Title: Effect of creative cognitive reappraisal on extinction of conditioned responses

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Introduction:

Extinction has been used to reduce fear, although it works to achieve the reduction in the form of reduced behavioural expectancy, for some people it later results in fear relapse. The reason could be that extinction works on reducing the expectation of the unconditioned stimulus (UCS) after the presentation of the conditioned stimulus (CS+), and not the negative valence associated with the CS+. Therefore, the negative valence associated with the CS+ could result in the relapse even after successful extinction. Cognitive reappraisal is an emotion regulation technique which involves changing the way or reinterpreting how a person thinks about an emotional event or stimulus. Cognitive reappraisal can be used to change the valence associated with the CS+. Apart from learning to expect the UCS after the CS+, the CS+ also acquires a negative valence which is difficult to resolve through extinction. Studies have also shown a positive relationship between degree of negative valence to CS+ after performing extinction and subjective fear ratings after reinstatement (Zbozinek et al., 2015). Literature has also suggested that negative valence associated with CS+ after extinction leads to avoidance which interferes with the strengthening of the CS-no UCS inhibitory association (Dour, Brown & Craske, 2016). Literature shows negative valence associated with CS+ even after extinction (Kang et al., 2018) could be the reason of reappearance of conditional responding.

The current study was designed to investigate the effect of cognitive reappraisal on valence and compare the effect of creative, ordinary reappraisal and standard extinction.

Methods:

We used the Screaming Lady paradigm (Lau et al., 2009). We followed a three-day fear conditioning paradigm with 27 participants (Males=20, Females=7). Habituation and Acquisition took place on day 1 with 4 and 16 trials of each CS. Extinction took place on day 2 with 12 trials of each CS. Extinction recall took place on day 3 with 6 trials of each CS. The experiment consisted of three groups: Creative cognitive reappraisal & standard extinction, ordinary cognitive reappraisal & standard extinction and standard extinction only group. All the groups followed the same procedure except for day 2, in creative cognitive reappraisal and ordinary reappraisal group participants were provided a creative reappraisal and ordinary reappraisal sentence respectively and cued to think about it when they saw the CS+ during extinction protocol the participants rated on measures of valence, arousal and fear after each phase and online expectancy in each phase.

Selection of face stimuli:

For selection of the stimuli to be used in the experiment we decided to take fear emotion pictures from two databases: NimStim and CBCS and asked a group of participants to rate the faces on three scales: Fear, Arousal and Valence. We asked a group of 15 participants (Males= 6 & Females= 9) with mean age of 21.3 years to rate the faces. After the analysis of the data, we selected two female model faces from the NimStim Face stimuli database.

Generation and selection of Cognitive reappraisal sentences:

For generation of cognitive reappraisal sentences we asked a group of 5 creative students (Mean age: 19.4 years) who were interested in the experiment to generate new interpretations for the unpleasant UCS, with the aim of reducing unpleasant feelings that arose from the stimuli. The cognitive and the ordinary reappraisal sentences were evaluated on creativeness, effectiveness and appropriateness on a 9-point Likert scale. We conducted a pairwise t-test to check if the creative and ordinary cognitive reappraisals differed on the three criteria of evaluation. The test showed that creative cognitive reappraisal and ordinary cognitive reappraisal differed significantly on creativeness t (14) =-2.560, p=.023 and not on effectiveness t (14) = .094, p =.927 and appropriateness t (14) = -.218, p = .830 of the sentences. We selected one sentence for both creative and ordinary reappraisal.

Result:

We performed a one-way ANOVA to check the difference in the means of the groups across four phases. We found a marginally significant difference at between groups in the extinction recall phase F (2,24) = 3.1, p=0.63, η^2 =.20. LSD post hoc test results revealed that the creative cognitive reappraisal group had significantly higher valence recall p= .029, 95% CI [.22,

3.77] (M =.11, SD =2.08) compared to the ordinary reappraisal (M = -1.8, SD =1.36) and a marginally significant *p*= .065, 95% CI [-0.10, 3.44] higher valence recall than standard extinction group (M = -1.5, SD =1.94) There was no significant difference in valence recall between the ordinary reappraisal group and standard extinction group. Due to the less sample size, we could not report the Bonferroni values. The LSD values were not corrected for multiple comparison and from the results we expect 5% of the comparisons to have uncorrected P values less than 0.05.

Discussion

Our results hint that for participants in creative cognitive reappraisal the valence for the CS+ had increased and exhibited a better recall of higher valence than ordinary reappraisal group and standard extinction group in the extinction recall phase. Although we didn't see any significant difference in valence in the extinction phase itself, it could be that creative cognitive reappraisals forms a new and novel representation or in other words updates the UCS mental representation (Liao, Xiao & Wang, 2022) during the extinction phase and leads to more positive valence recall on the third day. The insignificant difference between the groups during the extinction phase could be due the effect of similar extinction protocol being followed in all the three groups that could have overshadowed the effect of reappraisal.

For future studies and discussion, we will be incorporating and reporting physiological measures of fear as well for a better picture of reduction in fear responses through creative cognitive reappraisal. We will also increase the sample size for the experiment for better results and power.

References:

Dour, H. J., Brown, L. A., & Craske, M. G. (2016). Positive valence reduces susceptibility to return of fear and enhances approach behavior. *Journal of Behavior Therapy and Experimental Psychiatry*, *50*, 277–282. https://doi.org/10.1016/j.jbtep.2015.09.010

Kang, S., Vervliet, B., Engelhard, I. M., Van Dis, E. A. M., & Hagenaars, M. A. (2018). Reduced return of threat expectancy after counterconditioning versus extinction. *Behaviour Research and Therapy*, *108*, 78–84. https://doi.org/10.1016/j.brat.2018.06.009

Liao, S., Xiao, W., & Wang, Y. (2022). Sex Differences in the Effects of Cognitive Reappraisal Training on Conditioned Fear Responses. *International Journal of Environmental Research and Public Health*, *19*(23), 15837. https://doi.org/10.3390/ijerph192315837

Zbozinek, T. D., Hermans, D., Prenoveau, J. M., Liao, B., & Craske, M. G. (2015). Post-extinction conditional stimulus valence predicts reinstatement fear: Relevance for long-term outcomes of exposure therapy. *Cognition and Emotion*, *29*(4), 654–667. https://doi.org/10.1080/02699931.2014.930421