

# DOSE-DEPENDENT EFFECTS OF ALCOHOL ON ATTENTION TO CERTAIN AND UNCERTAIN THREAT

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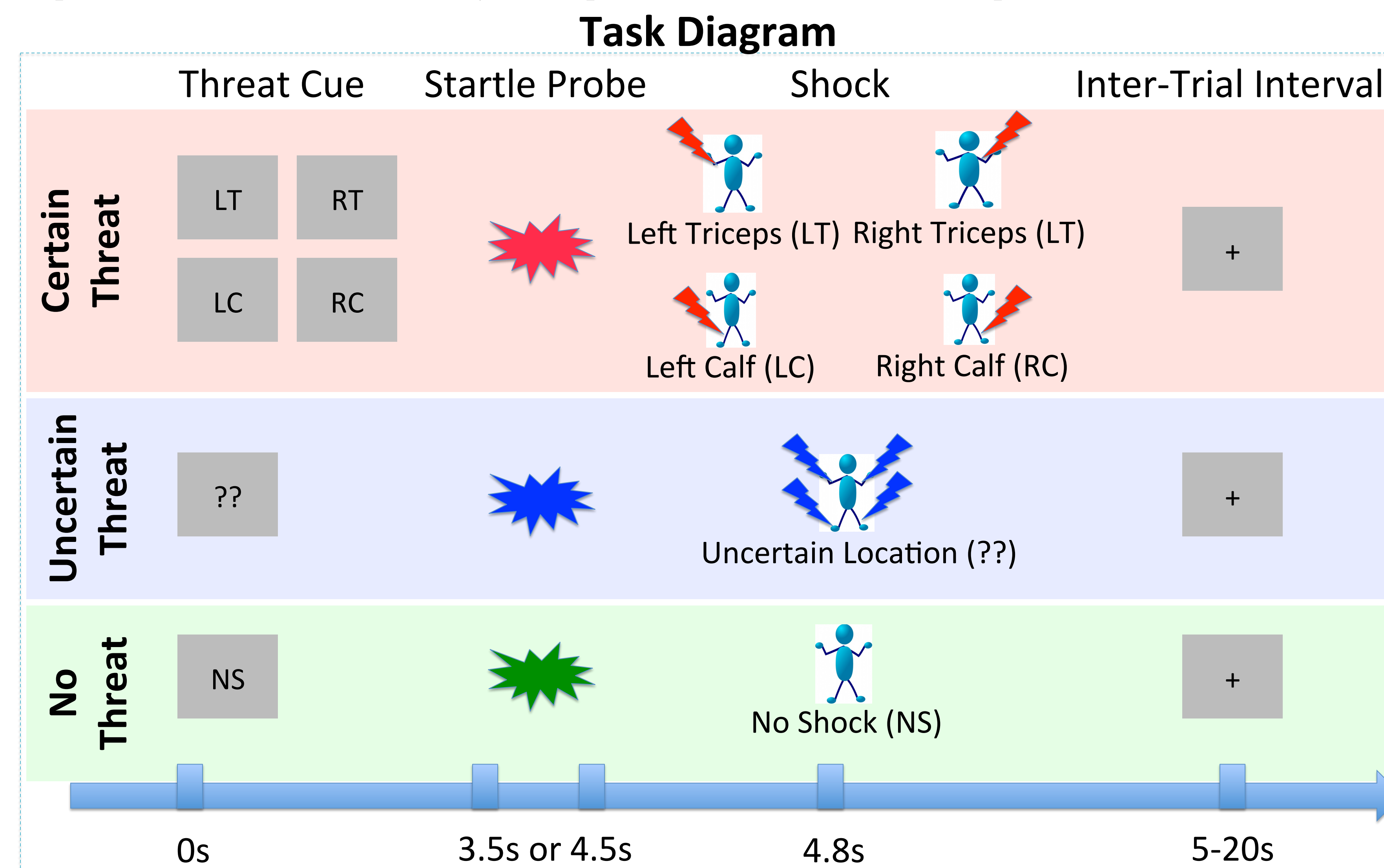
## Abstract & Aims

Although stress response dampening is a common motivation to consume alcohol, our understanding of the concomitant cognitive and affective changes that characterize this stress reduction remains incomplete. Research on the effect of alcohol on cognitive processes has predominately relied on inference from self-report indices of attention and peripheral nervous system measures of affect. These measures may lack temporal and construct specificity needed to characterize alcohol effects on cognition. In the current study, we used a novel cued threat task to examine dose-dependent effects of alcohol on response to shocks administered to four bodily locations. Visual threat cues on each trial indicated if a shock would occur, the laterality and location of a certain shock, or if the location of the impending shock was uncertain. We measured psychophysiological indices of affect (startle blink potentiation) and attention (electrocortical response to auditory probes) immediately prior to shock onset. As alcohol dose increased, attention-induced suppression of early perceptual encoding (N1) of certain and uncertain threat cue probes decreased. In contrast, increasing alcohol dose decreased attention-induced suppression of the evaluation of the motivational significance (P3) of probes presented during uncertain, but not during certain threat cues. These data reveal dissociable effects of alcohol on attention across cognitive systems and highlight the utility of multi-method approaches to interrogating the stress response dampening effects of alcohol.

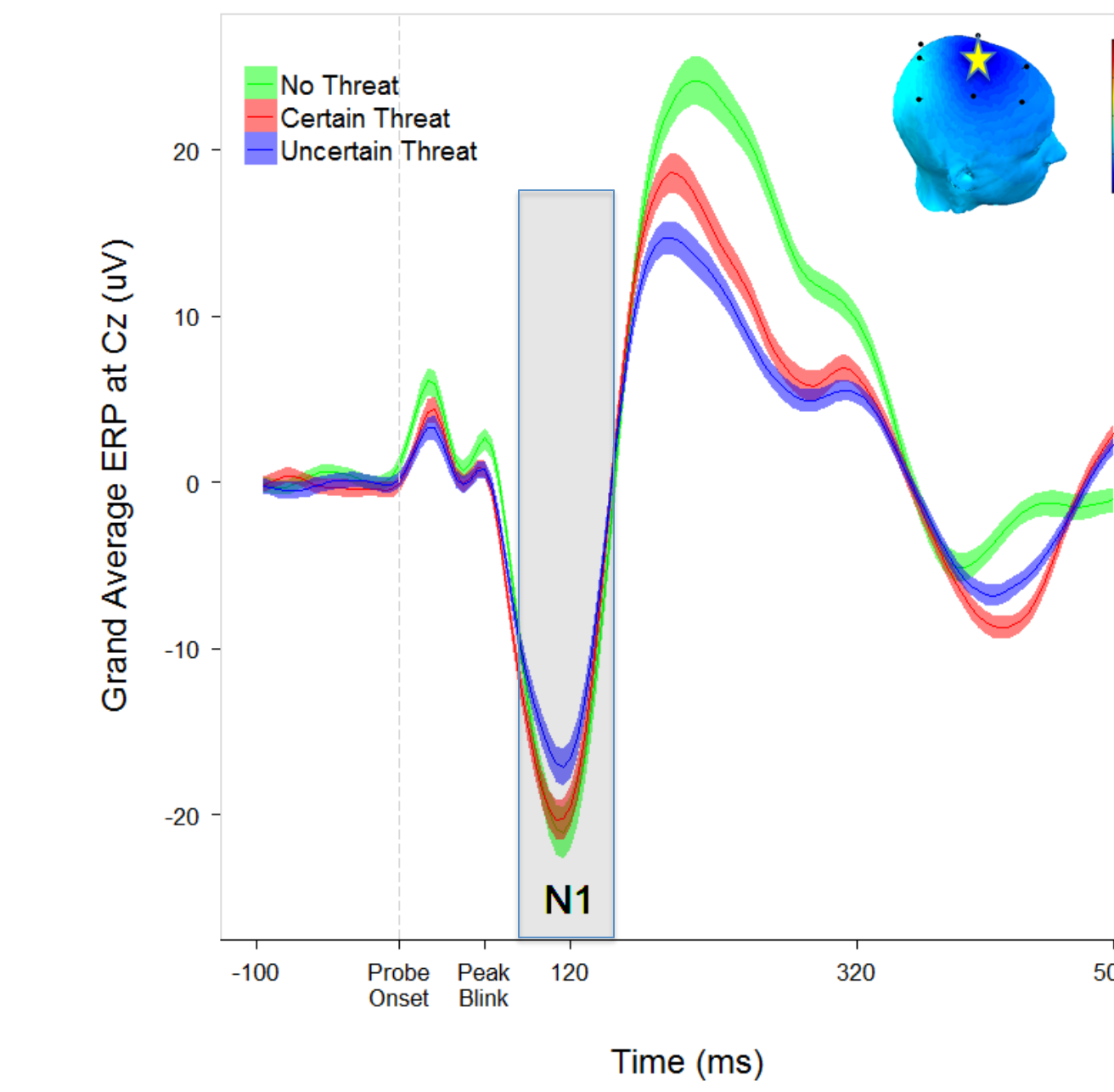
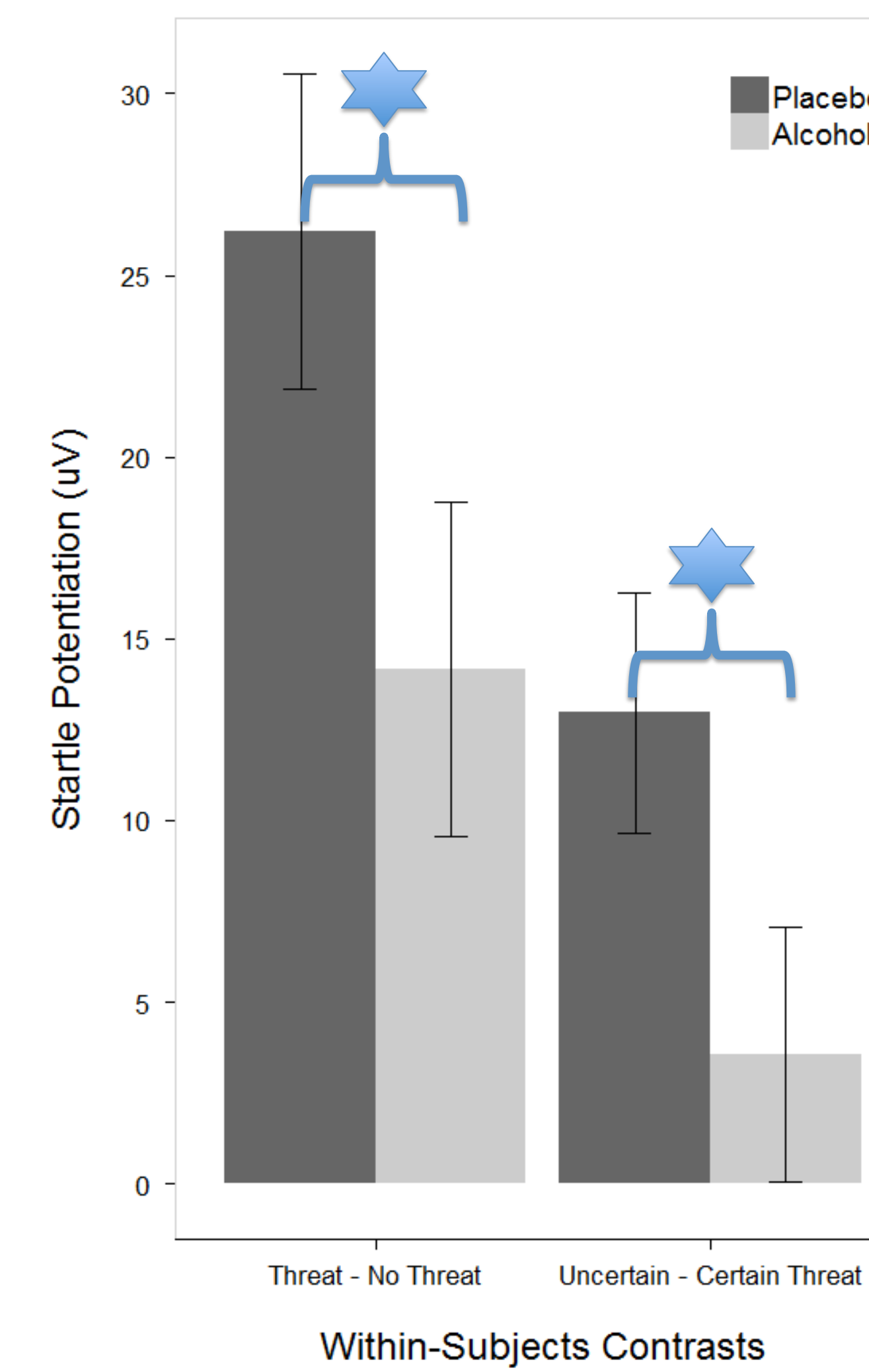
- Previous work from our lab indicates alcohol selectively reduces negative affective response to several dimensions of uncertain threats (e.g., probability, duration, and severity) more so than certain threats. The current study extends this line of research by testing if alcohol reduces negative affective response when the location of an impending threat is unknown.
- Affective and cognitive processes moderate the defensive response to threat. Whether alcohol reduces affective response to stress via indirect effects on attention (e.g., attend less to threat), direct effects on affective processing (e.g., reduce fear), or higher-order effects on affect-attention interactions (e.g., fear reduction biases attention away from threat or inattention to threat reduces fear), remains unclear. The current study was designed to evaluate concomitant effects of threat and alcohol on negative affect and attention.

## Methods

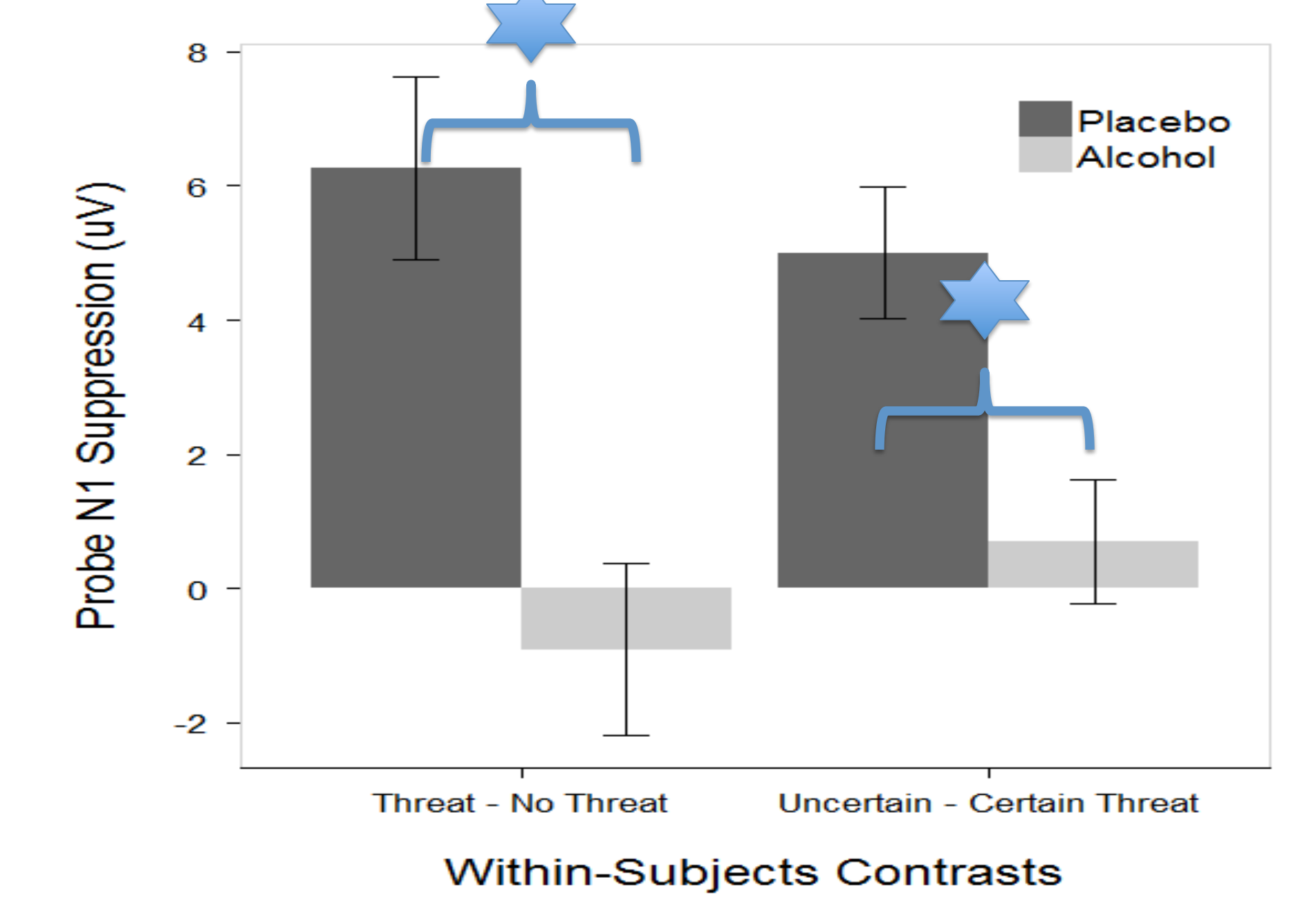
- **Participants.**
  - 79 undergraduates were randomly assigned to Placebo or Alcohol (target blood alcohol content varied from 0.03-0.12%) conditions.
- **Procedure.**
  - After consuming their beverage, participants viewed twelve blocks (3 Block Types: Certain Threat, Uncertain Threat, No Threat; 4 trials per block) of visual threat cues (see Task Diagram).
- **Measures.**
  - *Startle Blink* is sensitive to negative affective response to threat (e.g., electric shock). Blinks were quantified as the peak magnitude, 20-100ms after startle probe (102dB white noise) onset.
  - *Probe N1* putatively measures perceptual processing of auditory stimuli and is suppressed when measured while non-auditory stimuli are the focus of attention. Probe N1 was quantified as the mean of activity at scalp location Cz, 80-120ms after probe onset.
  - *Probe P3* is sensitive to the valence and arousal of non-probe foreground stimuli and is suppressed when these foreground stimuli are attended. Probe P3 was quantified as the mean of activity at scalp location Pz, 300-340ms after probe onset.
- **Analysis.**
  - Startle Blink, Probe N1, and Probe P3 were analyzed in separate General Linear Models, with BAC as a quantitative, between-subjects regressor. Planned orthogonal contrasts were constructed to test the effects of Threat (e.g., Threat v. No Threat) and Threat Type (e.g., Uncertain Threat v. Certain Threat).



## Eyeblink Startle



## Probe N1



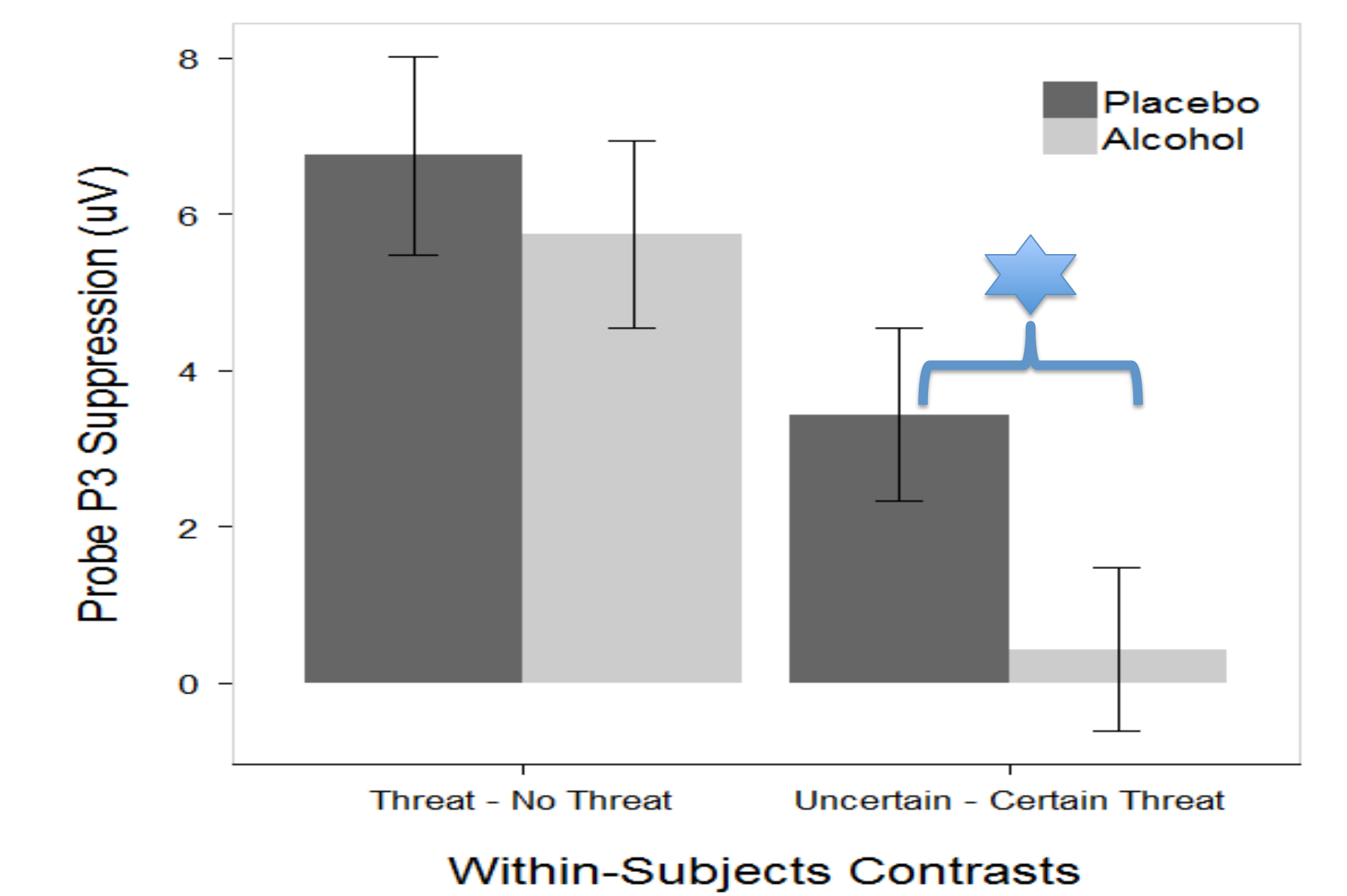
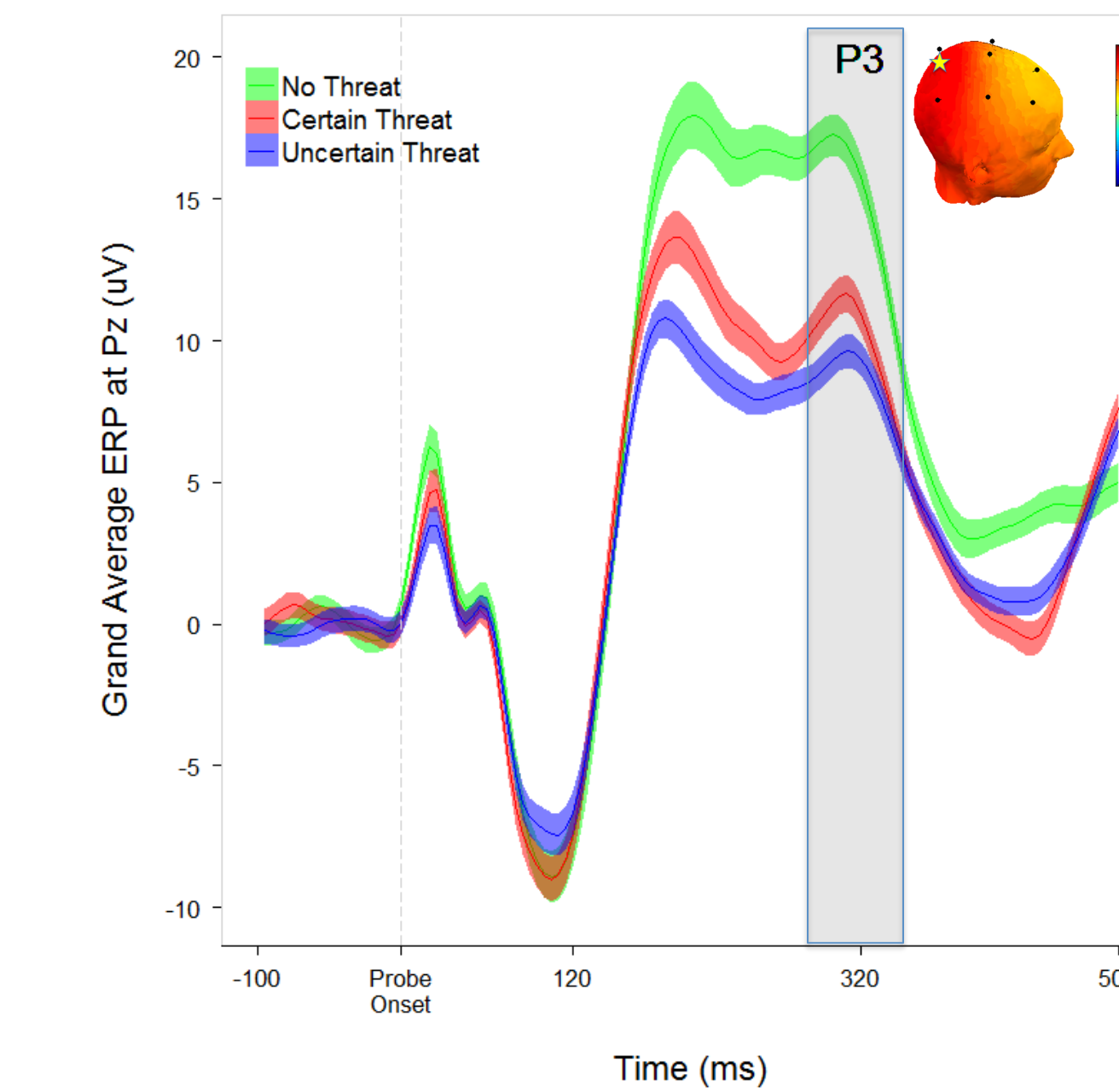
- Threat of shock increased suppression of perceptual processing of the threat-irrelevant startle probe;  $t(78)=2.4$ ,  $p<0.05$ . Perceptual processing of the startle probe was suppressed during uncertain threats, relative to certain threat;  $t(78)=4.08$ ,  $p<0.01$ .
- Alcohol dose-dependently decreased suppression of perceptual processing of the threat-irrelevant startle probe during threat exposure;  $B=-0.71\mu\text{V}$ ,  $t(75)=-3.61$ ,  $p<0.01$ . Furthermore, alcohol dose-dependently decreased suppression of perceptual processing of the startle probe during uncertain, relative to certain threat;  $B=-0.42\mu\text{V}$ ,  $t(75)=-2.98$ ,  $p<0.01$ .

Threat of shock potentiated startle ( $p<0.05$ ). Startle was elevated during uncertain, relative to certain threat ( $p<0.05$ ). As predicted, alcohol dose-dependently decreased startle potentiation more during uncertain, than certain threat;  $B=-1.05\mu\text{V}$ ,  $p<0.05$ .

These data are consistent with recent research demonstrating alcohol preferentially reduces negative affective response to uncertain threat characterized by one of several dimensions of uncertainty (e.g., probability, duration, severity).

- Plots of within-subjects contrasts display predicted values.
- Because the effect of alcohol dose on all measures was linear, the Alcohol condition is represented by the point estimate when BAC equals 0.10%.
- ★ denotes  $p<0.05$

## Probe P3



- Threat of shock suppressed Probe P3 amplitude to the threat-irrelevant startle probe;  $t(78)=-7.88$ ,  $p<0.01$ . Response during uncertain threat was suppressed, relative to response during certain threat;  $t(78)=-2.46$ ,  $p<0.05$ .
- Alcohol did not decrease response suppression to threat-irrelevant startle probes during threat of shock;  $B=0.1\mu\text{V}$ ,  $p>0.5$ . Rather, preliminary evidence suggests alcohol dose-dependently decreased response suppression to uncertain, but not certain threat;  $B=0.30\mu\text{V}$ ,  $p<0.05$ .

## Conclusions

The current study conceptually replicates and supports an accumulating body of evidence<sup>1,2,3</sup> that the stress response dampening properties of alcohol are partially attributable to changes in the processing of uncertainty. Data from the current study also suggest alcohol's effects on response to uncertainty are not uniform across cognitive and affective systems (e.g., defensive preparation, motivated attention, perception). Furthermore, the dissociation of alcohol's effects on startle blink and putatively exogenous and endogenous ERP responses, highlights the descriptive utility of paradigms that permit multi-method observation of affective chronometry.

