Reinforcement Learning Models of Dynamic Risky Decision Making in Rats
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INTRODUCTION

- Risky choice paradigms present individuals with choices between a single certain outcome (e.g., 2 pellets) and a variable risky outcome (e.g., 1 vs. 5, 0 vs. 4 pellets).
- Variable choice outcomes may be more ecologically valid.¹
- Different procedures differentially affect how previous outcomes influence subsequent choice,²,³ which may be due to the relationship between outcome magnitude and the expected value of other outcomes in the environment.²
- Hypothesis: Probabilistic presentation of differential risky outcome magnitudes may shift the encoding of risky gains and losses, altering riskiness following these outcomes.
- Goals: (1) Determine how risky loss magnitude/probability affect risky choice; (2) Determine if common reinforcement learning (RL) models can account for such effects.

METHODS

- 24 experimentally-naïve male Sprague Dawley rats
- Risky (R-0, R-1, R-11) vs. certain choice (C-2, C-4)

RESULTS: GLOBAL AND LOCAL CHOICE BEHAVIOR

- Globally and locally, Group Equal-Risk was riskier than Group Unequal-Risk, even when there were equivalent expected values in the Two-Loss conditions.
- The added 2nd loss (Two-Loss) elicits greater post-outcome staying behavior.

RESULTS: RL MODELS

- Three models: Simple,⁴ Asymmetric,⁵ Valence-Attentive RL⁶
- Model Selection: Akaike Information Criterion (AIC)

REINFORCEMENT LEARNING (RL)

- Constant value-updating rate for gains and losses
- Separate value-updating rates for gains and losses
- Differences in attention to gains and losses

REFERENCES & ACKNOWLEDGMENTS

- References:
- Acknowledgements: The research was supported by the National Institute of Mental Health (NIMH) via award MH085739. We would like to thank Jen Peterson, Catherine Hill, Sarah Swabing, Jeremy Lott, and Jessica Pirkle for assistance with animal care and experimentation.
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DISCUSSION

- Loss frequency has distinct effects on global and local risky choice behavior.
- Asymmetric RL provided best overall account of data out of the models tested.
- The lack of convergence in the model fits suggest that basic RL models may not reflect dynamic decision making mechanisms in this task, warranting further model development and testing (e.g., model-based RL, Bayesian models)