



Introduction

Previous work has demonstrated that while exposure to 2 weak shocks following context fear conditioning increases freezing evoked by that context, 10 weak shocks decreases freezing (Ferrara et al., 2019).

Behaviorally, this reduction in freezing following the weak shock exposure resembles performance observed following extinction learning (Bouton et al., 2021; Pavlov, 1927).

Here, we aimed to directly compare this 10 weak shock procedure to extinction both behaviorally and molecularly.

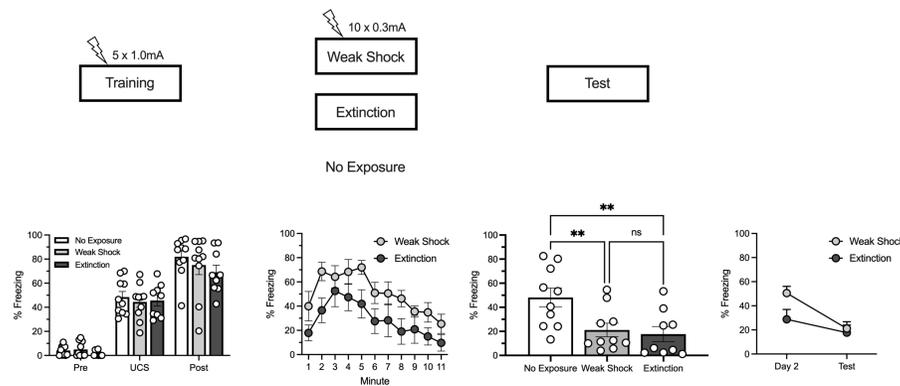
Materials and Methods

Subjects. Subjects were age-matched (70 days) male and female Long-Evans rats.

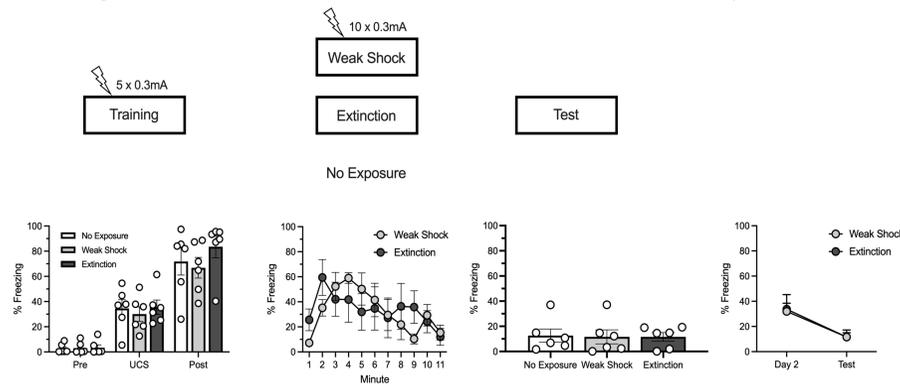
Apparatus. Behavioral procedures occurred in two sets of four Colbourn conditioning chambers that each consisted of plexiglass front, rear, and top walls and brushed stainless steel side walls. Two distinct contexts were created by changing tactile, visual, and olfactory cues. Training consisted of 5 context-shock (1.0 mA, 1-s) pairings. Phase 2 consisted of either 10 weak shocks (0.3 mA, 1-s) or context exposure. Testing consisted of a 10-min context exposure.

Tissue collection. 60-min following final behavioral testing, animals were sacrificed. Tissue was collected for immunofluorescence and Western blotting and compared to tissue from naïve animals sacrificed at the same time as experimental animals.

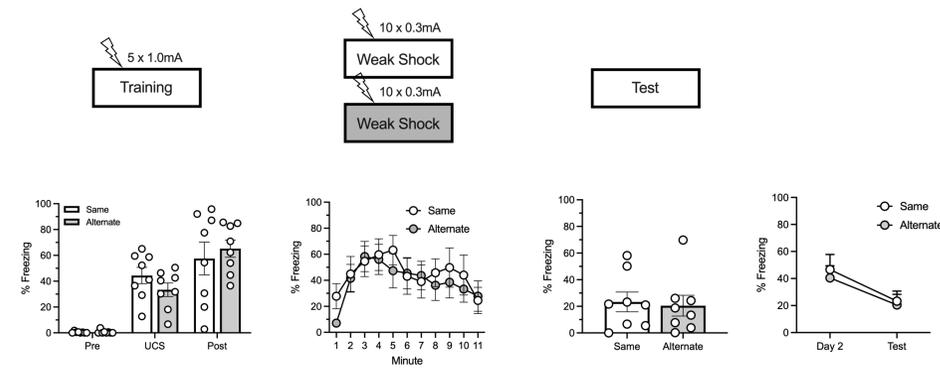
The weak shock and extinction conditions both reduce freezing relative to animals who received no exposure on the second day.



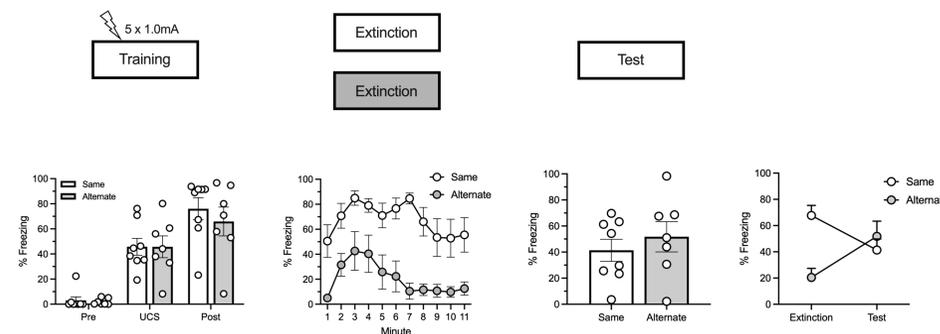
Conditioning with the weak shock does not create a fear memory.



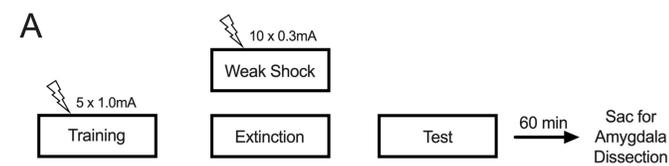
Presenting the weak shock in either the training (Same) or shifted (Alternate) context reduced freezing during testing.



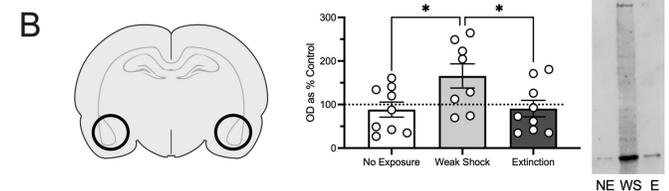
Extinction in an alternate context did not reduce freezing during testing.



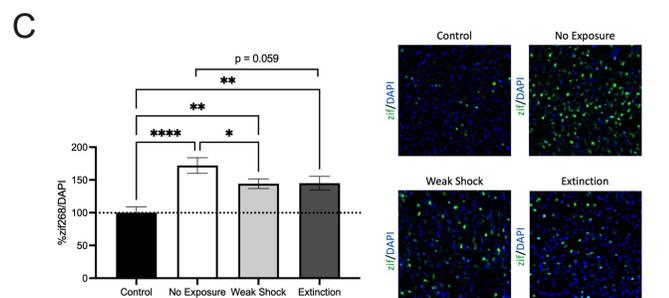
A) Experimental design for Western blotting and immunofluorescence.



B) The weak shock increased K48 expression in the basolateral amygdala (BLA) relative to the extinction and no exposure conditions following testing.



C) The weak shock and extinction conditions showed decreased zif268 expression in the BLA compared to the no exposure condition following testing.



Conclusions

Weak shock exposure and extinction decreased context fear relative to a group that received no exposure on the second day. Unlike in extinction, the decrease produced by weak shock exposure was not context-dependent. Zif268 expression in the BLA was reduced in the weak shock and extinction groups relative to the no exposure group, but synaptic K48 levels in the BLA were only increased in the weak shock group.

These results might be similar to previous work in which habituation to an unconditional stimulus (UCS) alone following conditional stimulus (CS)-UCS pairings resulted in reduced responding to the CS (Rescorla, 1973). However, we did not use the same intensity of UCS during the second phase making habituation to the original UCS unlikely. Therefore, our findings might align more closely with work demonstrating that animals will modulate their response to a CS based on the current value of the UCS it predicts (e.g., Holland, 1990).

Together, our results suggest that the weak shock procedure does not rely entirely on the creation of a new inhibitory memory like that created in extinction and instead might alter the original representation of the shock to reduce fear responding.

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References

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