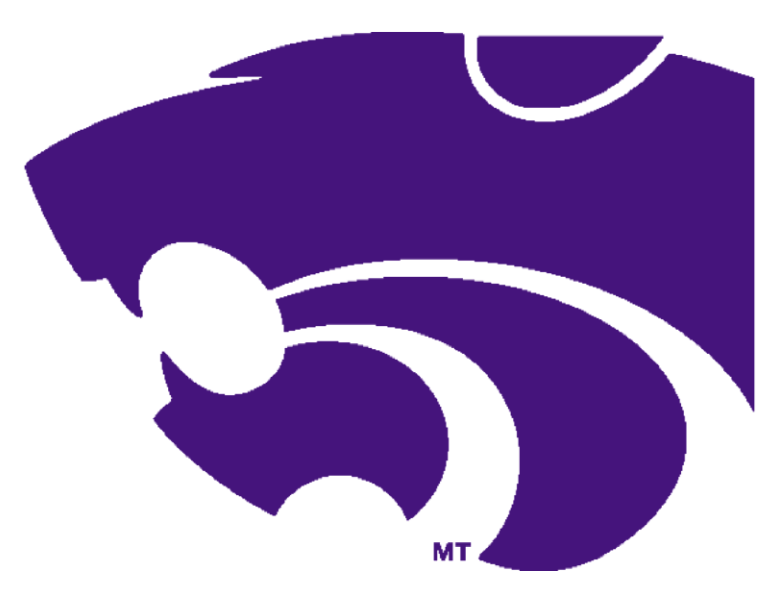




Impulsive choice mechanisms: a reductionist approach

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INTRODUCTION

- **Temporal discounting**: the reduction in subjective value of an outcome as the delay to that outcome increases.¹
- Choices for more immediate smaller outcomes rather than delayed larger outcomes are termed *impulsive*.
- Reward magnitude² and sensitivity to time³ have been shown to affect such intertemporal choice.
- The goal of the present study was to determine the roles of reward sensitivity, temporal sensitivity, and incentive motivation in choice behavior via multiple tasks to evaluate how such mechanisms contribute to individual differences in choice behavior.

METHOD – MAGNITUDE GROUP

- 12 experimentally-naïve male Sprague-Dawley rats
- **Impulsive choice task**
 - Smaller-sooner (SS): 1 pellet in 10 s
 - Larger-later (LL): 1, 2, 3 or 4 pellets in 30 s
- **Reward magnitude sensitivity test**
 - Alternating variable-interval – variable-interval (VI-VI) schedules of reinforcement
 - VI-30 for 1 pellet vs. VI-30 for 1, 2, 3 or 4 pellets
- **Progressive ratio (PR) task**
 - Four phases: PR 3 for 1, 2, 3, or 4 pellets

METHOD – DELAY GROUP

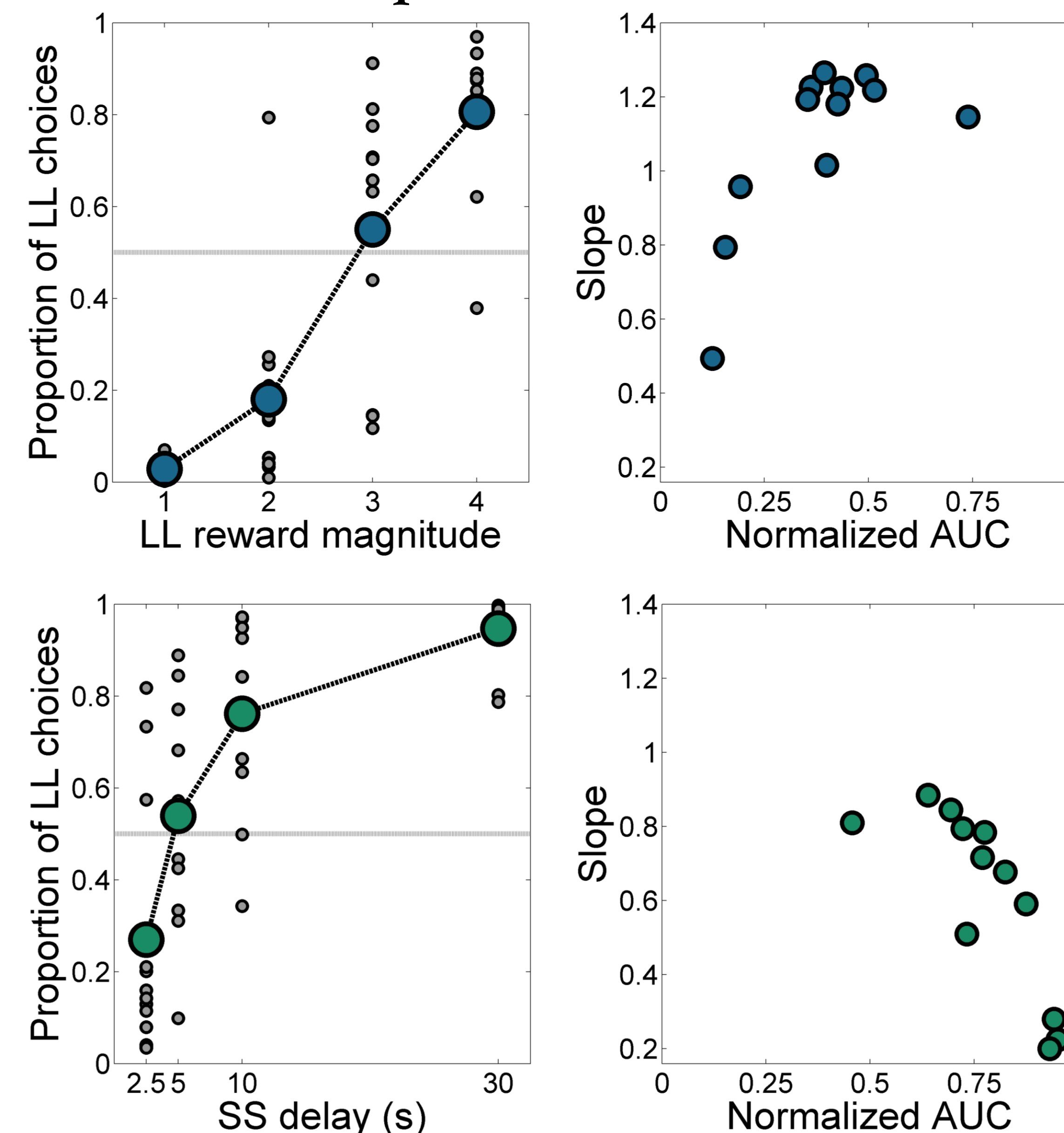
- 12 experimentally-naïve male Sprague-Dawley rats
- **Impulsive choice task**
 - Smaller-sooner (SS): 1 pellet in 2.5, 5, 10, or 30 s
 - Larger-later (LL): 2 pellets in 30 s
- **Temporal bisection task**
 - Training intervals: 4 s vs. 12 s
 - Intermediate test intervals: 5.26, 6.04, 6.93, 7.94, 9.12 s
- **Progressive interval (PI) task**
 - Four phases: Interval increased by 2.5, 5, 10, or 30 s for a 1-pellet outcome

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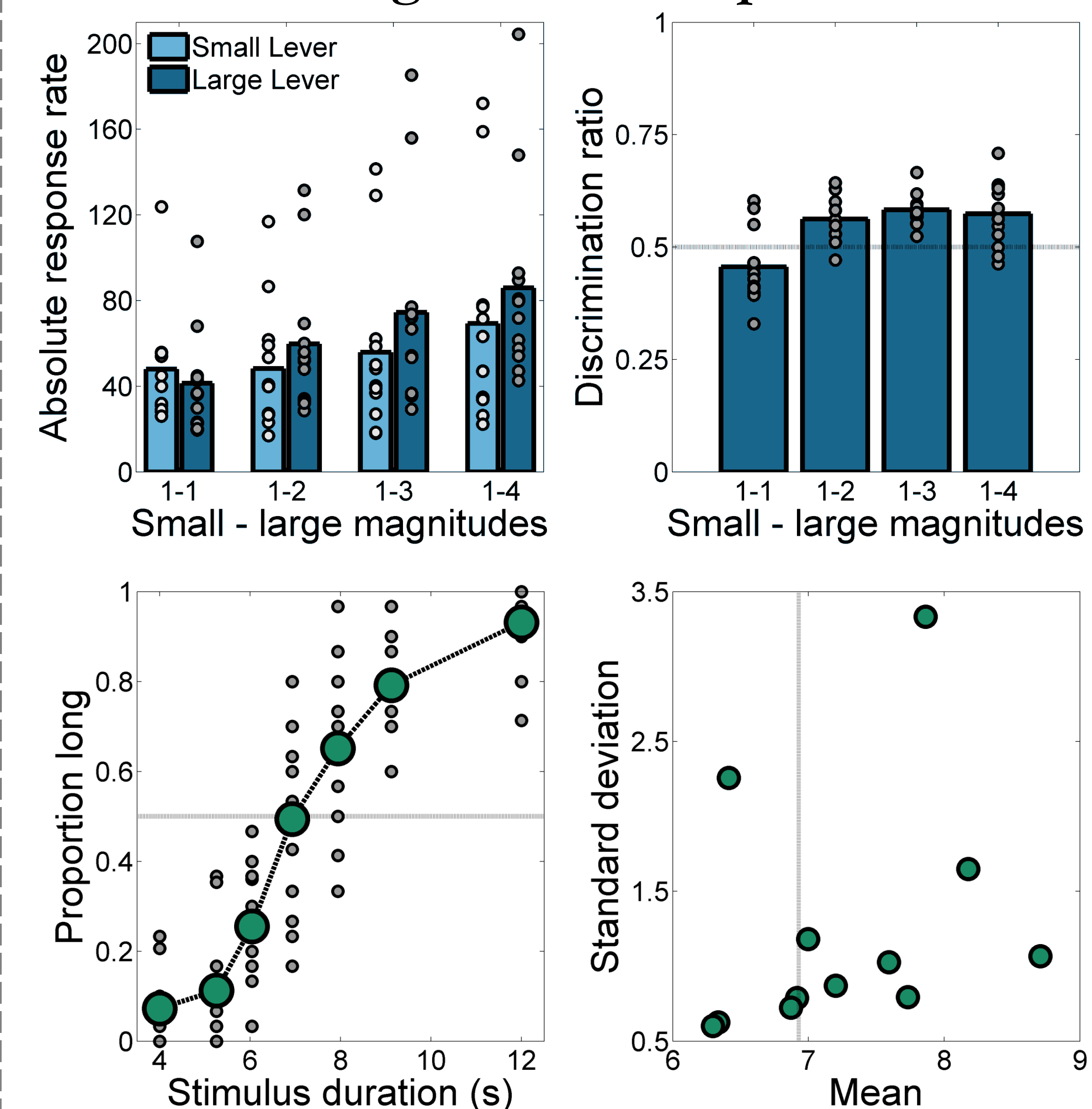
RESULTS

Impulsive choice task



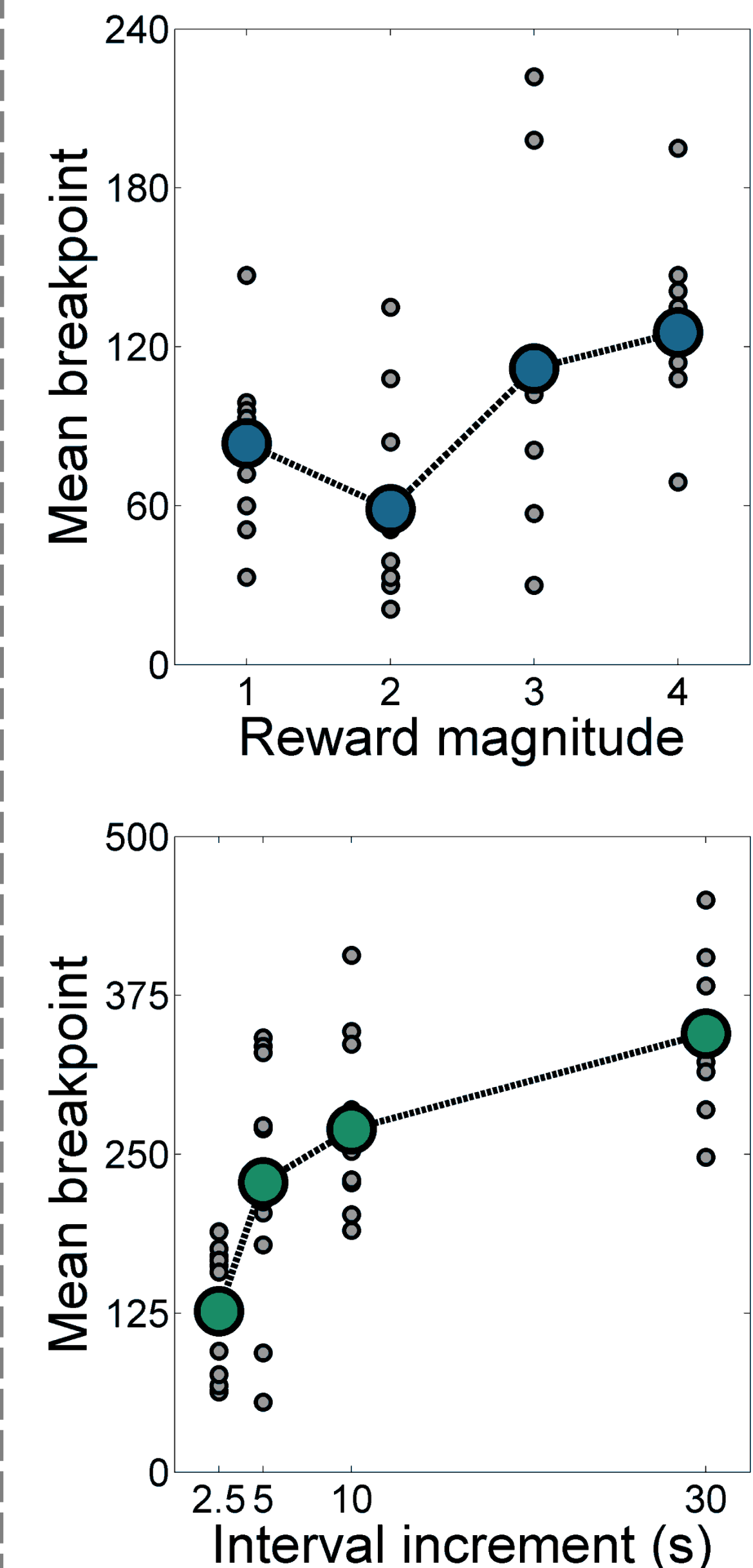
- Increase in LL choice behavior with increases in LL magnitude (top) or SS delay (bottom)

Reward magnitude / temporal bisection



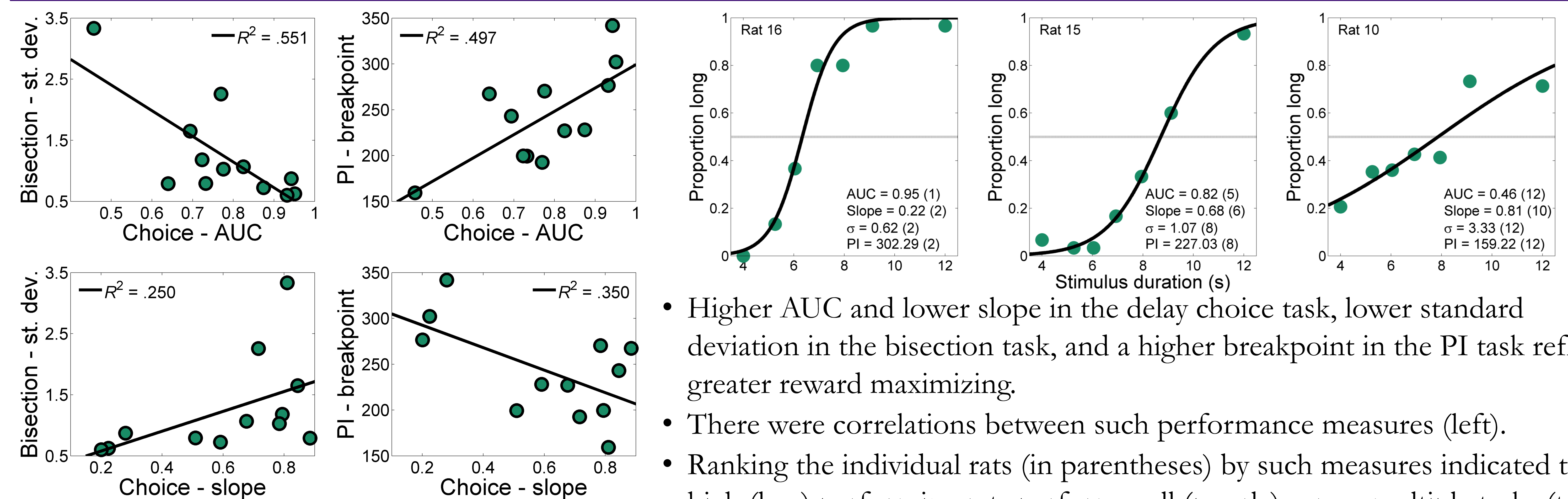
- Greater response rates with reward outcome (top)
- Mean bisection point \approx geometric mean (bottom)

PR/PI



- Effect of PR reward and PI interval

INTER-TASK CORRELATIONS: DELAY GROUP



- Higher AUC and lower slope in the delay choice task, lower standard deviation in the bisection task, and a higher breakpoint in the PI task reflect greater reward maximizing.
- There were correlations between such performance measures (left).
- Ranking the individual rats (in parentheses) by such measures indicated that high (low) performing rats perform well (poorly) across multiple tasks (top).

DISCUSSION

- Interval timing processes appear to play an important role in impulsive choice tasks, and individual differences reflect the ability to maximize reward earning under different delays to reward across different delay-based tasks.
- Sensitivity to reward magnitude does not appear to play a pivotal role in determining impulsive choice behavior, at least in the measures employed in the present study.