



# Testing Order and Generalizability of Intervention Effects on Impulsive Choice in Rats

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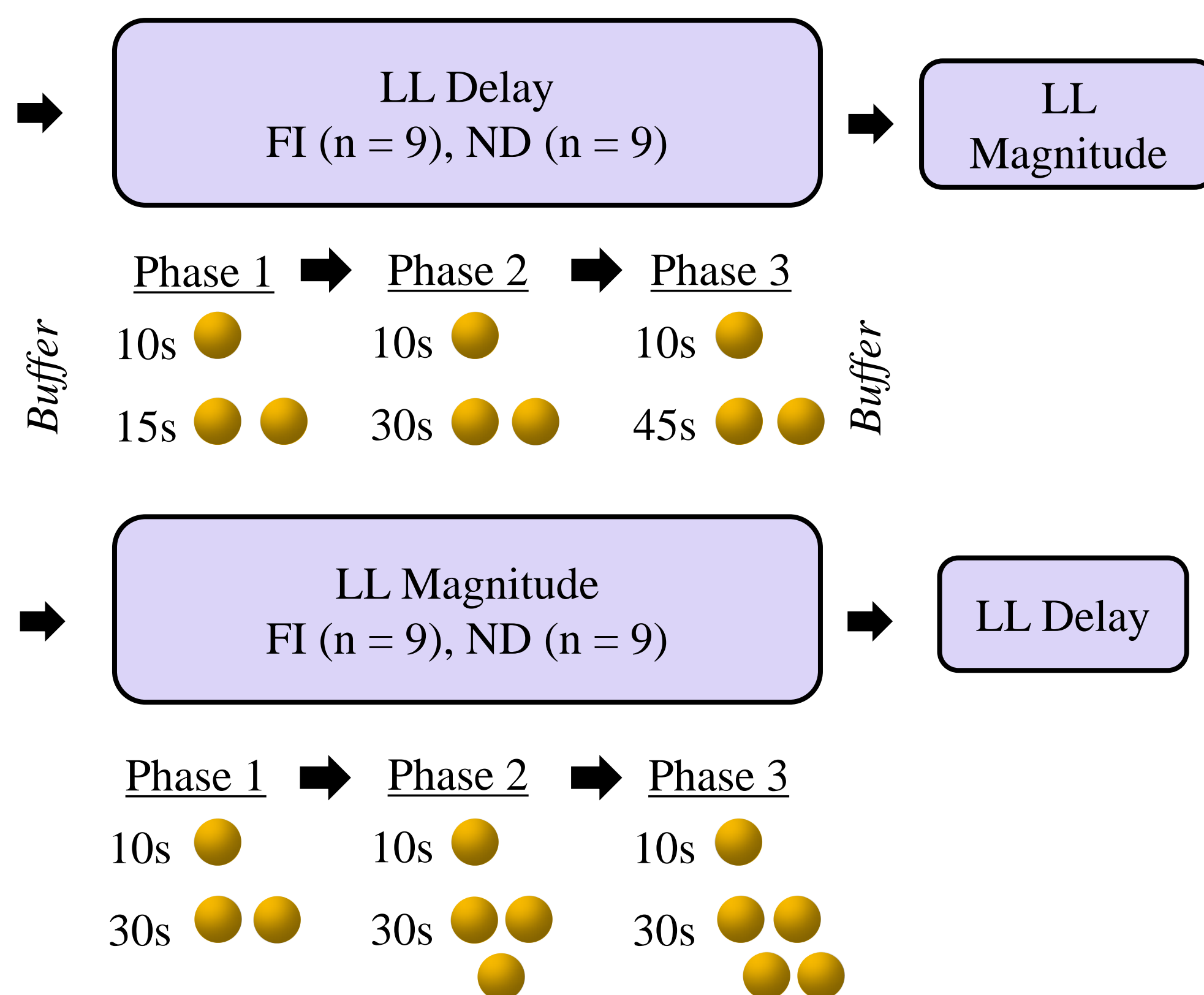


## INTRODUCTION

- Impulsive choice refers to choosing a smaller, sooner reward (SS) over a larger, later reward (LL) when the LL reward is the more advantageous option.<sup>1</sup>
- Impulsive choice involves trade-offs between reward delay and reward magnitude.<sup>2</sup>
- Higher rates of impulsivity are associated with ADHD, substance abuse, and gambling in humans.<sup>3,4</sup>
- It is important to develop neurocognitive interventions to address disorders that involve heightened impulsive choice.
- Previous research:
  - Rats exposed to a fixed-interval (FI) time-based intervention which involved extensive exposure to the SS and LL delays resulted in decreased impulsive choice lasting for a 9-month period.<sup>5</sup>
- Purpose: Assess the generalizability of the FI time-based intervention across LL delay and magnitude choice tasks.
- Hypotheses:
  - If the intervention is selective in affecting delay processes only, then the intervention should generalize to an LL delay task, but not an LL magnitude task.
  - If the intervention produces an overall improvement in choice behavior, then the results should generalize to both LL delay and LL magnitude tasks.

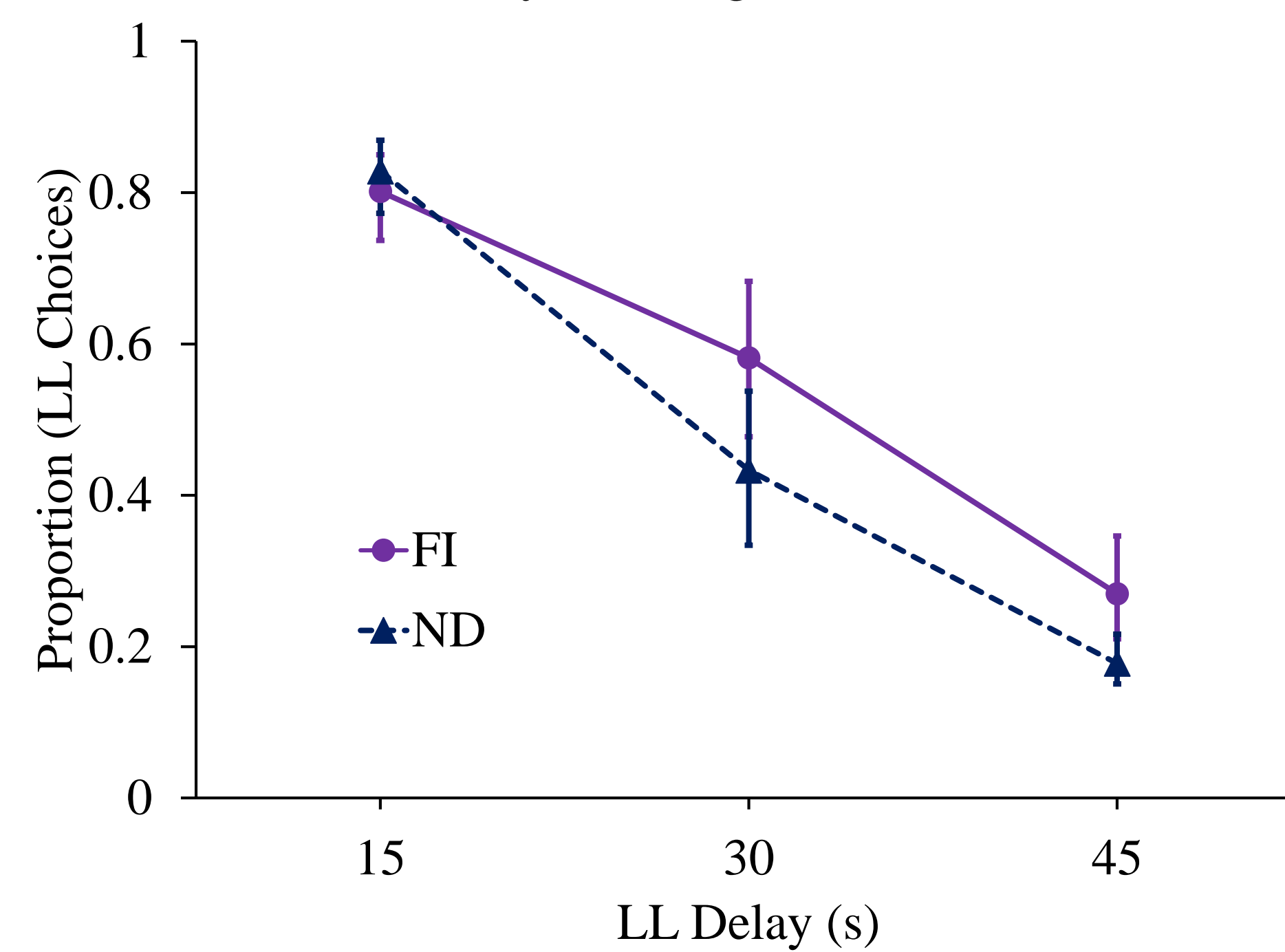
## METHODS

- **Animals:** 36 experimentally-naïve male Sprague-Dawley
- Rats were randomly assigned into two groups ( $n=18$ ), Fixed Interval intervention or the No Delay control group
  - Fixed Interval (FI)
    - SS — 10s → ●
    - LL — 30s → ●●
  - No Delay (ND)
    - SS — 0s → ●
    - LL — 0s → ●●
- To assess generalizability of the intervention, all rats completed two impulsive choice tasks.
  - Choice tasks were delivered in a counterbalanced order, with half of the rats receiving each order:
    - Order DM (delay first, magnitude second)
    - Order MD (magnitude first, delay second)



## RESULTS

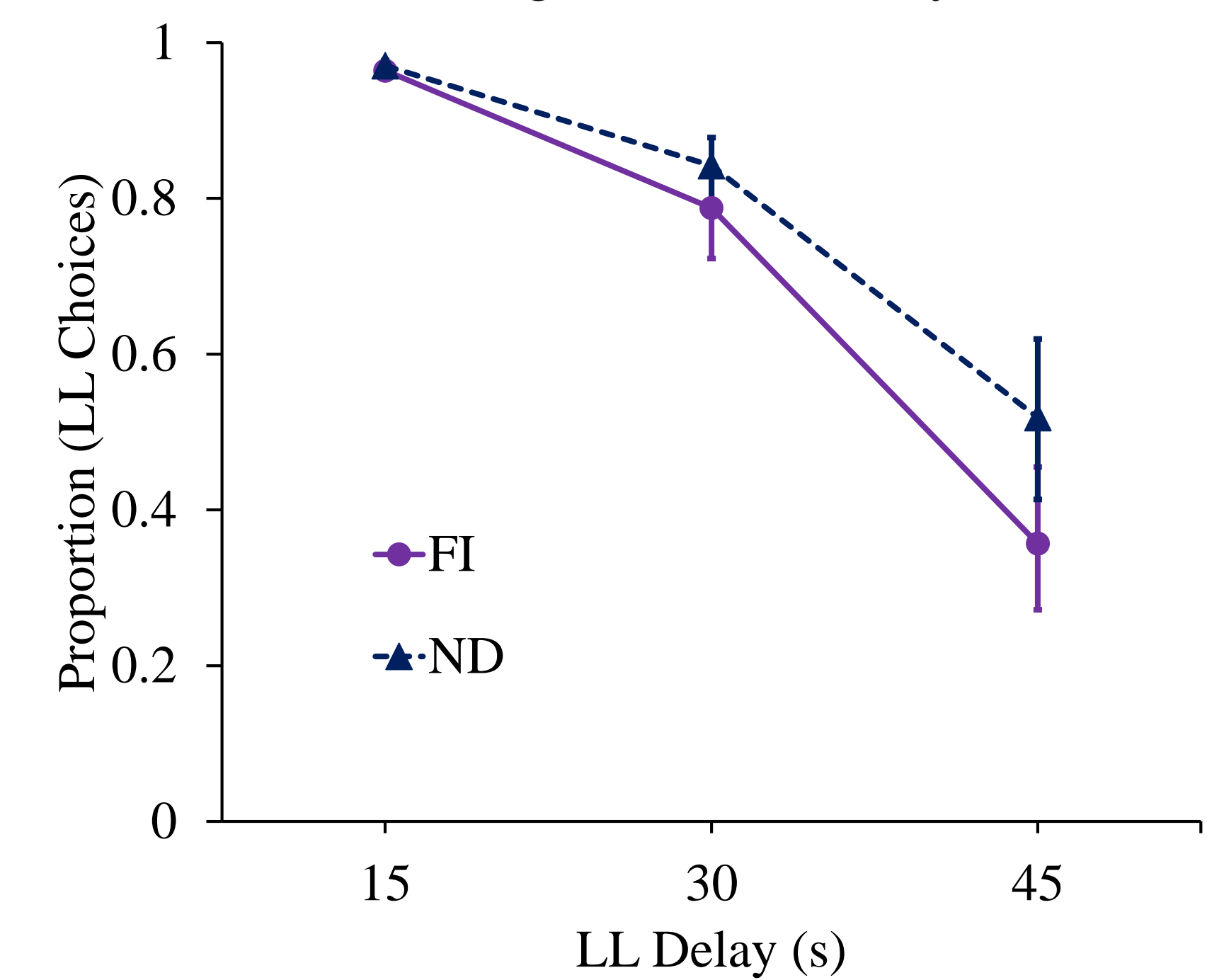
### Delay → Magnitude



**Figure 1. Testing on the LL delay task preceding LL magnitude task.** Both groups showed decrease in LL choices as the LL delay increased, demonstrating sensitivity to change in delay. The FI group had a shallower slope due to more LL choices at the longer LL delays in comparison to the ND group, thus showing an intervention effect in increasing LL choices.

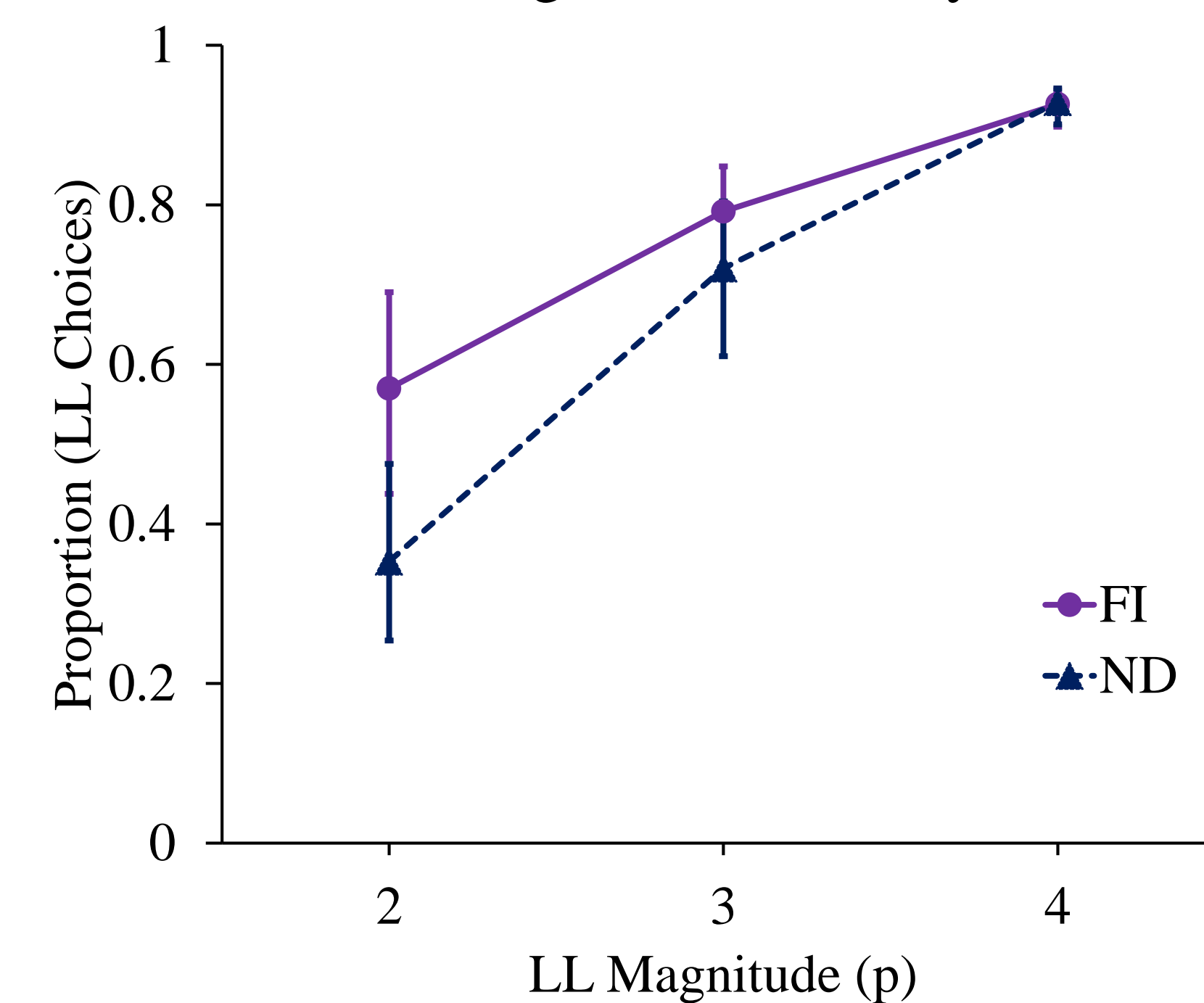
### LL Delay Task

### Magnitude → Delay



**Figure 2. Testing on the LL delay task following LL magnitude task.** Both groups decreased in LL choices similar to order DM. The FI MD rats had a steeper slope than the ND rats due to making fewer LL choices at the longest LL delay. This demonstrates failure of the intervention to transfer when the delay task was received following the magnitude task.

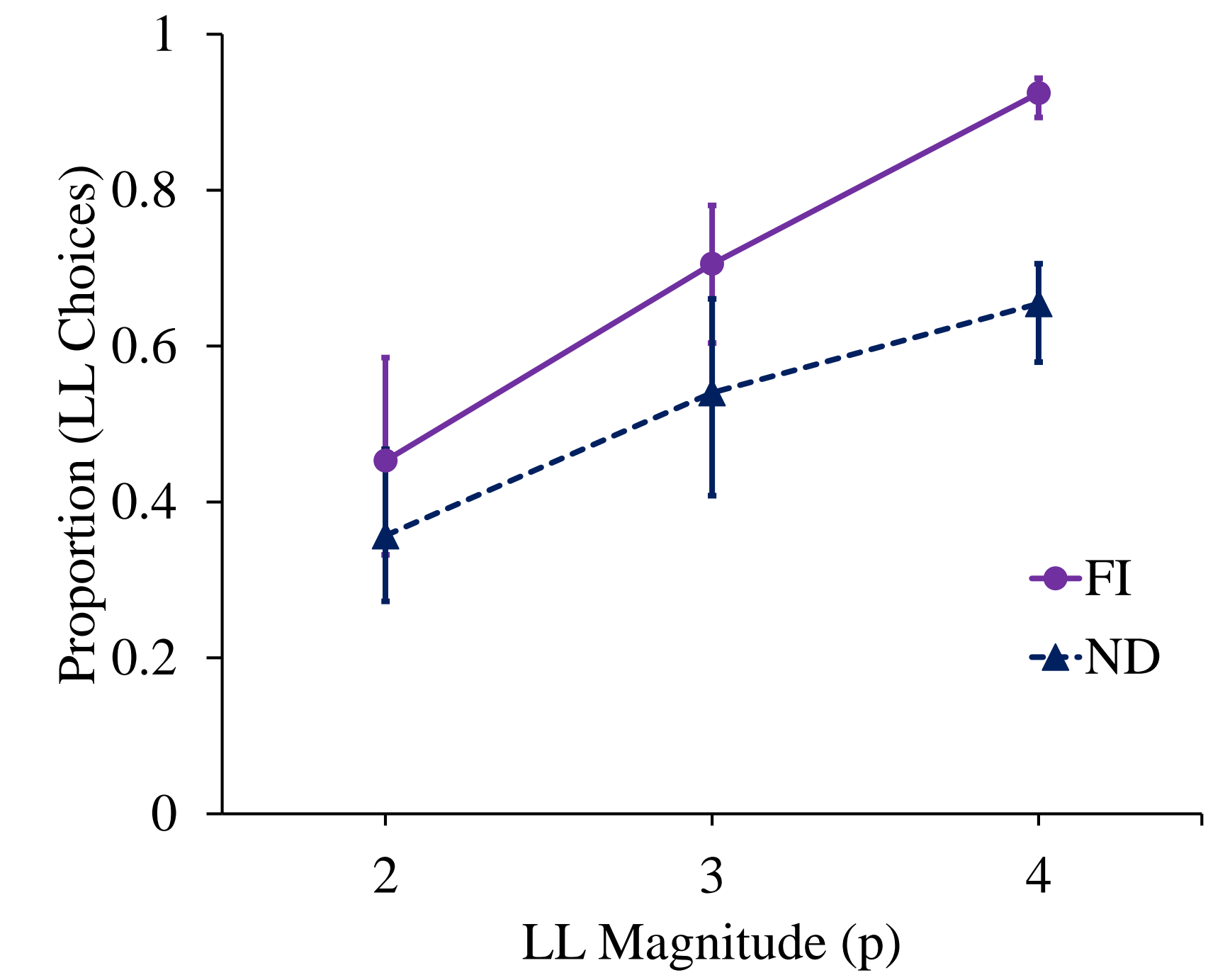
### Magnitude → Delay



**Figure 3. Testing on the LL magnitude task preceding LL delay task.** All rats increased in LL choices and the FI group made more LL choices. The FI group had a shallower slope than the ND rats, due to greater LL choices at the smallest LL magnitudes. This suggests that when the LL magnitude was experienced first, the FI rats showed a stronger elevation of LL choices at the smaller magnitudes.

### LL Magnitude Task

### Delay → Magnitude



**Figure 4. Testing on the LL magnitude task following the LL delay task.** Both groups increased their LL choices with increases in LL magnitude. The FI rats made more LL choices, suggesting that the intervention may help eliminate a bias for choosing the SS in this task. There were no effects of the intervention on the slope of the choice function.

## CONCLUSIONS

- When both tasks were tested initially, a successful intervention effect was observed.
- The generalized effects of the intervention suggest an overall effect on impulsive choice rather than a specific effect on delay processes as transfer was observed to both tasks.
- However, testing on the LL magnitude task impaired transfer to the LL delay task (Figure 2), whereas testing on the LL delay task enhanced transfer to the LL magnitude task (Figure 4). This suggests a degree of specificity of the intervention effects on timing processes, consistent with previous research<sup>2</sup>.
- Future work should focus on addressing potential order effects as this may provide further clues into the nature of the intervention effects on timing, reward processing, and impulsive choice.

## REFERENCES

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