INTRODUCTION

- Losses-disguised-as-wins (LDWs): Objective losses that are presented along with win-related stimuli (e.g., flashing lights on slot machines).
- LDWs represent a nontrivial proportion of gambling outcomes.¹
- LDWs may cause gamblers to overestimate frequencies of winning.²
- Rats are riskier after zero-valued and non-zero-valued losses that occur at similar frequencies of large gains than losses that occur at different frequencies of large gains,³ suggesting that rats are sensitive to differential losses and may be susceptible to LDWs.
- Experimental goal: Determine whether exposure to LDWs promotes increased risky choice in rats after recent and past losses.

METHODS

- 24 experimentally-naïve male Sprague Dawley rats
- Risky choice (R-0, R-1, R-11 pellets) vs. certain choice (C-2, C-4 pellets)
- P[0]: p(R-0) = 1.5, 9; p(R-1) = p(R-11) = .45, .25,.05
- P[1]: p(R-1) = 1.5, 9; p(R-0) = p(R-11) = .45, .25,.05
- Two groups (n=12): Normal-Feedback, Extra-Feedback
- Normal-Feedback: For both choices, # nosepoke key flashes above chosen lever = # delivered food pellets
- Extra-Feedback: Certain choices: same as Group Normal-Feedback; Risky choices: 0, 1, or 11 delivered food pellets + 11 nosepoke key flashes above risky lever + 11 food pellets delivered to external receptacle (i.e., multimodal win-related stimuli of LDWs)

RESULTS: PREVIOUS OUTCOME EFFECTS

- Analysis: Generalized linear mixed effects model (binomial)
- Criterion: Certain choices (0) and risky choices (1)
- Model: Group × Phase × Previous Outcome, Group × Probability × Previous Outcome (random effects = phase, previous outcome)
- Results: Group Extra-Feedback was riskier than Group Normal-Feedback after risky outcomes across phases (A) and probabilities (B); Post R-0 loss-chasing in P[1] condition in both groups (A).

RESULTS: REINFORCEMENT HISTORY

- Analysis: Nonlinear mixed effects model
- Criterion: Regression coefficients of past 9 outcomes
- Model: Hyperbolic and exponential decay functions (random effects = intercept, decay rate of function)
- Results: Steeper decay functions in Group Extra-Feedback; Better fit by hyperbolic decay function

RESULTS: REINFORCEMENT LEARNING (RL) MODEL

- Analysis: Asymmetric RL
- \( \delta_{N,T} = R_{N,T} - V_{N,T-1} \)
- \( V_{N,T} = V_{N,T-1} + \alpha \delta_{N,T} \)
- \( \alpha = (a_L, \alpha_L, \delta_L) > 0 \)
- Softmax decision rule
- Results: Model fits corresponding to 25%ile, median, and 75%ile of \( \omega^2 \) values (mean \( \omega^2 = .50 \)); Model tracked rats’ trial-by-trial behavior

DISCUSSION

- LDWs in Group Extra-Feedback increased risky choice, decreased relative effect of past reinforcement, and reduced loss sensitivity.
- Greater risk-taking given LDWs may be driven by deficits in learning from losses or a reduced sensitivity to differential losses.
- Greater loss-based value-updating indicative of loss aversion in rats.³

REFERENCES

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