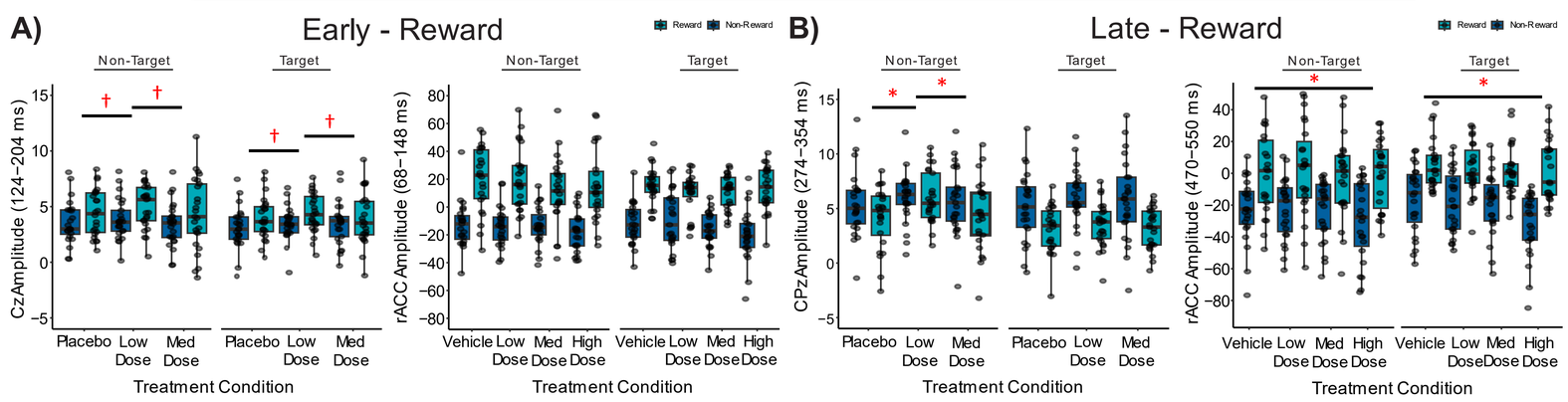


Both species elicited an early- and a late-reward related ERP (grey boxes below) in all treatment conditions.

- Measurement windows were selected using collapsed localizers.



- Trend level effects of Treatment condition for early-reward component in both species.
- Significant effects of Treatment condition for late reward component in both species.



Conclusion

Overall, these results support the view that reward processes may be similarly regulated across species and that EEG may provide useful metrics for translating preclinical models.

- Future research examining cross-species differences in behavioral strategy may further help translation.

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