ALCOHOL DAMPENS STRESS REACTIVITY BUT NOT PERCEPTION TO VISUALLY UNCERTAIN STRESSORS IN A STIMULUS GENERALIZATION PARADIGM

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Background and Significance

Stress reduction is an important motive for both recreational and problematic alcohol use[1].

Over three decades of research have yet to specify the precise mechanisms and boundary conditions for alcohol stress response dampening (SRD)[2].

Our laboratory has programmatically demonstrated greater alcohol SRD during uncertain relative to certain stressors across multiple dimensions of uncertainty and measures of stress[3,4,5,6].

The mechanisms for greater alcohol SRD during uncertain stressors are largely unknown and may partly be the result of alcohol induced cognitive-attentional and perceptual changes[7].

We explored these mechanisms by testing alcohol SRD during stressors which were uncertain in the visual domain using a stimulus generalization procedure[8] which included rings of various sizes serving as a CS+, CS-, and Generalization Stimuli.

General Procedures

We recruited a final sample of 60 participants (Mean age = 21.99, SD = 1.814) from the university community.

We randomly assigned participants to No-alcohol (N = 22), Placebo (N = 16), and Alcohol (N = 22) groups. Placebo and No-alcohol groups were combined for the current analysis.

Participants in the Alcohol condition drank beverages consisting of alcohol and juice in a 3:1 ratio mixture. Placebo and No-Alcohol participants drank juice with placebo drinks including an alcohol mist and floater. We calculated the alcohol dose to produce a peak BAC of 0.08% confirmed via breathalyzer.

Participants reported their maximum tolerance to a series of electric shocks of increasing intensity administered to their left hand[9]. The maximum tolerated shock served as the US which was paired with the CS+.

We measured stress reactivity via EMG eye blink startle response to 102 db noise probes in the task. We scored fear potentiated startle (FPS; i.e., difference score of increase in startle response during rings relative to ITI) separately for each ring type[10].

We measured Perceived Risk of shock via button press (1 = "no risk", 2 = "moderate risk", and 3 = "certain risk")[8] on a subset of trials prompted by a question mark appearing in the center of the ring. We scored Perceived Risk similarly to fear potentiated startle (i.e., increase in perceived risk during ring relative to ITI).

Task

1. Preacquisition: Prior to drinking, participants viewed 8 small and 8 large gray rings. Rings in each phase were presented serially for 6 seconds with a variable ITI (M = 7s) displaying a crosshair. No shocks were administered during the preacquisition phase. Mean general startle reactivity from this phase served as a covariate in analyses of acquisition and test phases.

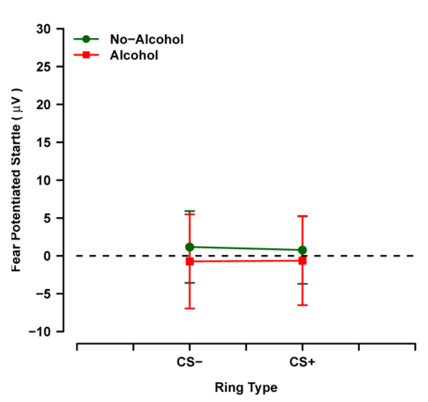
2. Acquisition: After drinking, participants viewed 12 small and 12 large rings. The large ring served as the CS+ for half the participants (counterbalanced). Electric shocks occurred at 5.8 seconds post-onset on 10 of the 12 CS+ trials. Shocks never occurred during the CS- or ITI. The acquisition phase was followed by a 2 min break.

3. Stimulus Generalization: Participants viewed 10 CS+, 10 CS-, and 50 Generalization Stimuli (GS, 10 of each size). Shocks were administered at 5.8s post-onset of 6 of the 10 CS+ stimuli. Shocks were never administered during CS-, GS's or ITI.

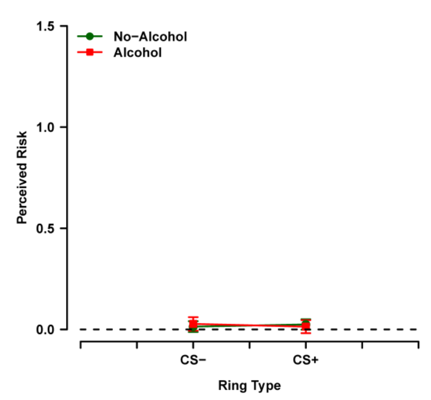
4. Same/Different assessment: Participants viewed each ring for 6 seconds with a 7s ITI followed by another ring. Participants were told to indicate, via button press, if they believed the rings were the same or different.

Preacquisition

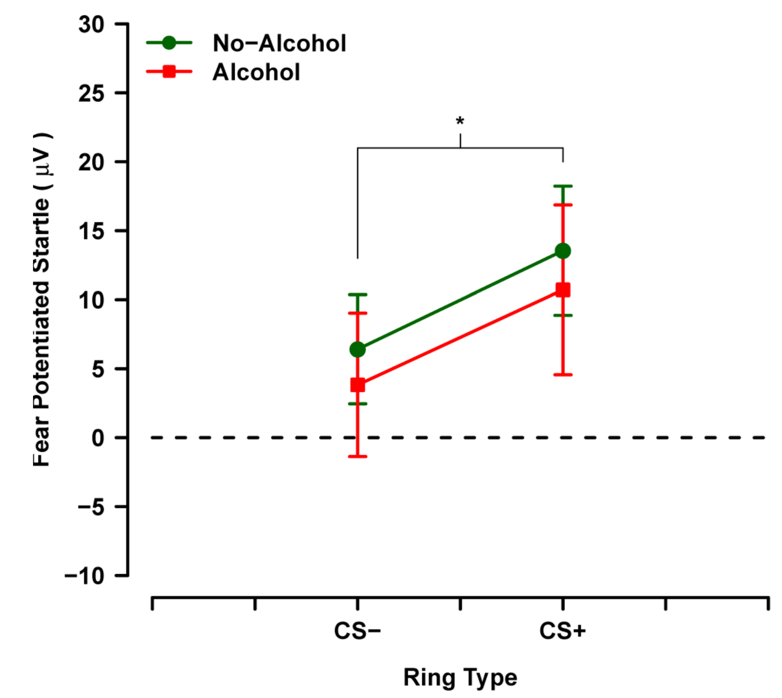
Data Analysis: We analyzed FPS and behavioral data for each phase in separate general linear models (GLM) with repeated measures for Ring Type and additive between-subject regressors for Beverage Group, gender, and general startle reactivity.

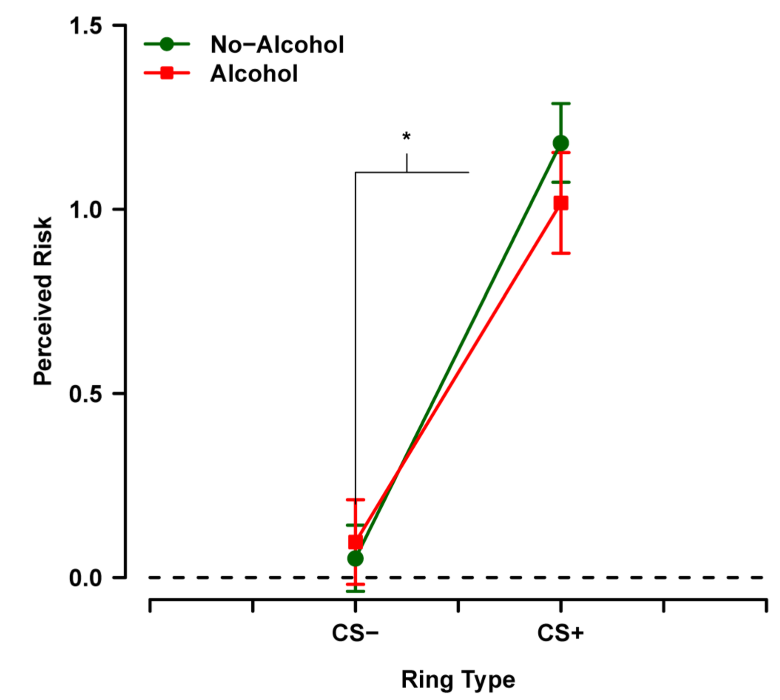


As expected, we observed no significant effects for Beverage Group, Ring Type, or their interaction for either FPS or Perceived Risk during this baseline phase.



Acquisition

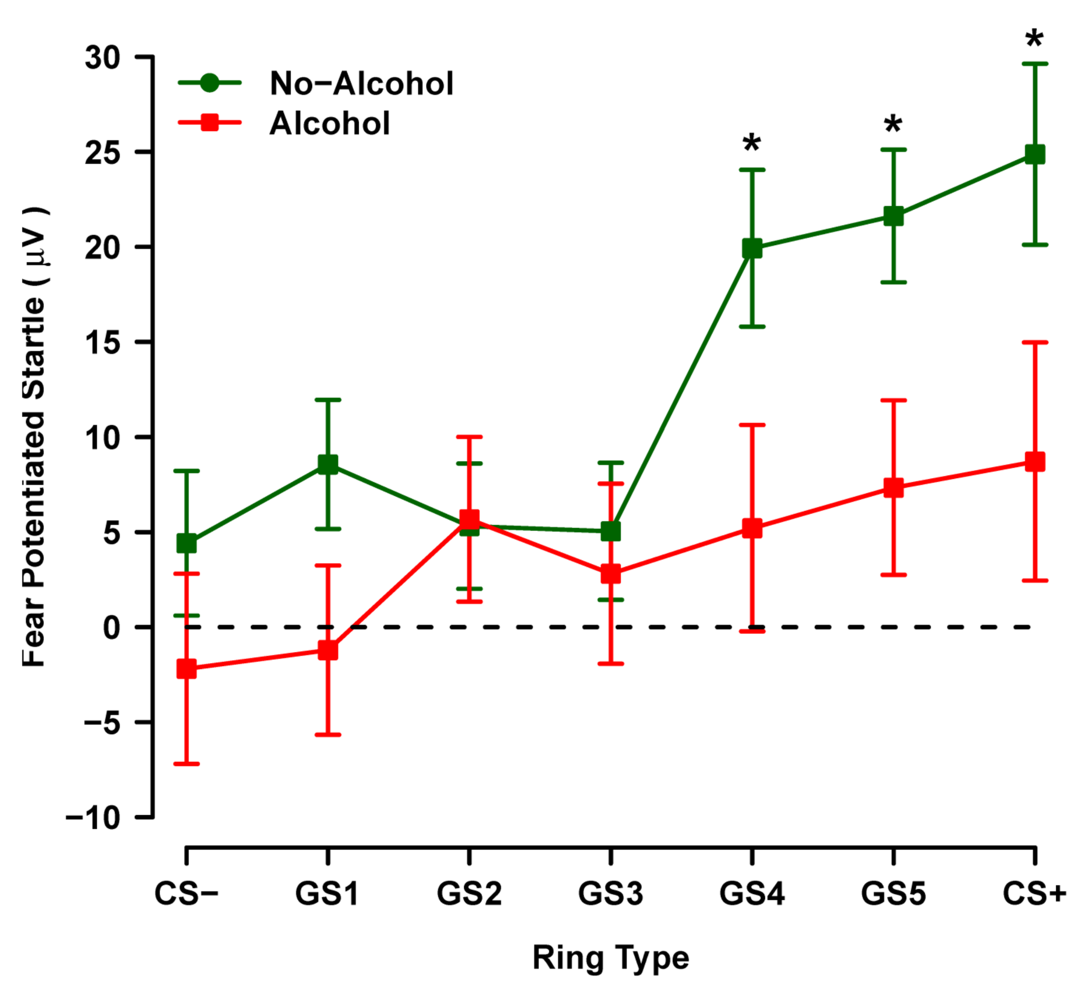


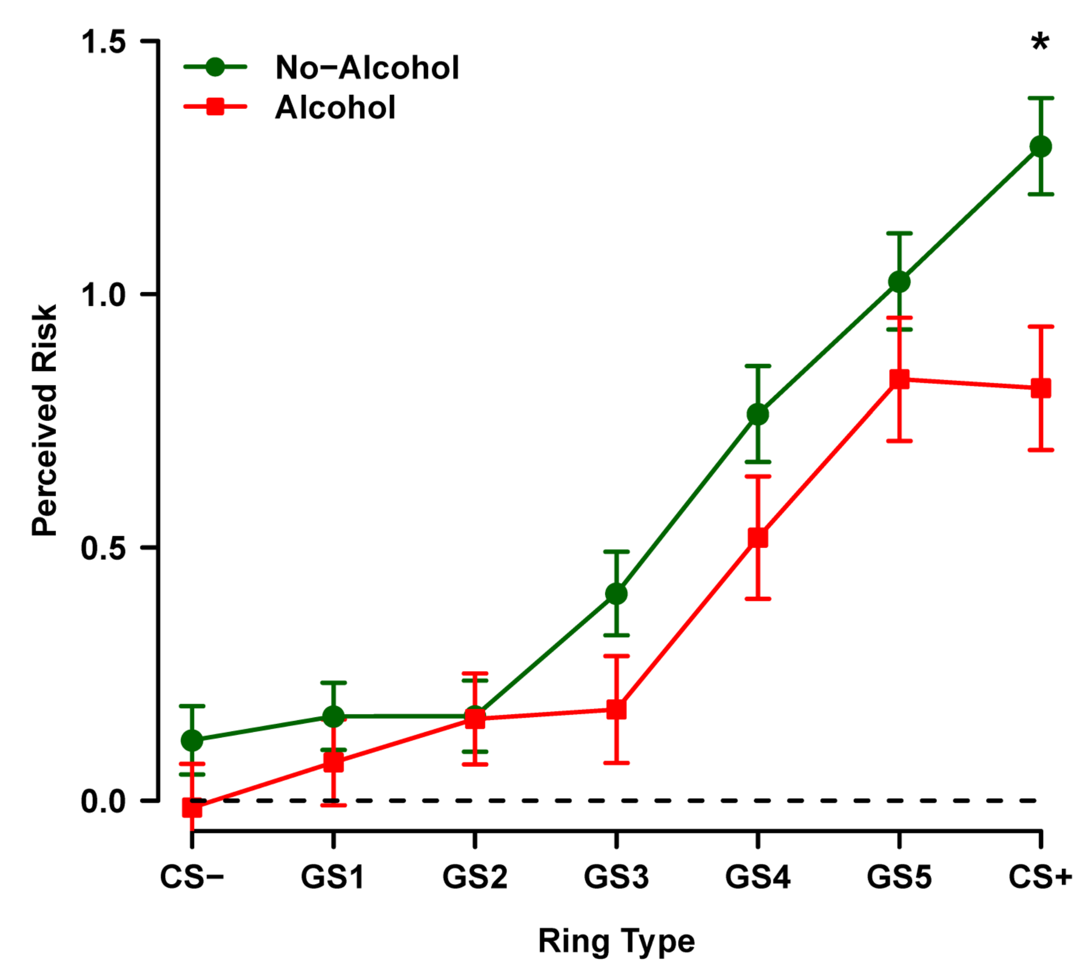


FPS was significantly higher during CS+ vs. CS- presentations across Beverage Groups (b=7.0, p<.05). There was no Beverage Group X Ring Type interaction indicating that alcohol did not affect stress response to the CS+.

Perceived Risk was significantly higher during CS+ vs. CS- presentations across Beverage Groups (b=1.0, p<.001). There was no Beverage Group X Ring Type interaction indicating that alcohol did not affect Perceived Risk from the CS+.

Stimulus Generalization





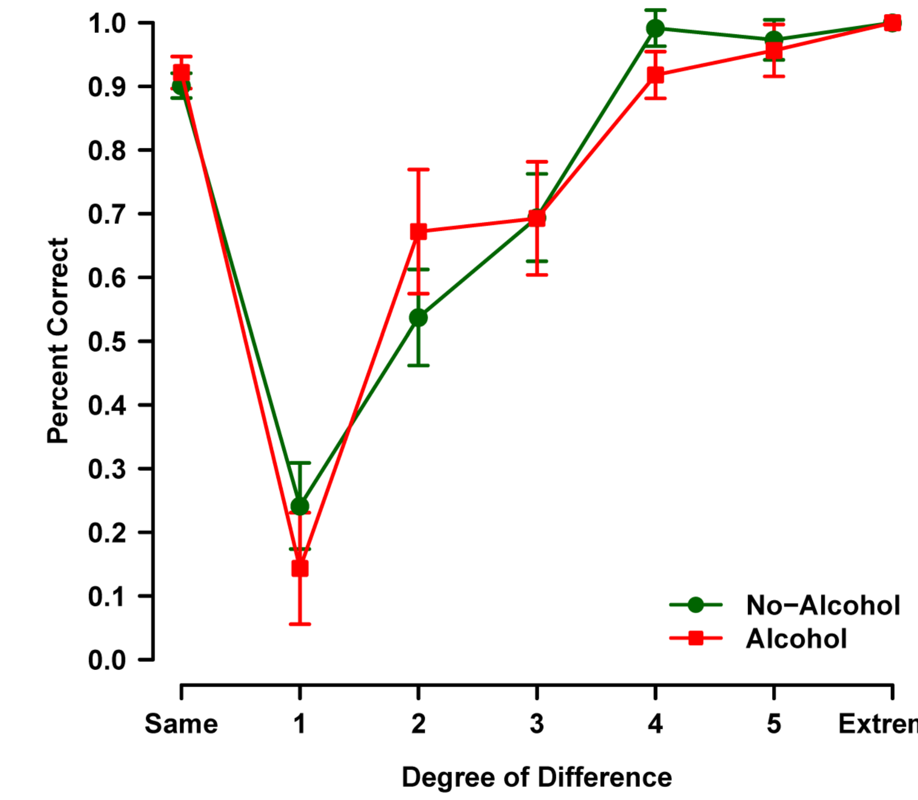
We observed a significant Beverage Group X Ring Type interaction for FPS, p<.05. We decomposed this interaction with separate tests of the Ring Type effect in each Beverage Group. We observed a simple effect of Ring Type in the No-alcohol Group, p<.0001. Follow-up tests confirmed that significant FPS was observed for CS+ (p<.001), GS5 (p<.001), GS4 (p<.001) , and GS1 (p<.05).

In contrast, we observed no significant effect of Ring Type for FPS in the Alcohol Group. Furthermore, FPS was not significantly different from zero for any ring in the Alcohol Group. Simple tests of Beverage Group indicated that FPS was greater in the Alcohol Group vs. the No-alcohol Group for CS+ (b= -16.4, p<.05), GS5 (b= -14.6, p<.05), and GS4 (b= -16.1, p<.05) indicating that alcohol dampened stress reactivity during these rings.

We observed a significant Beverage Group X Ring Type interaction for Perceived Risk, p<.05. We decomposed this interaction with separate tests of the Ring Type effect in each Beverage Group. We observed a simple effect of Ring Type in the No-alcohol Group, p<.0001. Follow-up tests confirmed that significant Perceived Risk was observed for CS+ (p<.001), GS5 (p<.001), GS4 (p<.001) , GS3 (p<.001), GS2 (p<.05) and GS1 (p<.05).

We observed a significant effect of Ring Type for Perceived Risk in the Alcohol Group, p<.001. Follow-up tests confirmed that significant Perceived Risk was observed for CS+ (p<.001), GS5 (p<.001), GS4 (p<.001).Simple tests of Beverage Group indicated that Perceived Risk was dampened in the Alcohol Group vs. the No-alcohol Group for CS+ (b= -.5, p<.05).

Same/Different Assessment



We observed no significant effects for Beverage Group, Ring Type, or their interaction during the Same/Different Assessment, suggesting that alcohol did not affect participants' ability to visually discriminate between the various ring types.

Discussion

Alcohol did not affect stress responding during the acquisition phase when the stressor (CS+) was relatively certain. However, alcohol had robust SRD effects during the stimulus generalization phase when increased visual uncertainty about the stressor existed.

These results are consistent with a growing body of evidence from our laboratory and others demonstrating greater SRD when stressors are uncertain in various ways[3,4,5,6]. Previous research in this realm has used instructed threat paradigms to establish stressors. This study is the first to extend these findings to a true conditioning paradigm.

A moderate dose of alcohol dampened stress reactivity across uncertain stressors in the current study while interfering with participant's perception of risk only during Stimulus Generalization. However, alcohol appeared to have no effect on participants' ability to visually discern one potential stressor from another in the Same/Different assessment.

This suggests that alcohol's SRD effects may be partially dependent on alcohol affecting participants' cognitive ability to recognize stimuli as predicting stressors in less certain situations even if they can still visually discern one stimuli from another while intoxicated.

The current paradigm was adapted from paradigms recently used to show increased stimulus generalization among individuals suffering from some anxiety disorders[11]. In recognition of the high co-morbidity between PTSD and alcohol dependence, the current results may have interesting implications for the "self medication" theories of alcohol use in anxiety disorders.

Better understanding of the mechanisms and boundary conditions of alcohol stress response dampening gained from studies such as this one may help to support healthy, adaptive use and lead to better informed treatment for maladaptive use. This understanding will also better inform researchers about the stress response generally.

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