Working Memory Performance for Differentially Conditioned Stimuli

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Introduction

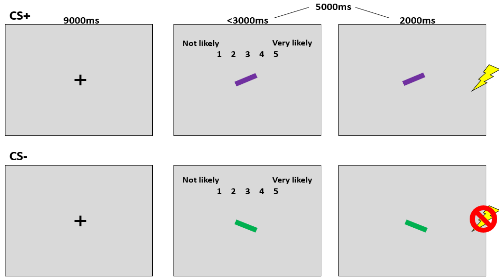
Research has found that enhanced attention to stimuli leads to greater working memory storage. Emotionally salient stimuli garner attention even if they are task-irrelevant[1]. While prior work has found that safe (CS-)[2] and threat (CS+) associated stimuli preferentially capture attention[3,4,5,6,7,8], there is a a gap in the literature regarding how these stimuli are stored in working memory. The current study aims to address this gap in the literature by examining how learned threat (CS+) and safe (CS-) stimuli impact working memory storage.

Method

Participants: N = 54 (36 Female)

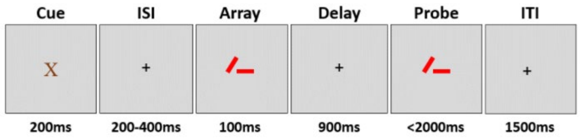
Differential Fear Conditioning Task:

- CS+ (paired with shock) and CS- (not paired with shock)
- Participants rated online shock likelihood on a scale of 1-5

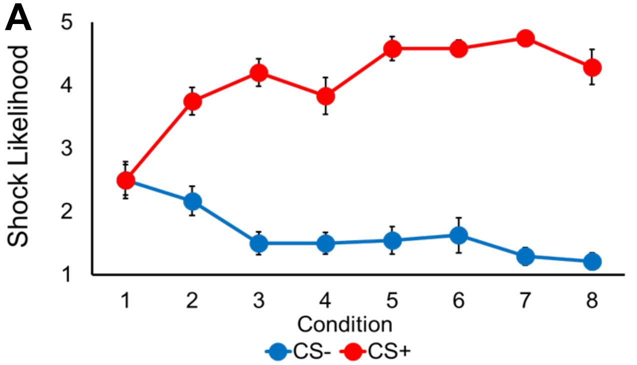


Change Detection Working Memory Task:

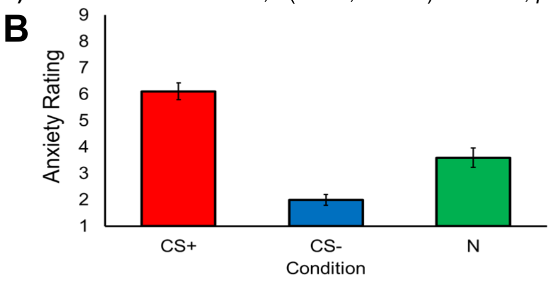
- CS+, CS-, and novel stimulus of a different color (N)
- 2 and 4 item load per each condition



Fear Conditioning Results

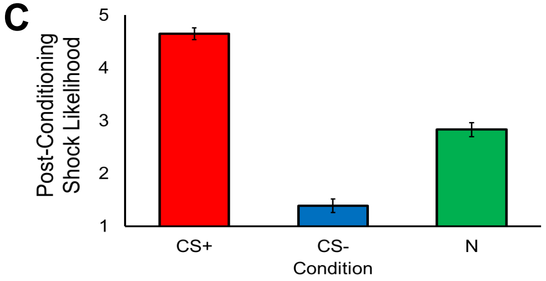


A) Main effect for Condition, $F(1.489, 78.913) = 67.113$, $p < 0.001$



B) Main effect for Condition, $F(1.899, 100.626) = 59.994$, $p < 0.001$

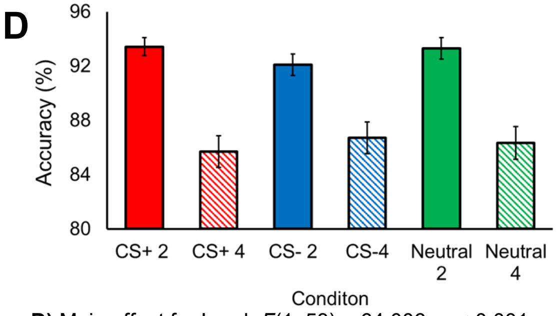
- CS+ greater than CS- ($p < 0.001$) and N ($p < 0.001$)
- CS- lower than N ($p < 0.001$)



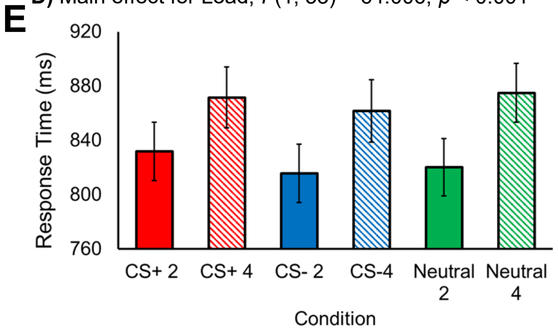
C) Main effect for Condition, F(1.763, 93.434) = 152.742, p < 0.001

- CS+ greater than CS- ($p < 0.001$) and N ($p < 0.001$)
- CS- lower than N ($p < 0.001$)

Working Memory Results



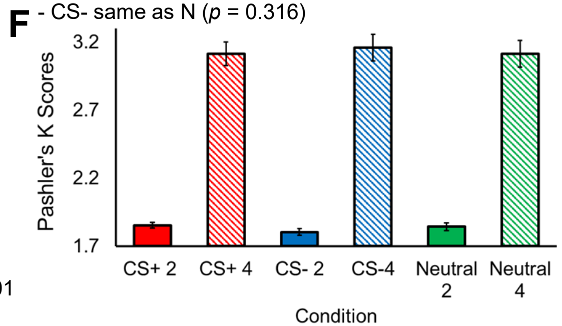
D) Main effect for Load, $F(1, 53) = 64.006$, $p < 0.001$



E) Main effect for Load, $F(1, 53) = 51.232$, $p < 0.001$

E) Main effect for Condition, $F(1.901, 100.752) = 3.233$, $p = 0.06$

- CS+ longer than CS- ($p = 0.020$) but not N ($p > 0.99$)
- CS- same as N ($p = 0.316$)



F) Main effect for Load, $F(1, 53) = 361.279$, $p < 0.001$

Discussion

Acquired threat-related stimuli (i.e., CS+) yielded greater anxiety scores than both the safe (i.e., CS-) and novel neutral stimuli (i.e., N). CS- stimuli induced lower levels of self-reported reported anxiety compared to N stimuli. These effects remained throughout the working memory task (not reported here).

However, we found no significant differences in accuracy or behavioral estimates of working memory storage between CS+, CS-, and N stimuli. Despite this, CS+ stimuli produced greater response times compared to CS- and N stimuli. CS- and N stimuli trials did not show significant differences in response time.

These outcomes suggest that CS+ stimuli do not impact working memory accuracy or storage compared to CS- and N stimuli. However, CS+ stimuli require more processing time to perform to the same degree in this condition, which is consistent with previous reports processing efficiency deficits for threat-related stimuli[9]. These results inform our understanding of how acquired threat-related stimuli impact working memory processes.

References

1. Dolcos, F., & McCarthy, G. (2006)
2. Schmidt et al. (2017))
3. Dolcos et al. (2013)
4. Hopkins et al. (2016)
5. Hur et al.. (2016)
6. Lissek et al. (2005)
7. Mogg & Bradley (2016)
8. Seglowski et al. (2018)
9. Eysenck et al., (2007)

Acknowledgements

We recognize and are grateful for funding provided through grants from the University of Wisconsin – Milwaukee Office of Undergraduate Research.