



# Social Dominance Increases Risky Choice but not Impulsive Choice

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## INTRODUCTION

- Research has shown that a dominant/subordinate relationship forms in paired housing conditions with rats.<sup>1</sup>
- Dominant rats have increased food-reward motivation and increased risky decision making.<sup>2</sup>
- Risky and impulsive choice are primary endophenotypes that may lead to behaviors such as: gambling, obesity, illicit drug usage, smoking, and alcohol abuse.<sup>3</sup>
- Goals of study:
  - To understand the effect that housing condition has on the formation of a dominant/subordinate relationship
  - To understand how either dominant or subordinate relationships in paired housing relates to risky choice, impulsive choice, and food-reward motivation
- Understanding these relationships will give insight into how common housing conditions affect choice behavior in rats.

## METHOD

- Twenty-four male Sprague-Dawley rats were randomly assigned to one of two groups ( $n = 12$ ).
- The rats were placed in either single or paired housing conditions in Part 1 of the study.
- In Part 2, their housing conditions were switched and all other conditions remained the same.



### Operant Choice Tasks

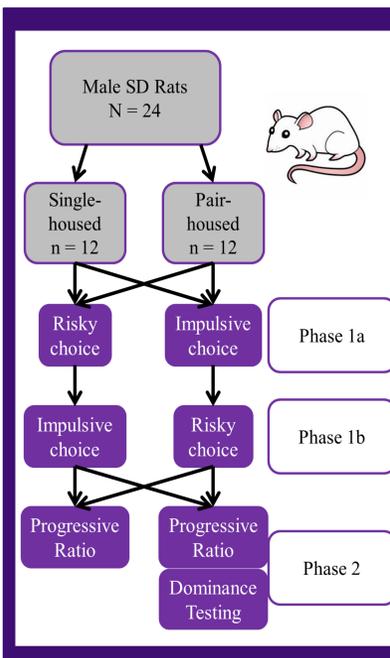
- The smaller-sooner reward in the Impulsive Choice task was 1 pellet after 10s and the larger-later (LL) reward changed from 1 to 2 to 3 pellets after a 30s delay. The log odds of self-controlled (LL) choices was analyzed.
- The certain-smaller reward in the Risky Choice task was either 1 or 3 pellets with probability ( $P$ ) = .5 for both and the uncertain-larger (UNC) was 3 or 9 pellets with  $P = .2, .5, \text{ and } .8$  in an increasing order. The log odds of risky (UNC) choices was analyzed.
- There were 80 trials in two 40-trial blocks, each block had 16 forced trials and 24 free trials with a 60-s ITI between trials for a duration of 2 hr.
- In the Progressive Ratio task, the initial response requirement was three responses and each additional reinforcer required an additional three responses ( $3 \rightarrow 6 \rightarrow 9$ ). The initial progressive ratio reward was one pellet which increased by one in each subsequent session block. The number of rewards earned was analyzed.

### Dominance

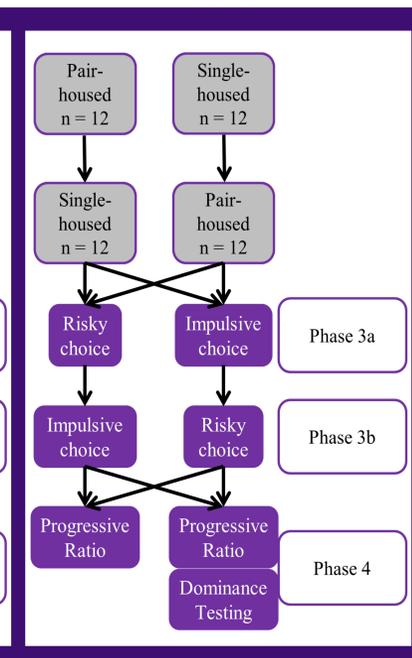
- Pinning Behavior:
  - Pinning was assessed by the number of pins and time spent pinning between cage mates.
  - Pinning was monitored by a video camera in the home cages for 10 min after testing for risky/impulsive choice.
  - Pinning was defined as a contested mount.
  - Pinning time and the number of pins were analyzed.
- The Tube Test:
  - Cage mates were placed in opposite ends of a clear tube.
  - The tube was 3'' x 3' with holding chambers on each side of the tube, and the test was monitored with a video camera.
  - Rats were evaluated based on the number of "wins" in a five minute period.
  - A win was achieved by backing the other rat out of the tube.

## DESIGN

### Part 1



### Part 2

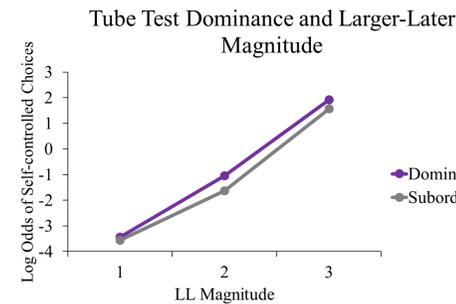


### Tube Test

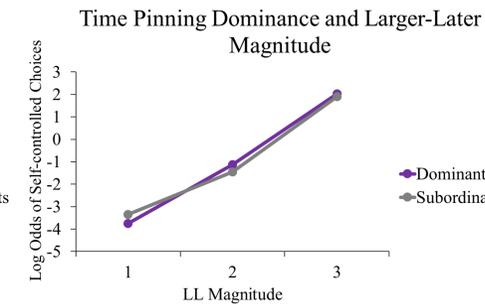


## RESULTS

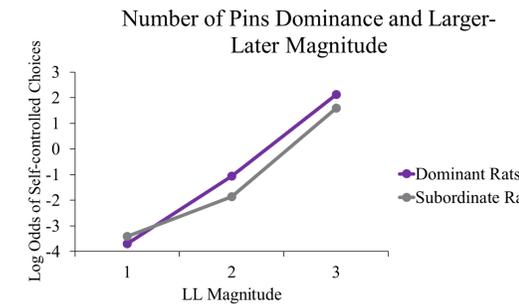
### Impulsive Choice



Dominant rats, as determined by the tube test, were less impulsive than subordinate rats.

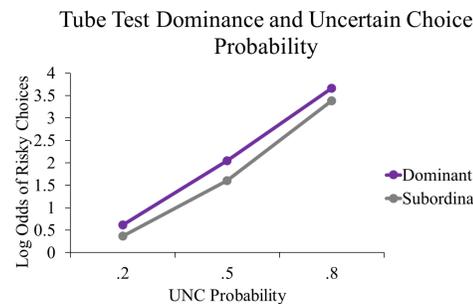


Dominant rats, determined by pinning time, were less impulsive as the LL magnitude increased compared to subordinate rats.

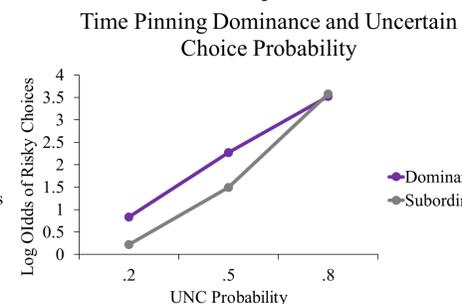


Dominant rats, determined by the number of pins, were less impulsive as the LL magnitude increased compared to subordinate rats.

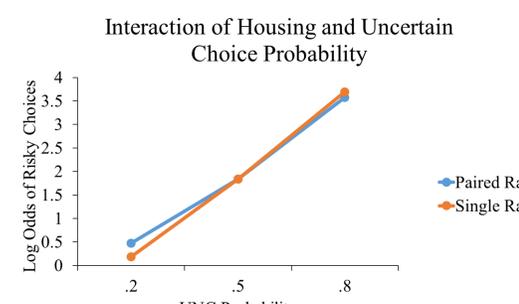
### Risky Choice



Dominant rats, as determined by tube test, were more risky than subordinate rats.

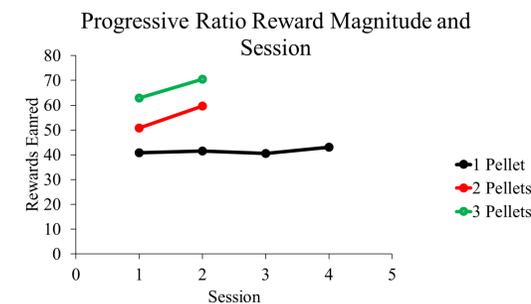


Dominant rats, as determined by pinning time, were more risky than subordinate rats.



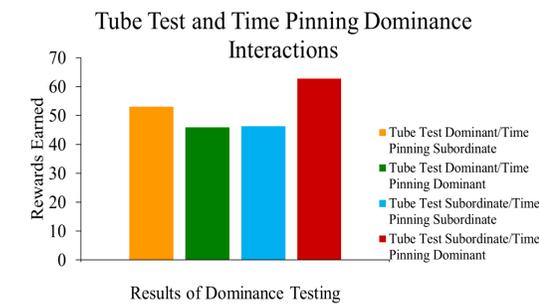
Pair-housed rats were displayed a flatter slope of their risky choice functions than single-housed rats.

### Progressive Ratio



Left: The rewards earned in progressive ratio task increased over sessions, and as a function of the reward magnitude on the PR.

Right: Rats that were dominant by tube test and subordinate by pinning time earned more rewards on average than rats that were dominant by tube test and pinning time. This relationship is reversed in subordinate rats.



## CONCLUSIONS

- Dominant rats determined by pinning time, number of pins, and tube test measures displayed decreased impulsive choice as compared to subordinate rats. This suggests a dichotomy of impulsive-choice behavior in pair-housed rats consistent with previous findings which suggest emergence of individual differences in group housed rats.<sup>4</sup>
- Dominant rats determined by pinning time and tube test measures were more risky than the subordinate rats. This suggests a dichotomy of risky-choice behavior in pair-housed rats, consistent with previous research.<sup>2</sup>
- Pair-housed rats were less sensitive to the probability of the uncertain choice than the single-housed rats possibly due to higher average risky choice and lower sensitivity to the uncertain choice probability in dominant rats.
- Rats that were dominant in time pinning alone displayed increased motivation when compared to rats that were dominant in tube test alone.
- Overall, pair housing rats may be a contributing variable to the measurement of individual differences in choice and thus could effect the analysis of choice behaviors and their correlates.

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