

Are you tired or have you accustomed to your workout?

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Introduction

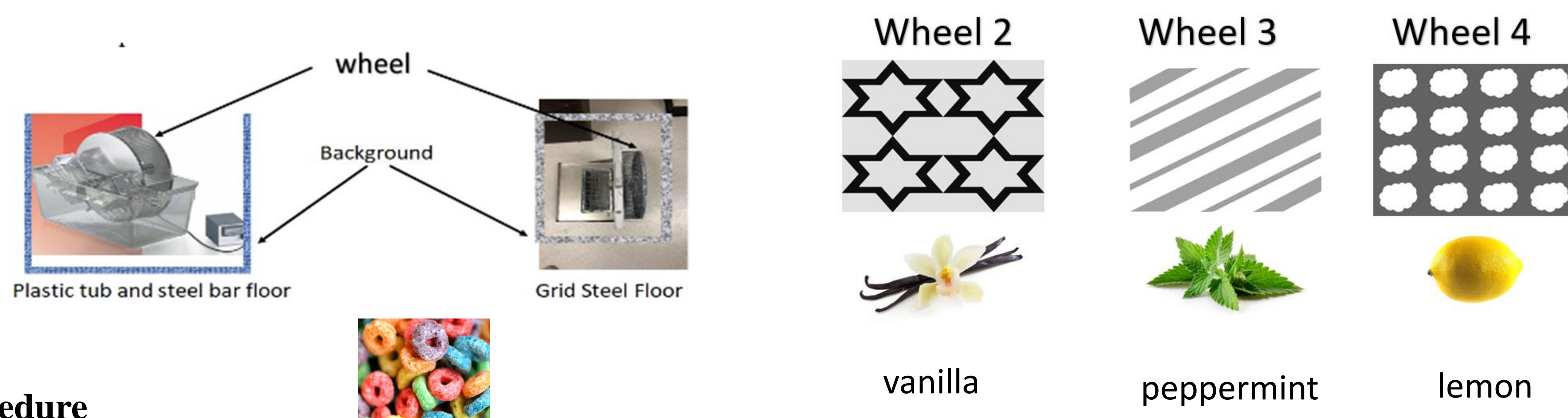
- **Habituation:** when the response to an eliciting stimulus decreases with repeated exposure. This is distinguishable from fatigue or sensory adaptation (Rankin et al., 2009)
 - People will consume less food when exposed to the same food (eliciting stimulus) than when it is varied (Epstein et al., 2010; 2011)
 - The incentive value (drive) to perform a behavior decreases if the same food is always the reinforcer (McSweeney & Swindell, 1999)
 - Humans show habituation to walking on a treadmill at the same speed within twelve sessions (Wall & Charteris, 1981)
- **Habituation of exercise in nonhuman animals**
 - Exploration (i.e., for food) in rats can be modeled by providing them with a wheel to run in.
 - Aoyama & McSweeney (2001) found that wheel running is subject to habituation. Rats ran less over sessions not because of fatigue, but rather from habituation of exercise.
 - In the same study, when the running wheel was changed within the same session, habituation in rats was slowed (i.e., rats ran more)
- **Current Study**
The context in which running occurred each day was varied for one group of rats. It is hypothesized different contexts each day will slow habituation and result in faster rates of running within session. This research can demonstrate the benefit of varying your workout routine and context for long-term exercise and performance.

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., Carr, K. A., Cavanaugh, M. D., Paluch, R. A., & Bouton, M. E. (2011). Long-term habituation to food in obese and nonobese women. *The American Journal of Clinical Nutrition*, 94(2), 371-376.
 Epstein, L. H., Robinson, J. L., Roemisch, J. N., Maruszewski, A. L., & Roba, L. G. (2010). What constitutes food variety? Stimulus specificity of food. *Appetite*, 54(1), 23-29. McSweeney, F.K., & Swindell, S. (1999). General-process theories of motivation revisited: The role of habituation. *Psychological Bulletin*, 125, 437-457.
 Wall, J. C. & Charteris, J. (1981). A kinematic study of long-term habituation to treadmill walking. *Journal of Ergonomics*, 24(7), 531-542.
 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.

Method

Subjects: Eight female Long-Evans rats (*Rattus norvegicus*) were used.

Apparatus: Four different running wheels were placed across two rooms. Each running wheel was connected to a resting chamber and had a counter to measure the number of wheel turns. Wheel 1 (diameter 33.3 cm) consisted of a running wheel (with a plastic holding cage and steel bars wheel) in which there were no differentiating factors. In a separate room, wheels 2,3,and 4 (diameter 35.6 cm) consisted of mechanical wheels (with steel holding cage and steel grid running wheel), located on different corners across the room. Each wheel was differentiated with different scents (i.e., lemon, mint, vanilla) and patterned poster boards (i.e., clouds, stars, diagonal lines) surrounding the wheel on four sides.



Procedure
Pretraining. The rats were able to experience the resting cage of each wheel during four days prior to the start of the experiment. In order to help them habituate to the new apparatus, they were left inside the resting cages with a Fruit Loop for 10 minutes.

Experiment Proper. Rats completed 12, 30-minute sessions with complete access to the wheel and resting cage. First, rats were split into two groups. The control group ran in the same wheel every day. The experimental group ran in a different wheel every day. The number of wheel turns was recorded in 10-minute intervals.

Rat Extraction. After the rats finished their session, the door between the wheel and the resting cage was locked. Subsequently, the door from the resting cage was opened and a steel plate holding a Fruit Loop was placed in front of the cage to motivate the rat to leave the resting cage.

Results

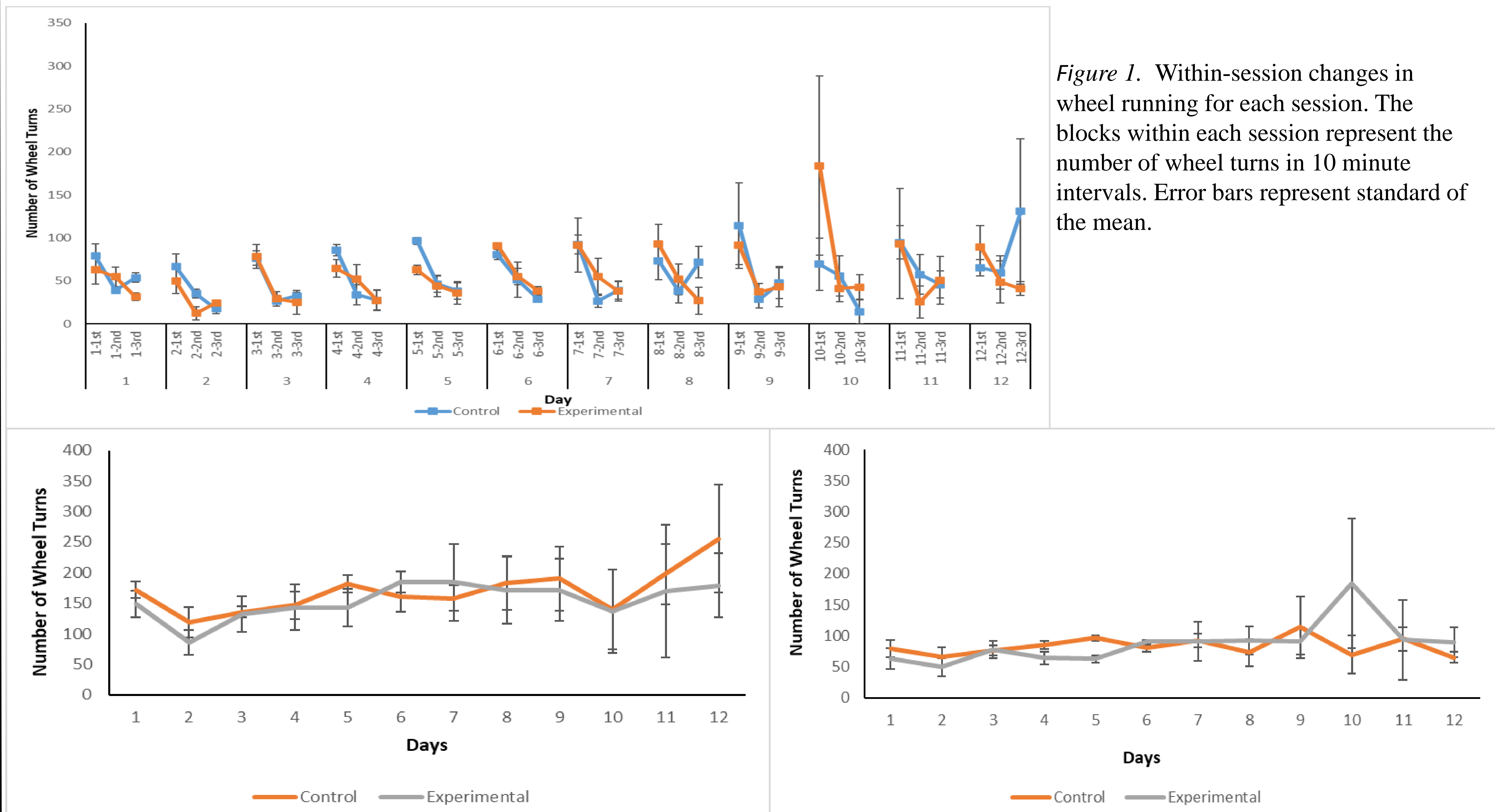


Figure 2. Long-term habituation in the total number of wheel turns for each session. Error bars represent the standard of the mean.

Figure 3. Long-term habituation in the total number of wheel turns for the first ten minutes of each session. Error bars represent the standard of the mean.

Long-term Habituation and Within-Session Changes

- An outlier from the Experimental group was dropped from this figure ($n = 3$, Experimental; $n = 4$, Control).
- Each block of sessions represents 4 sessions
- 3(Session: 1, 2, vs. 3) by 3(Within-session Block: 1, 2, vs. 3) by 2(Group: Control vs. Experimental) mixed-measures ANOVA was conducted on the total number of wheel turns, with group as the between-subjects factor.
- Main effect of Session, $F(2, 12) = 4.46, p = .04$, with rats running more in the third block of session as compared to the first block, $p = .03$.
- Main effect of Within-session Block, $F(2, 12) = 32.22, p < .01$, with rats running more in Block 1 as compared to Blocks 2 and 3, $ps \leq .01$.
- No main effect of group, $F(1, 6) = .71, p = .43$
- No significant interactions, $F_s < 1.09, ps > .37$

Long-term Habituation during the 1st 10 minutes of each session

- ANOVA with Group and Session (blocked) was run on only the total number of wheel runs for the first within-session block of each session
- Main effect of Session, $F(2, 12) = 4.66, p = .03$, with a trend toward an increase of running from the first Block of Sessions to the last Block of Sessions
- No main effect of Group or interaction, $F_s \leq 2.48, ps \geq .13$

Conclusions

- It was predicted that rats in the Experimental group would habituate at a slower rate (i.e., run more) than rats in the Control group because they experienced daily context changes.
- The results indicated that both groups ran more at the end of the experiment as compared to the beginning. All rats' running decreased after the first 10 minutes of each session, exhibiting within-session habituation.
- There was one rat in the Experimental group who ran significantly more than the others and increased the average of that group.
- Originally, the groups were going to switch after 12 sessions in a within-subjects design. However, COVID-19 happened. ☹️
- Future research should increase the number of subjects per group and include the group switch. Also, we would use the same model of wheel for all rats to better control comparisons between context changes.