



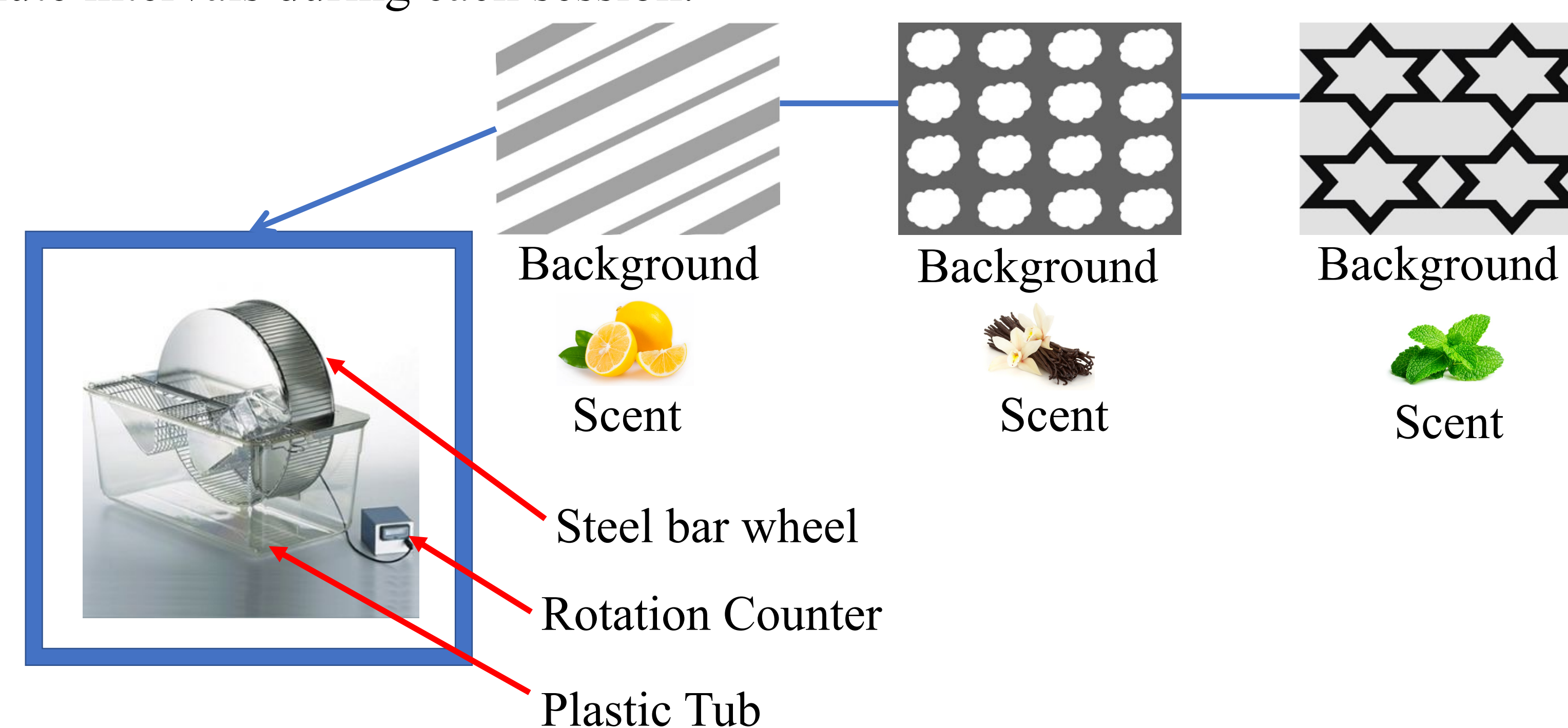
Introduction

- Habituation refers to a reduction in responding to a stimulus after prolonged exposure or repeated presentations of that stimulus. This can affect everyday behavior, like eating (Epstein et al., 2010)
- Unlike sensory adaptation and motor fatigue, the reduction in responding seen following habituation results from repeated stimulus presentations rather than being an automated, reflexive process that entails a reduction in sensitivity to constant sensory stimulation. One way to distinguish between sensory adaptation/fatigue and habituation is by presenting a novel stimulus, or a dishabituating stimulus in between presentations of the habituating stimulus. Whereas a habituated response will recover following dishabituation, no response recovery is seen if sensory adaptation or fatigue is the cause for the decrease in responding (Rankin et al., 2009).
- Wheel running in rats has been found to decrease within daily sessions. However, because wheel running is a form of exercise, this decrease was attributed to fatigue as opposed to habituation. In contrast to this idea, Aoyama and McSweeney (2001) showed that wheel running in rats is habituated during daily sessions and that the response recovered following a mid-session wheel switch (i.e., dishabituation) compared to rats that ran on the same wheel for the entire 30-minute session.
- The current experiment investigated whether habituation could be attenuated in rats using contexts changes across sessions of wheel running.
- Rats in the experimental group were placed in one of three contexts that differed in terms of the background surrounding the wheel (clouds, stars, or diagonal lines) and odor (lemon, mint, or vanilla) each day. Rats in the control group were placed in a running wheel with no explicit context.
- It was hypothesized that when rats run in different contexts, they will habituate slower and have higher rates of running compared to those who run in the same context every day.

Method

Subjects: 11 Long-Evans rats (9 male and 2 female).

Apparatus: Four different wheels were placed in 4 separate corners of one room. Each running wheel was connected to a resting chamber where the rat could have unrestricted mobility. Counters attached to each wheel measured the number of wheel rotations. Wheel 1 consisted of a running wheel (with a plastic holding cage and a steel bars wheel) and no controlled contextual setting. Wheels 2, 3, 4 consisted of a similar running wheel, but each wheel was differentiated by unique scents (lemon, mint, or vanilla) and patterned poster boards (clouds, stars, diagonal lines) that surrounded the running wheel apparatus on all four sides. Additionally, to account for within-session changes, iPads were used to take video recordings of the wheel rotation counter to be able to look at the number of wheel rotations in 10-minute intervals during each session.



Procedure: The rats were given access to one of four wheels (1-4) for 30-minute sessions for 12 days. Rats were either assigned to the Experimental group ($n = 6$) or the Control group ($n = 5$). The subjects in the control group were assigned to run in the same wheel and context (olfactory, visual, and tactile) each session for the entirety of the experiment. Subjects in the experimental group ran for the same 30-minute interval as the control group but alternated between the four wheels and contexts across sessions.

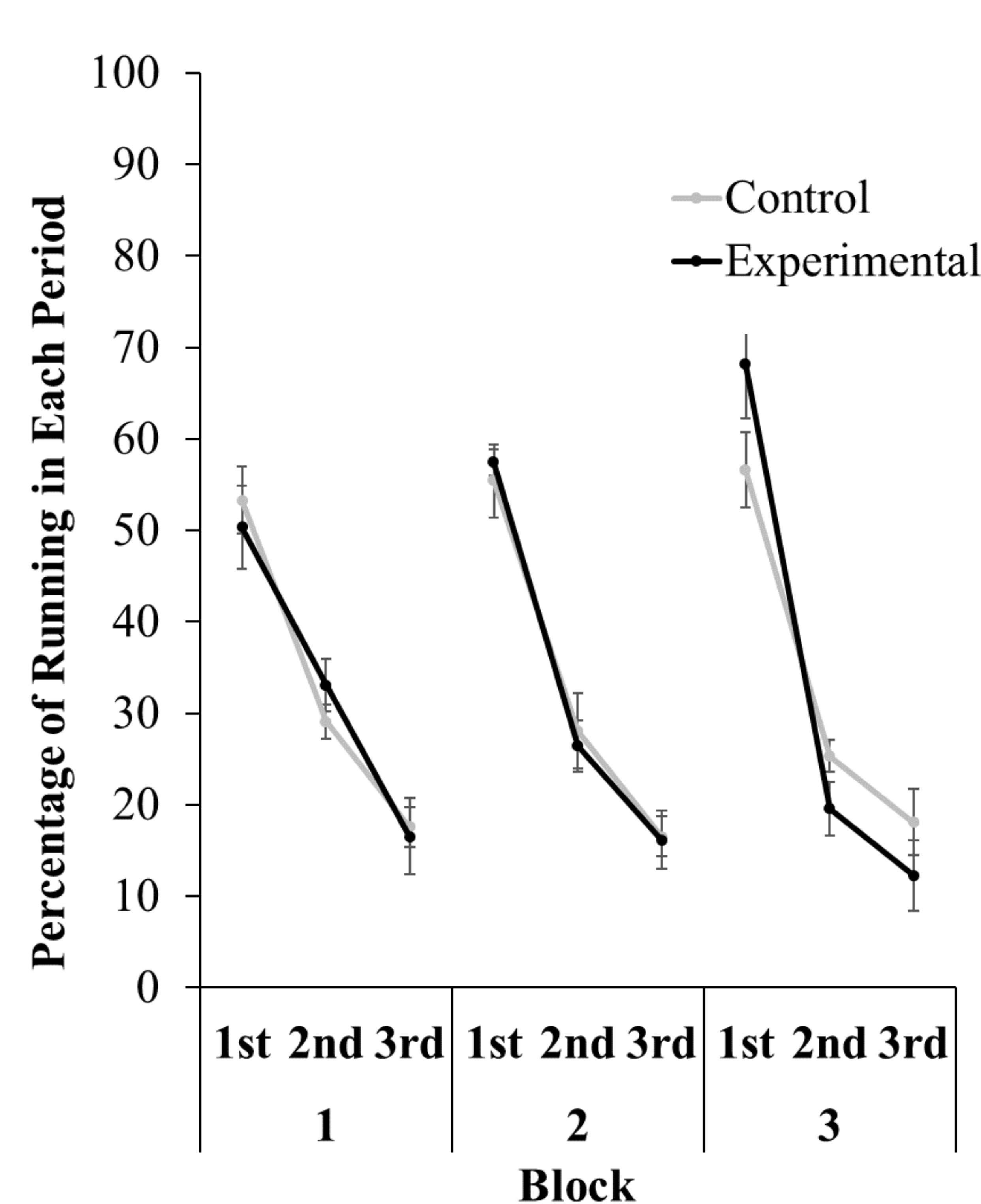


Figure 1. A repeated measures ANOVA was performed on percentage running in each period with Block (Block 1: Sessions 1-4, Block 2: Sessions 5-8, and Block 3: Sessions 9-12) and Time (first 10-min, second 10-min, and final 10-min) as the repeated measures and Group (Control vs. Experimental) as the between-subjects factor. There was a main effect of Time, $F(2, 18) = 107.84, p \leq .001$. All interactions were nonsignificant $F_s \leq 2.45, p_s \geq .07$. Tukey's HSD Post-Hoc analyses performed on the Time main effect revealed that all time periods were different from each other, $p_s \leq .004$, with the percentage decreasing across time.

Results

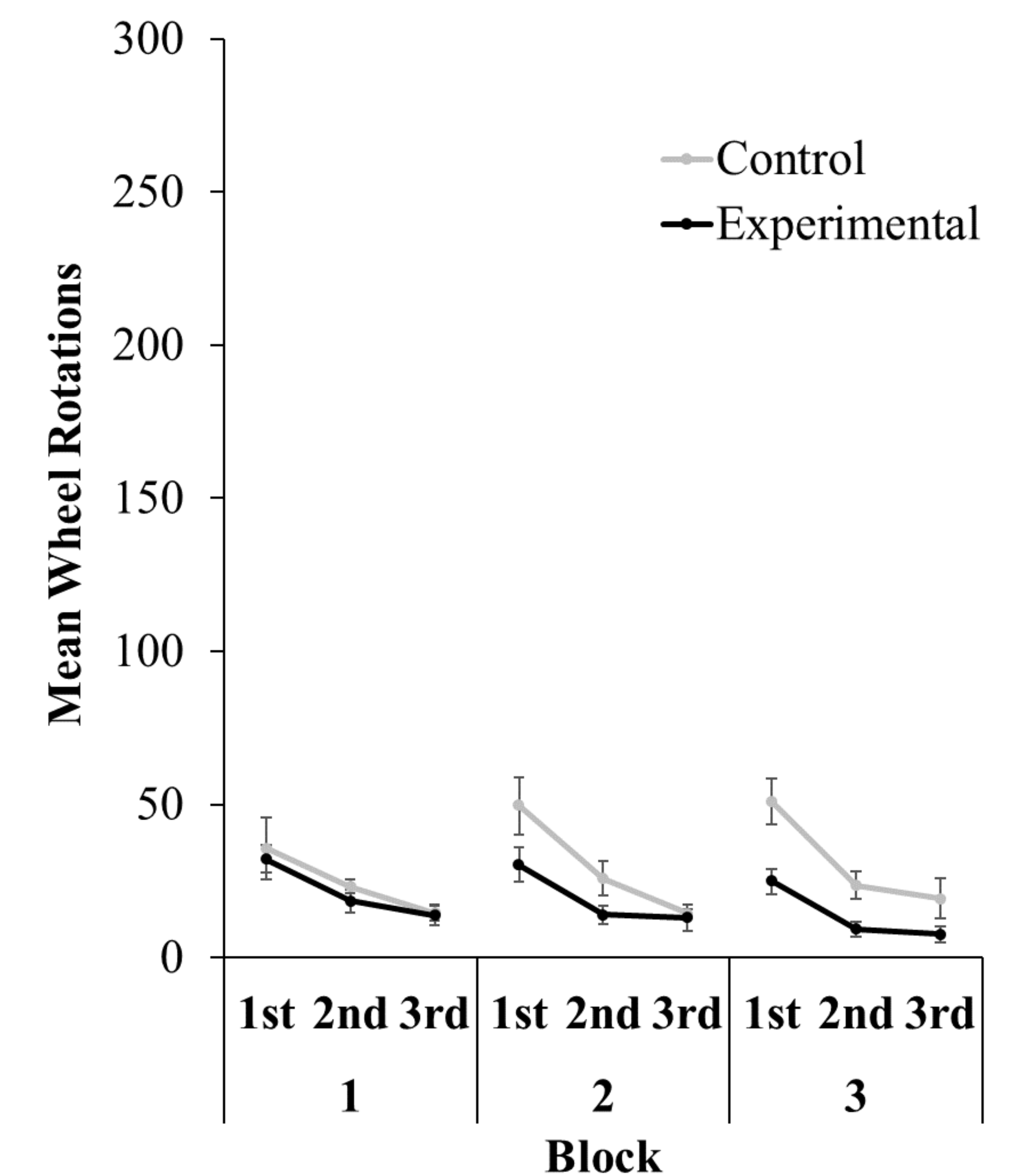


Figure 2. A repeated measures ANOVA was performed on the mean wheel rotations with Block (Block 1: Sessions 1-4, Block 2: Sessions 5-8, and Block 3: Sessions 9-12) and Time (1st 10-m, 2nd 10-m, and 3rd 10-m) as the repeated measures and Group (Control vs. Experimental) as the between-subjects factor. There was no main effect of Group, $F(1, 9) = 4.15, p = .07$. There was a main effect of Time, $F(2, 18) = 84.01, p \leq .001$, with the mean number of wheel turns decreasing across time. There was a Group by Block interaction, $F(2, 18) = 7.43, p \leq .004$, and a marginal Group by Time interaction, $F(2, 18) = 3.12, p = .07$. All other interactions were nonsignificant, $F_s \leq 3.12, p_s \geq .06$. Tukey's HSD Post-Hoc analyses performed on the Group by Block interaction revealed marginally more wheel running in the control group during Block 3, $p = .09$, but not during Block 1, $p > .05$. For the Group by Time interaction, though non-significant, two patterns emerge. First, the difference in wheel running between groups was larger during the 1st time period than the last, $p_s \geq .13$. Second, the difference in the control group between the 2nd and 3rd time period was greater, $p = .10$, than in the experimental group, $p = .59$.

Discussion

- Both measures revealed reliable within-session habituation in the experimental and control groups. This indicates that changing the context of the running wheel did not reduce the effects of habituation in the experimental group.
- The percentage of running in each period indicates that rats in both groups are both habituating similarly, though more subjects may reveal a difference across blocks.
- The mean wheel rotations also indicates habituation in both groups, but additionally, that the experimental group may be running less than the control group in the first time period during Block 3. Perhaps the repeated introduction of different stimuli is increasing habituation of dishabituation. However, the overall difference in Block 3 between groups suggests that this effect may interfere with running throughout a session, not just at the end of the session. Switching wheels may induce stress, and over time that stress reduces the amount of running.
- If the results of this experiment are translated to humans, then changing the location of a workout across days will not increase the rate of exercise throughout a workout and may even decrease it over time.
- Future research could involve increasing the number of sessions each subject experiences before a context change. This could lessen the effects of dishabituation and novelty/fear.

References

- Aoyama, K. & McSweeney, F. K. (2001). Habituation contributes to within session changes in free wheel running. *Journal of the Experimental Analysis of Behavior, 76*(3), 289-302.
- Epstein, L. H., Robinson, J. L., Roemmich, J. N., Marusewski, A. L., & Roba, L. G. (2010). What constitutes food variety? Stimulus specificity of food. *Appetite, 54*(1), 23-29.
- Rankin, C. H., Abrams, T., Barry, R. J., Bhatnagar, S., Clayton, D. F., Colombo, J., & McSweeney, F. K. (2009). Habituation revisited: an updated and revised description of the behavioral characteristics of habituation. *Neurobiology of Learning and Memory, 92*(2), 135-138.