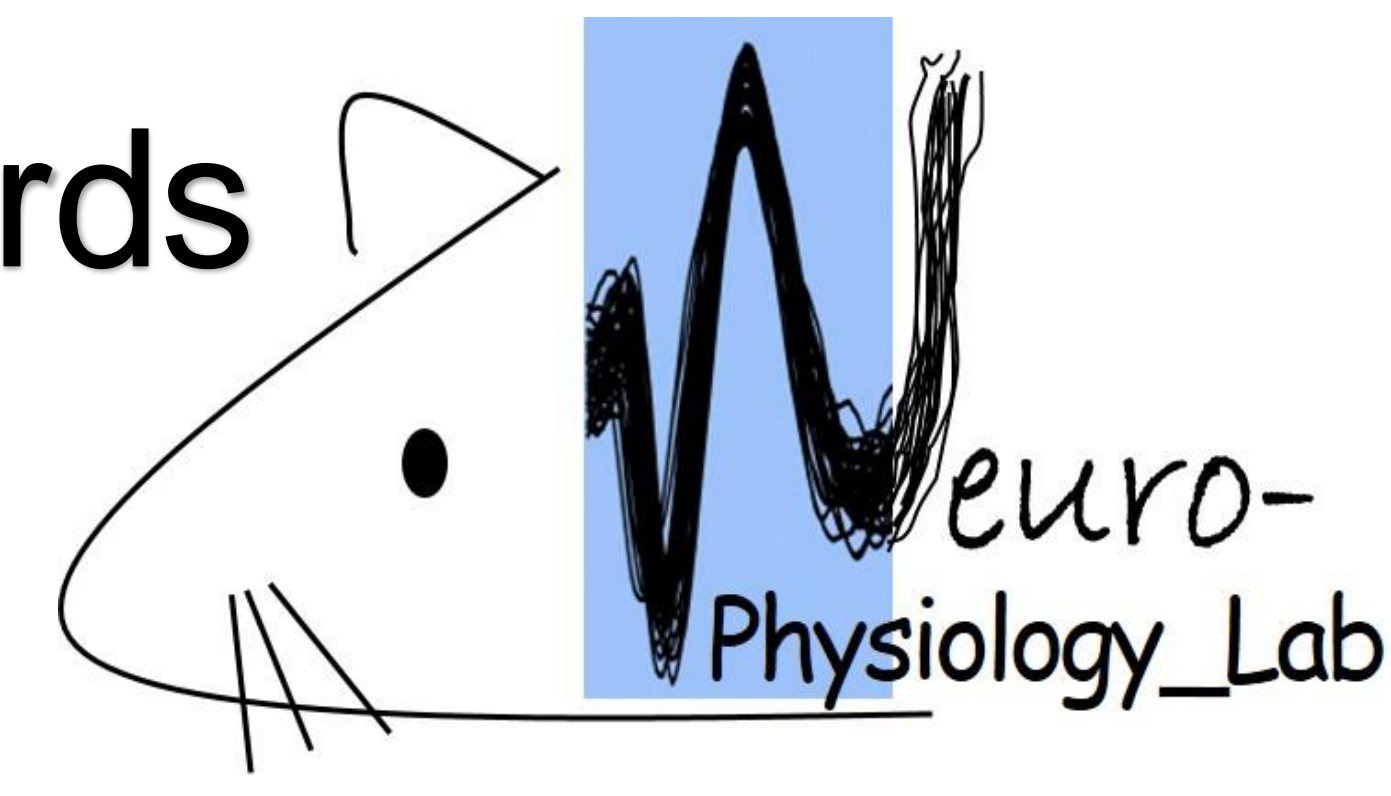




Effects of Intermittent Episodes of Social Stress on the Motivation to Seek Rewards

Christopher E. Lemon and Alberto Del Arco

HESRM, School of Applied Sciences, University of Mississippi, Oxford MS



Introduction

Repeated social stress in humans increases the vulnerability to develop psychiatric disorders such as depression and drug addiction. To produce these effects, stress is thought to modulate areas of the brain that are responsible for reward and motivation. This study utilizes an animal model of repeated intermittent social stress to investigate how stress changes cost/benefit decision making.

Methods

Male Long Evan rats (n= 16) were slightly food restricted (15% body weight) and trained in the Effort-based reward discrimination task (see below). After stable performance, they were divided in two groups: Control (n= 8) and Stress (n= 8). Stress rats were subjected to repeated intermittent social defeat (Resident-Intruder paradigm) and Control rats were handled.

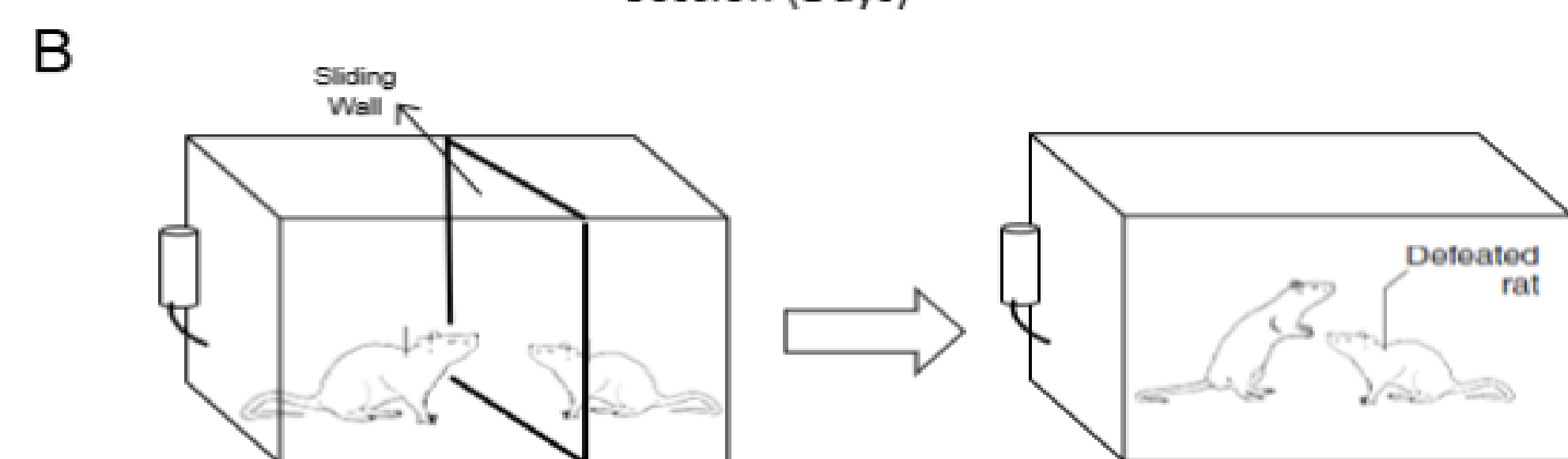
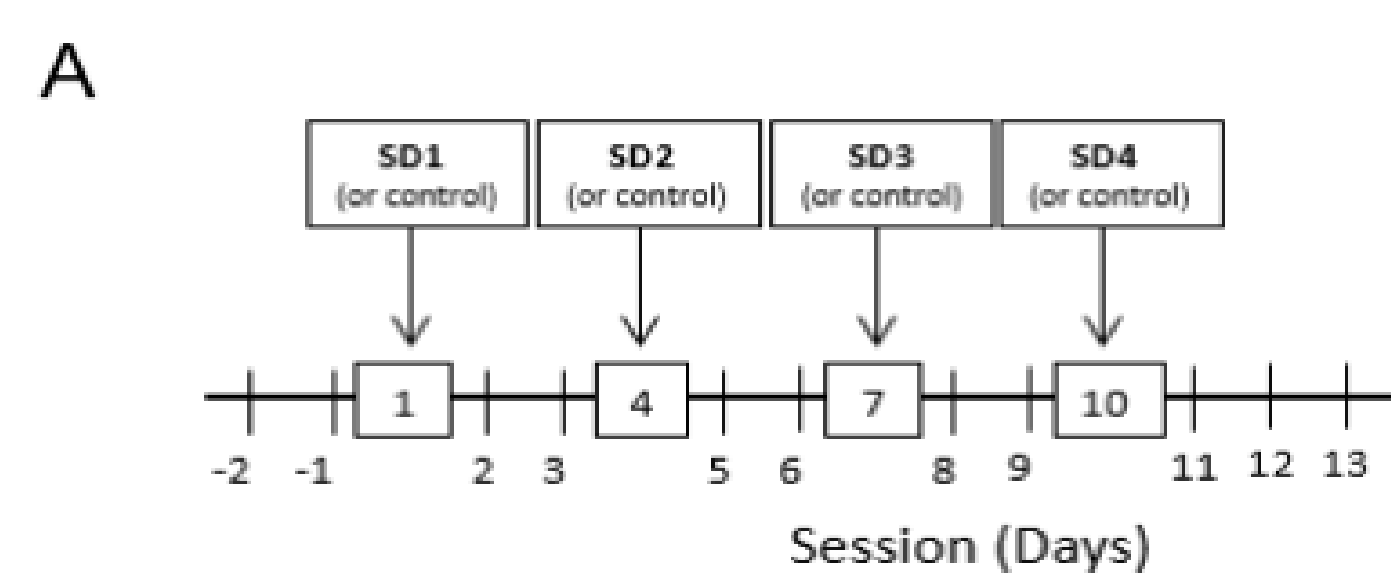
Repeated Intermittent Social Defeat Stress (Figure 1): The Resident-Intruder paradigm consists of housing a larger male rat (resident) with a female rat in a big cage (45 x 61 x 61 cm) for two weeks before stress begins. Then, every stress episode goes as follows: first, the female rat is removed from the resident cage; second, the "intruder" is placed into the resident's cage with a clear dividing wall that allows them to see each other without physical interaction for 10 minutes; third, the wall is removed allowing the rats to interact physically. The interaction ends immediately after a bite, the intruder spends more than 5 seconds in a supine (on their back) position, more than 6 attacks are observed, or 5 minutes had passed. Control rats are taken to a separate room for the same amount of time and handled by researchers for 5 minutes. Fourth, the dividing wall is set again to separate both rats for 10 more minutes. Finally, intruders are returned to their home cages.

Effort-Based Reward Discrimination Task (Figure 2): Rats were trained to discriminate between a high-reward lever (HR) (3 pellets) and low-reward lever (LR) (1 pellet) until they reached the criterion of 75% HR choices in 60 trials. After this had been achieved, the training in the effort-based decision-making task began; this task consisted of 4 different blocks with 12 trials each in which the rat had to choose between the HR and the LR. In every block, the rat was required to press an increasing amount of times the HR to get the 3 pellets, starting at 2 presses, then 5 presses, 10 presses and finally 20 presses. Pressing the LR once was always enough to get 1 pellet in every block.

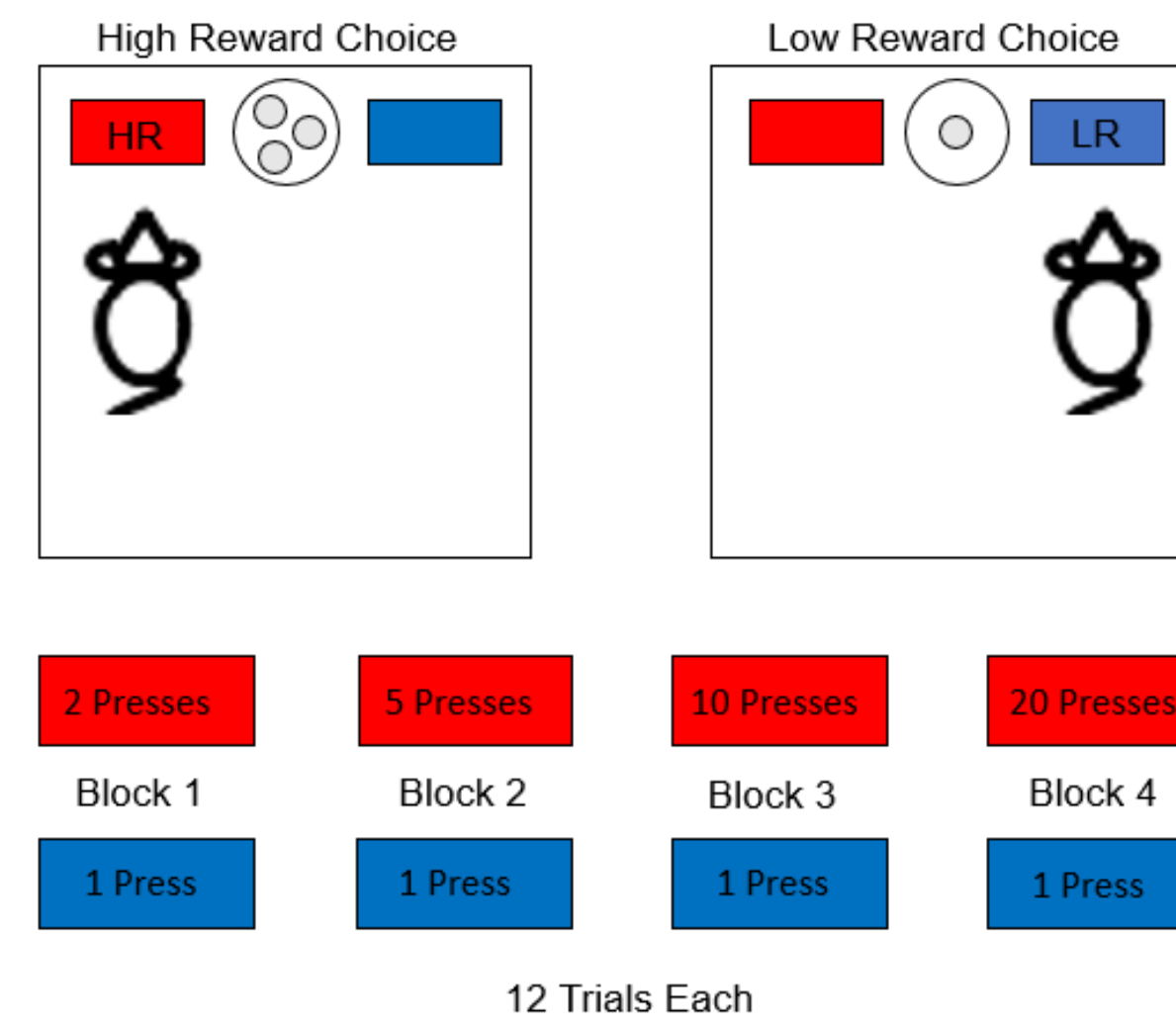
Progressive Ratio Reward Seeking Task (Figure 3): Rats were presented a lever where they would be allowed to continuously press in order to receive a reward during a 10-minute block. The amount of effort to receive this reward was increased every block. The amount of lever presses began at 2, went to 5, 10, 20, 31, 44, 56, 78 and finally 100 to receive one sugar pellet as many times as they could meet the criteria in the 10-minute block. The task was ended once number of presses equaled 0 in a 10-minute block or time expired in the 100-press condition.

Data Analysis: Two-way ANOVAs with repeated measures were used to evaluate the effects of training and stress on both tasks.

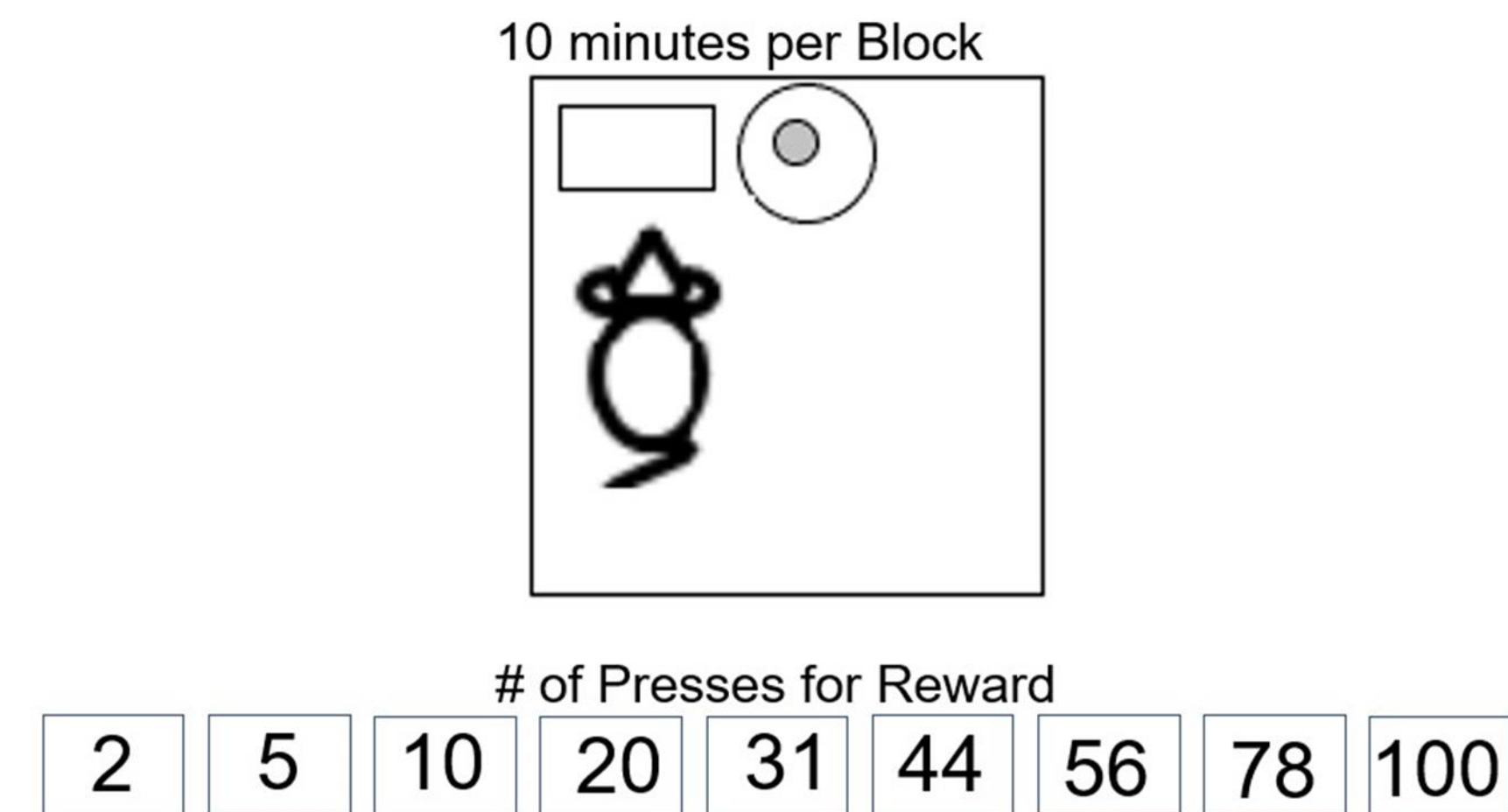
1. Intermittent Social Defeat Protocol



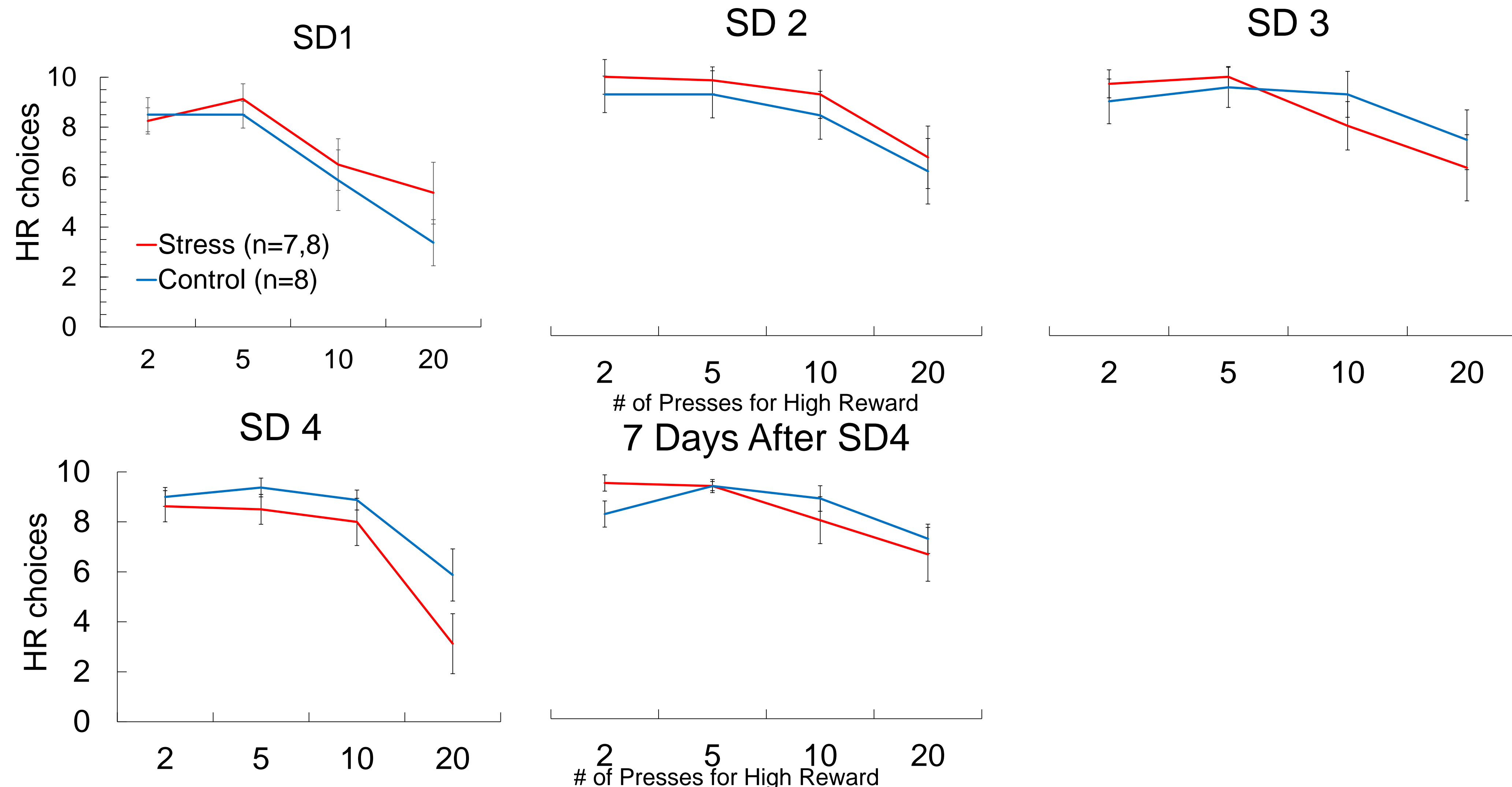
2. Effort Based Decision Making Task



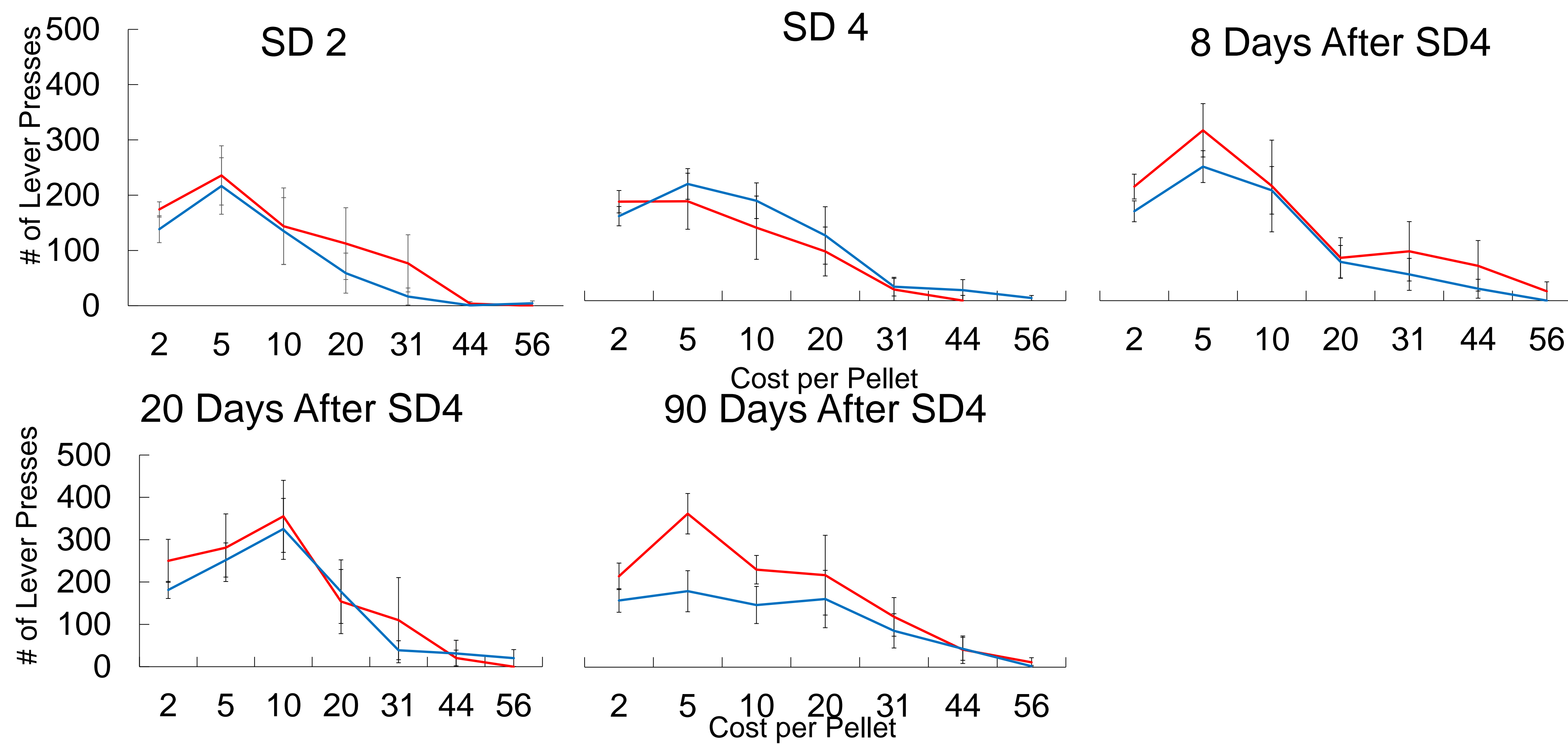
3. Progressive Ratio Task



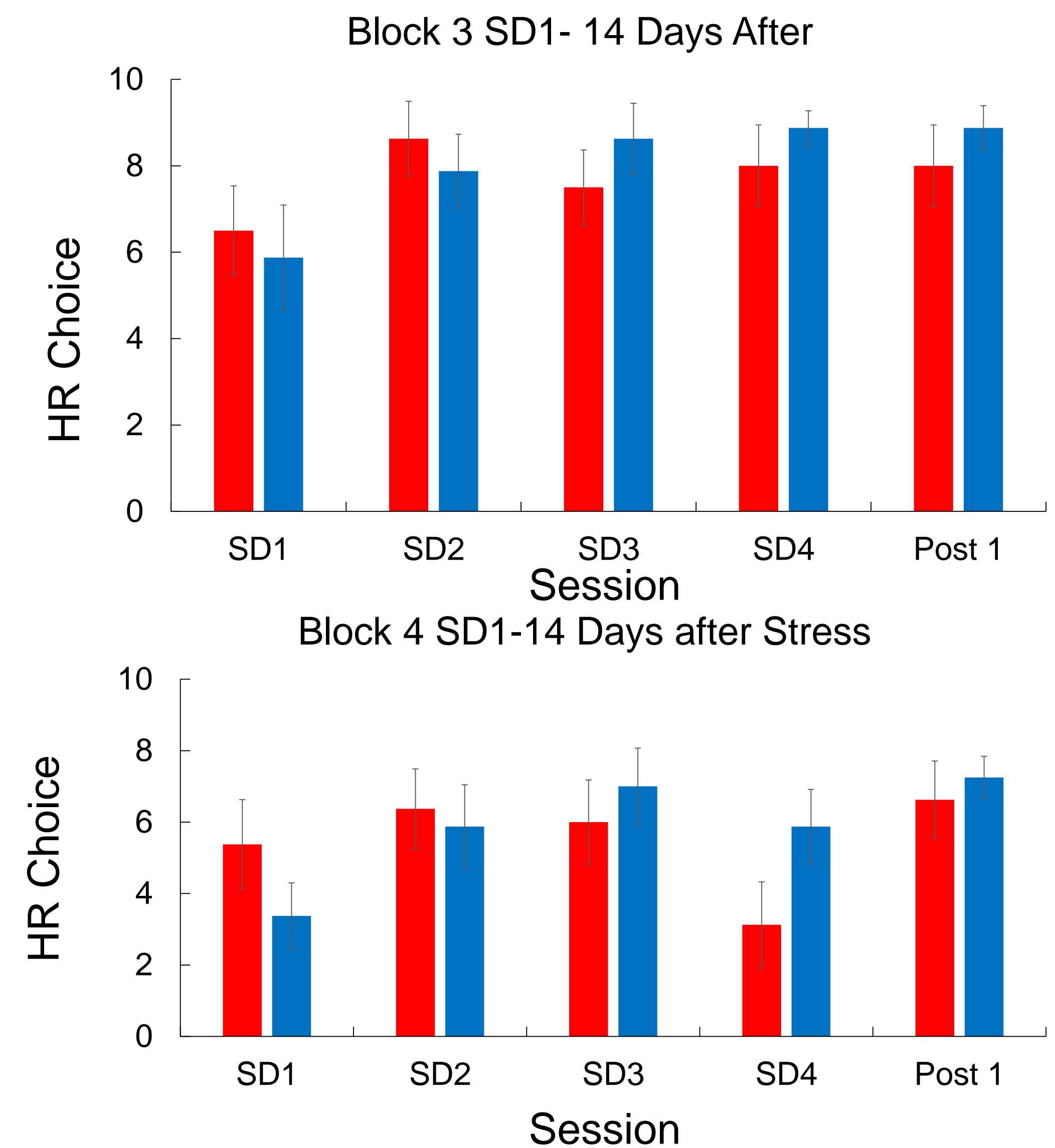
4. Stress does change effort-based decision making after SD4



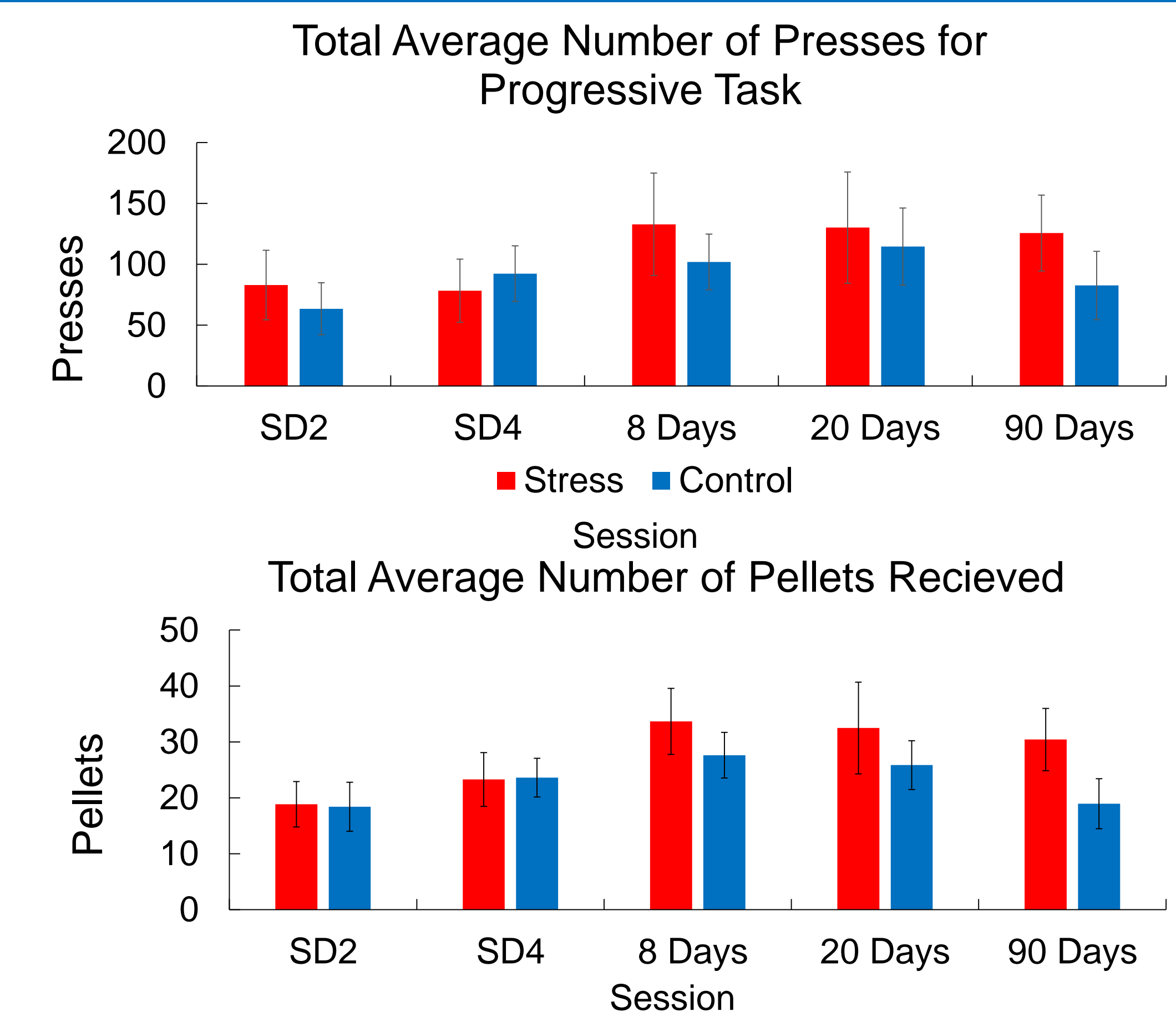
5. Stress has long term effects on the motivation to seek rewards in a progressive ratio task



6. Summary of Effort Based Results



7. Summary of Progressive Ratio Results



8. Conclusion

1. The effort-based decision task shows that social stress reduces rat's preference to choose the high effort (high reward) lever. This short-term effect was reversed 7 days after the last episode of social stress and suggests that social stress alters cost-benefit decision making.
2. The progressive ratio task shows that social stress increases the number of times that rats press the lever for rewards. This effect emerged in the long-term, 90 days after the last stress episode and suggests that social stress increases the motivation to seek rewards.
3. Over all these results suggest that intermittent social stress produces opposite short- and long-term effects on the motivation to seek rewards