



INTRODUCTION

- Research has shown that a dominant/subordinate relationship forms in paired housing conditions with rats.¹
- Dominant rats have increased food-reward motivation and increased risky decision making.²
- Risky and impulsive choice have serious implications that are linked to behaviors such as: gambling, obesity, illicit drug usage and alcoholism among others.³
- 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 a pair relates to risky and impulsive choice.
- Understanding these relationships will give insight into how standard housing conditions could affect choice behavior in rats.

METHOD

- Twenty-four male Sprague-Dawley rats were randomly assigned to one of two groups ($n = 12$).
- One group was placed in paired housing conditions in a standard sized shoe-box container.
- The other group was placed in individual housing under standard conditions.



Operant Choice Tasks

- The SS outcome in the Impulsive Choice task was always 10-s delay for 1 pellet and the LL was always 30-s delay but the reward magnitude was altered from 1 to 2 to 3 pellets.
- The certain-smaller (C-S) reward in the Risky Choice task was either 1 or 3 pellets with probability (p) = .5 for both and the uncertain-larger (U-L) was always 3 or 9 pellets with $p = .2, .5$ and .8 in an increasing order.
- 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.
- For the Progressive Ratio task (data not shown), the initial response requirement was three responses and each additional reinforcer required an additional three responses (3→6→9→12...).

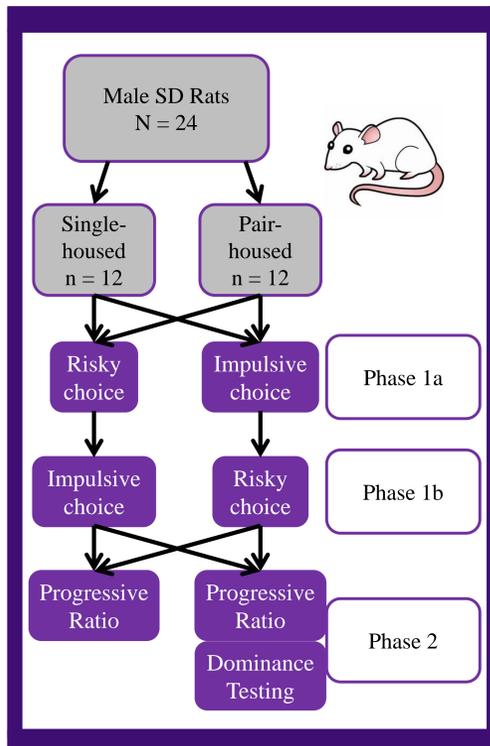
Dominance

- Pinning behavior:
 - Pinning was assessed by the number of pins and time spent pinning between cage mates.
 - The pinning was monitored by video camera in the home cages for 10 min after testing for risky/impulsive choice.
 - Pinning was defined as a contested mount.
- The tube test:
 - Cage mates were placed in opposite ends of a clear tube.
 - The tube was three feet long with a three inch diameter and 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" (A win was achieved by backing the other rat out of the tube).

DESIGN

- Phase 1a
 - Risky and impulsive choice
 - 30 sessions
- Phase 1b
 - Risky and impulsive choice
 - 30 sessions
- Phase 2
 - Progressive ratio
 - 7 sessions
 - Dominance tested following progressive ratio sessions

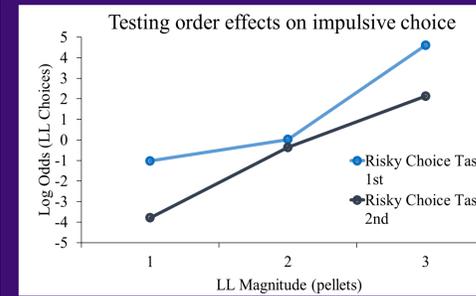
Pinning Behavior



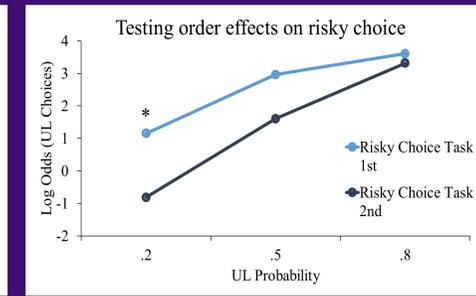
Tube Test



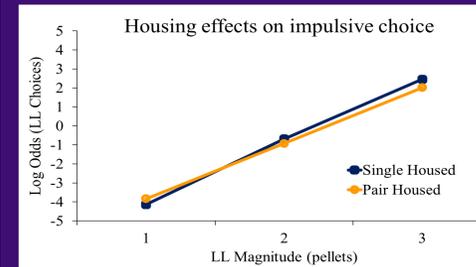
RESULTS



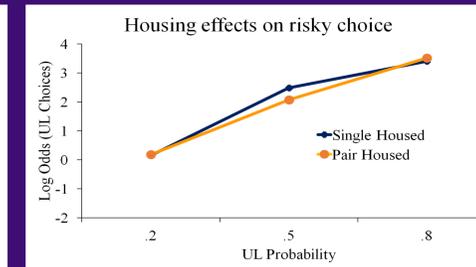
- LL choices increased as LL magnitude increased.
- There were no significant order effects on impulsive choice.



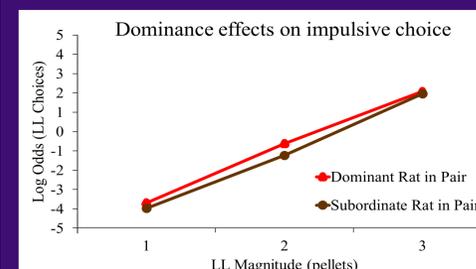
- At the lowest probability, there was a difference in risky choice due to task order.
- There was also a difference in the risky choice bias between groups.



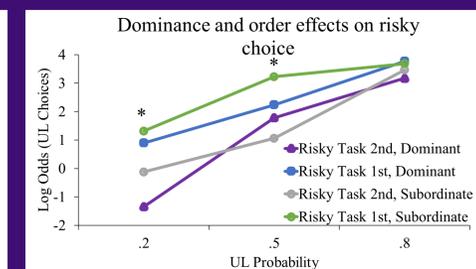
- There were no significant differences between single- and pair-housed rats in their impulsive choice behavior.



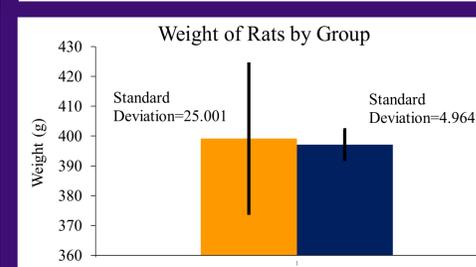
- There were no significant differences between single- and pair-housed rats in their risky choice behavior.



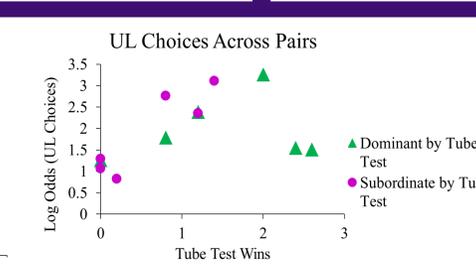
- There were no significant differences between dominant and subordinate rats in their impulsive choice behavior.



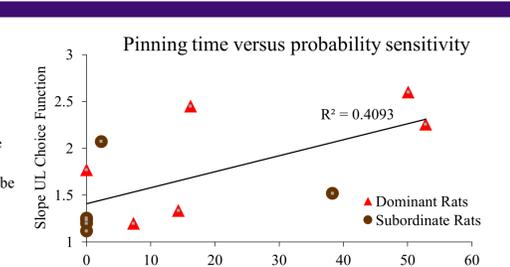
- At the two lowest probabilities, there was a difference in risky choice due to both task order and dominance.
- The subordinate rats that were tested for risky choice first showed more UL choices than when they were tested second.



- The average weight did not significantly differ between groups; however, the variance in weights was higher for the pair-housed rats.



- More dominant rats in the tube test tended to make more UL choices, but this was not significant.



- There was a significant positive correlation between the slope of the risky choice function and pinning time.

CONCLUSIONS

- Overall housing condition (single or paired) did not significantly affect choice behavior. However pair-housing, which led to dominant versus subordinate relationships, did change risky choice behavior in that dominant rats (measured by time pinning) showed steeper risky functions.
- While time pinning was positively related to sensitivity to the slope of risky function, dominance in the tube test was (non-significantly) positively related to overall UL choices suggesting that the two dominance measures had different relationships with risky choice.
- The group of rats that were tested for risky choice second were significantly less risky at the lower probabilities, and this interacted with dominance.
- However, dominance did not affect impulsive choice behaviors, indicating that the social relationship effects were specific to risky choice.

REFERENCES

- Flannely, K., & Lore, R. (1975). Dominance-subordinance in cohabiting pairs of adult rats: Effects on aggressive behavior. *Aggressive Behavior*, 1(4), 331-340.
- Davis, J., Krause, E., Melhorn, S., Sakai, R., & Benoit, S. (2009). Dominant rats are natural risk takers and display increased motivation for food reward. *Neuroscience*, 162(1), 23-30.
- Kirkpatrick, K., Marshall, A., Smith, A., Koci, J., & Park, Y. (2014). Individual differences in impulsive and risky choice: Effects of environmental rearing conditions. *Behavioural Brain Research*, 269, 115-127.

ACKNOWLEDGEMENTS

Thank you to the members of the Kirkpatrick RTD lab, past and present, for your help with this project: Andrew Marshall, Catherine Hill, Ashton Triplett, Sydney Edmisten, Melina Campa, Jesseca Pirkle, Andrea Rhodes. This research was supported by National Institute of Health grant MH-085739 and a Kansas State University Department of Arts & Sciences Undergraduate Research Award.

*Email: lottj@ksu.edu