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Stress Effects on Extinction of Free Operant Behavior

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Introduction

- Free operant behavior can involve a rat lever pressing for food reward. Once the behavior is learned, lever pressing typically occurs at a steady, high rate
- Extinction is a general procedure where the cues previously paired with an unconditioned stimulus (e.g., food) are presented without that outcome (no food), which leads to a decrease in responding
 - Extinction here involved a no food reward phase where no presentation of the reinforcer (i.e., no food) when the lever pressing behavior was performed. This extinction phase leads to a decrease in lever pressing [1]
- Stress has been shown to interfere with extinction learning in fear motivated tasks. Moreover, extinction is not an “unlearning” of previous events, but rather a new, competing memory [2]
- The present study focused on whether stress would interfere with extinction learning using an operant task

Aim

The purpose of this experiment was to address the issue of stress interfering with extinction learning of free operant behavior

Method

- Subjects**
 - Eighteen male Long-Evans rats served as subjects. Prior to the start of the experiment, animals were food deprived to 80% of the initial body weight.
- Apparatus**
 - Conditioning chambers (Coulbourn Instruments H10-11R) measure 30.5 x 25.4 x 30.5 cm and are housed in sound attenuating chambers
- Procedures**
- Stress**
 - Once the animals were at 80% of their *ad lib* weight, some rats received a single, 60-minute restraint session
- Magazine training**
 - Twenty-four hours after stress, all animals received a 30-minute magazine training session
 - Training consisted of rats being placed in the chamber and received approximately 60 food pellets delivered randomly on average every 30 seconds.

Acquisition

- On each of the next 5 consecutive days, rats received one 30-minute session of lever press training on a variable interval (VI) 30 second reinforcement schedule, meaning that a food pellet was available approximately every 30 seconds. This schedule of reinforcement has been demonstrated to produce steady response rates.

Extinction

- Following acquisition, on each of the next 4 days all animals received daily 30-minute sessions of extinction training. Extinction involved the rats to be placed in the chamber while lever pressing did not result in the delivery of a food pellet. This results in a decrease in the lever pressing behavior.

Test

- Twenty-four hours the last extinction session, all animals received a single 10-minute test session. Testing was similar to extinction where no pellets were delivered. The number of lever presses were recorded and a response per minute was calculated as the dependent variable.

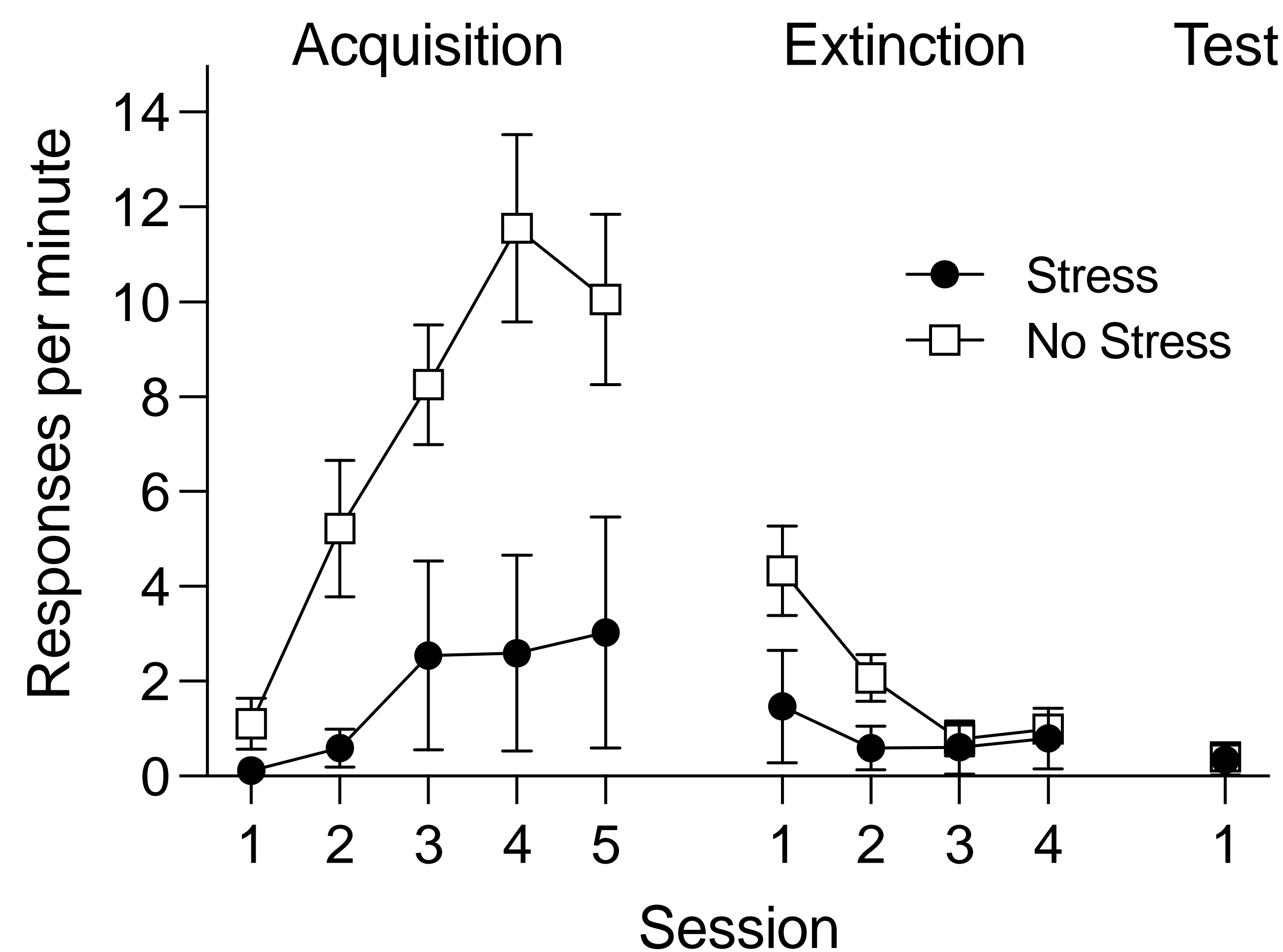


Figure 1. Mean (\pm SEM) responses per minute during each 30-minute session of acquisition and extinction, and during the 10-minute test session.

Results

Acquisition

- As shown in Figure 1, the rats acquired lever pressing over the five days at different rates. A group X session ANOVA was performed and confirmed that the main effect of group was significant, $F(1, 16) = 8.77, p = .009$, confirming that the No Stress group acquired the lever pressing response more quickly than the Stress group. The effect of session was also significant, $F(1.598, 25.56) = 13.72, p = .0002$. There was also a significant interaction, $F(4, 64) = 4.17, p = .0046$.

Extinction

- Figure 1 also shows that extinction was also learned. A parallel ANOVA of extinction indicated that overall, responding declined over the sessions, $F(1.45, 23.14) = 13.51, p = .0004$. In addition, a nonsignificant group effect showed the groups learned at similar rates, $F(1, 16) = 1.98, p = .178$. There was a significant interaction, $F(3, 48) = 5.45, p = .003$, suggesting that the No Stress had higher responses early in extinction.

Test

- An independent t-test confirmed that the two groups did not differ at test, $t(16) = .175, p = .863$. Thus, stress did not appear to effect extinction of the operant response.

Discussion

- Although stress did not appear to effect extinction learning of the operant response, it appears that the restraint stress did effect the acquisition of the response
- Some research has shown that reward behavior is affected by stress by decreasing motivation [3,4]
- Stress has been shown to effect learning in several paradigms
 - That stress impaired original acquisition in this appetitive task, but has been shown to disrupt extinction learning using an aversive task leads to an important question about stress effects on original learning and competing inhibitory learning

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