

## INTRODUCTION

- The strength of a fear memory influences the extent to which it can be effectively regulated
- Yet, operationally speaking, “memory strength” is a fuzzy construct
- There is no clear consensus in the human fear learning literature on how to effectively measure or manipulate it
- Some studies point to the magnitude of responses to the conditioned stimulus (CS+) during late acquisition as reflecting the strength of the memory
- It has also been suggested that memory strength can be indexed by the rate at which responses persist across extinction, with stronger memories extinguishing more slowly
- An additional index, fear recovery (extinction retention), is a clinically relevant measure, as it’s the analogue of post-therapeutic relapse of fear
- One methodological factor that can potentially impact the strength of a fear memory is rate of threat reinforcement during acquisition
- However, evidence shows full reinforcement drives strong acquisition responses but fast extinction, while partial reinforcement drives prolonged extinction but weaker acquisition responses. Impact on fear recovery is unknown.

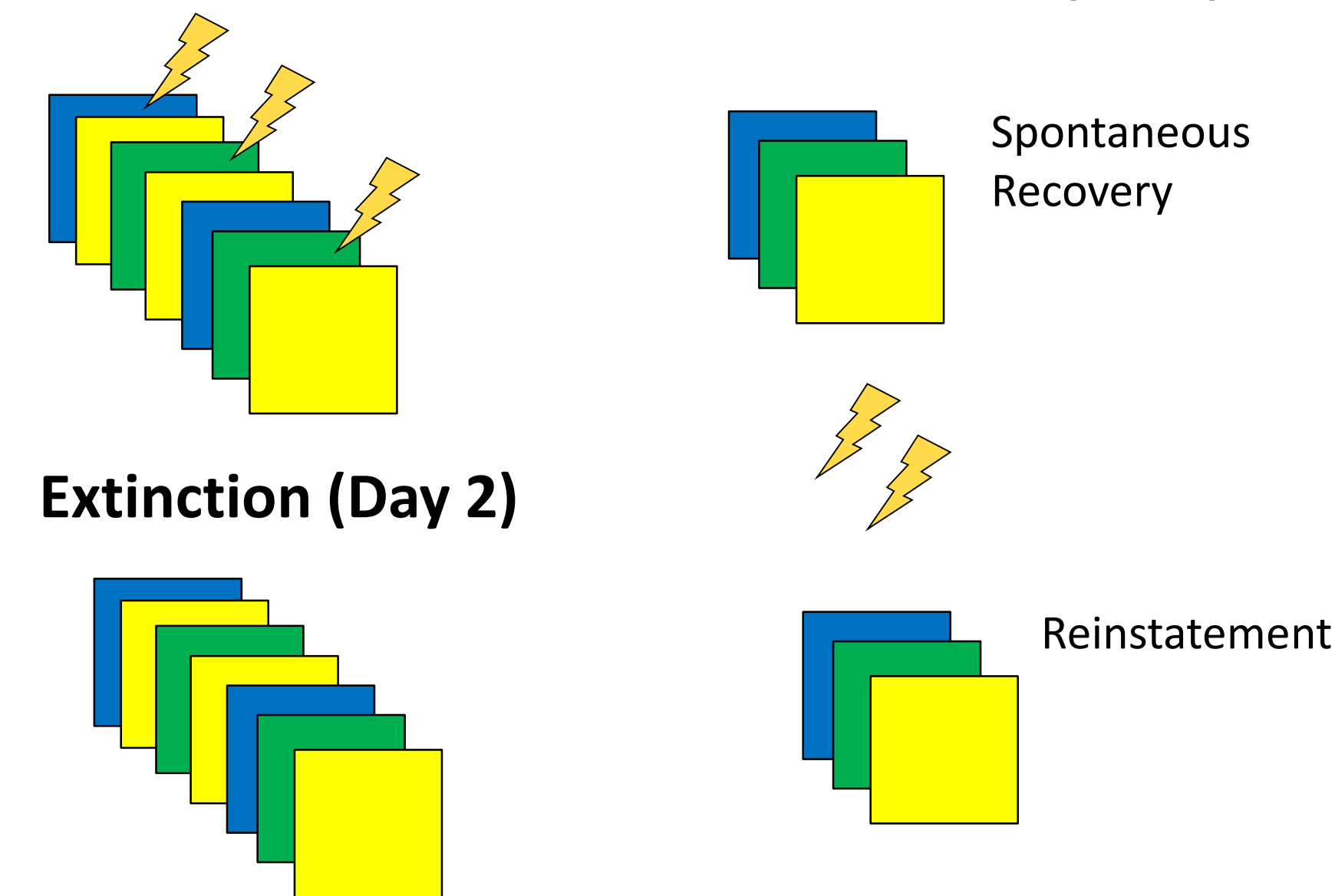
**Objective 1:** Test effect of threat reinforcement rate on acquisition (ACQ), extinction (EXT) and fear recovery (REC) responses.

**Objective 2:** Test if strength of memory tracks across different phases (ACQ, EXT, REC) for both full and partially reinforced CS+.

## METHODS

### Acquisition (Day 1)

### Fear recovery (Day 3)

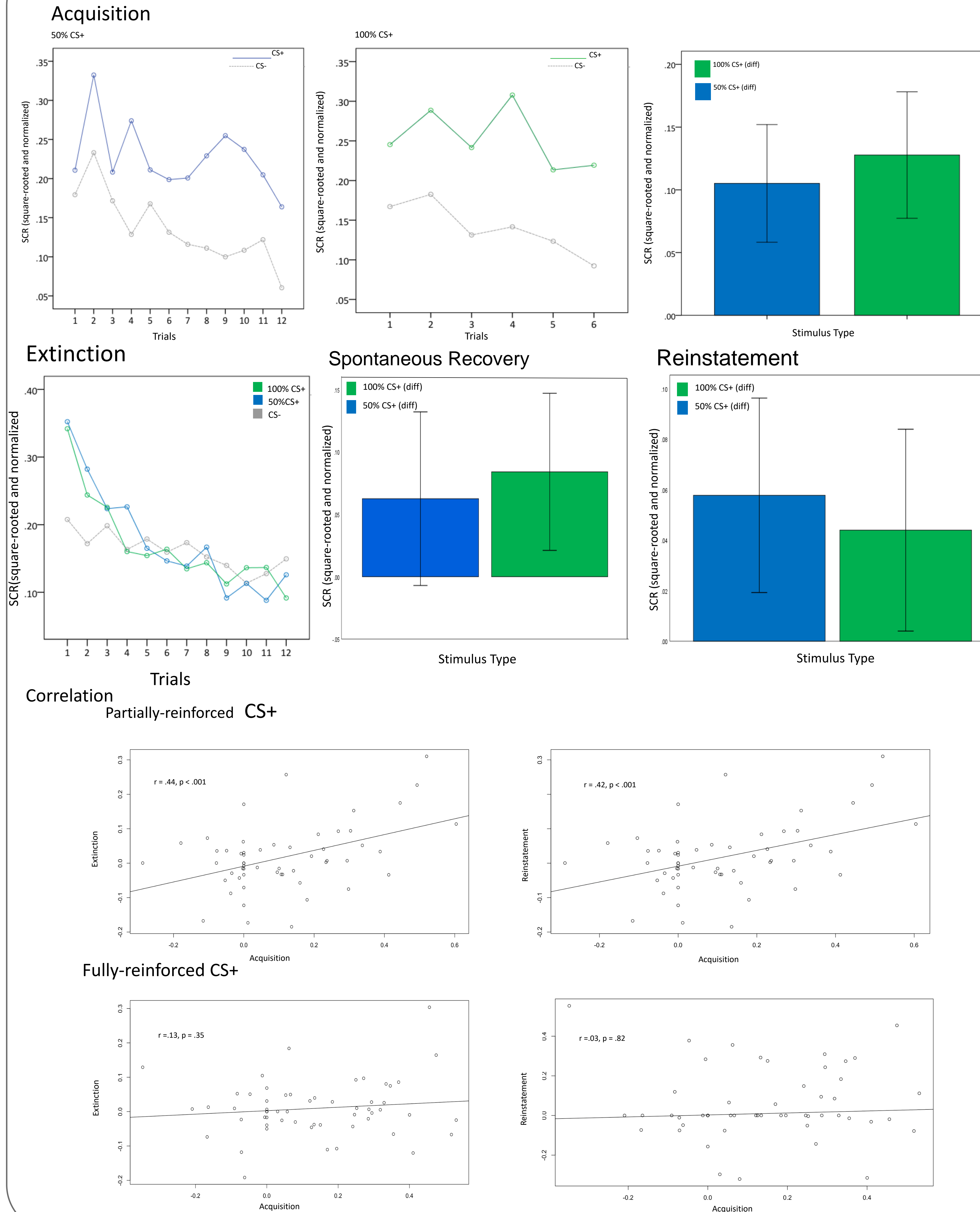


Within-participant design; Output measure: SCR  
Reinforcement rates: partial, 50%; full, 100%

### Demographics

N = 59 (age range = 18-35)

## RESULTS



## CONCLUSIONS

- There was no effect of reinforcement rate on any of the indices of memory strength, in contrast with previous results and theoretical predictions
- However, acquisition responses for the partially (but not fully) reinforced stimulus were correlated with responses during extinction and reinstatement on the intra-individual level.
- This data suggests that acquisition responses in fear conditioning studies utilizing partial (but not full) reinforcement designs serve as a valid index of conditionability (strength of learning)
- It is important to control for strength of learning in order to constrain interpretation of extinction learning and retention data. Therefore, it is recommended that researchers carefully consider the reinforcement rate they utilize in the experimental design, depending upon the research question at hand.
- For example, when testing for group differences in extinction (e.g., by age, sex, genotypic variation, etc.) where group-mediated differences in acquisition are possible and could offer an alternative explanation for extinction results, full reinforcement designs should perhaps be avoided.
- This suggestion is in accordance with methodological discussions inspired by the so-called “replicability crisis” in psychology, which have highlighted the need for a more unified procedural and terminological framework in human fear learning research (Lonsdorf et al., 2017).

## References

Lonsdorf, T. B., Menz, M. M., Andreatta, M., Fullana, M. A., Golkar, A., Haaker, J., ... & Drexler, S. M. (2017). Don't fear 'fear conditioning': Methodological considerations for the design and analysis of studies on human fear acquisition, extinction, and return of fear. *Neuroscience & Biobehavioral Reviews*, 77, 247-285.

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