

# Not Just Noise: Individual Differences in Baseline Startle are Anxiety Relevant



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## BACKGROUND AND SIGNIFICANCE

• **Baseline Startle** is defined here as resting eyeblink startle response elicited before any intentional manipulation of affect.

• Baseline Startle manifests with large individual differences. This leads researchers to standardize startle outcome measures to remove variability between participants in their baseline under the assumption that it is task-irrelevant "noise".

• The current study examined whether baseline startle may indeed index meaningful affect related individual differences.

• Recent research has suggested that uncertain vs. certain threat elicit distinct stress response components referred to as "anxiety" vs. fear<sup>1</sup>. Furthermore, preclinical research suggests that the neurobiological substrates of these components may be dissociable.<sup>2</sup>

• We reanalyzed baseline startle response and startle potentiation collapsed across 3 tasks in our laboratory. Each task manipulated threat (electric shock) predictability, probability, or temporal uncertainty to examine anxiety and fear response.<sup>3,4,5</sup>

## TASKS

☀ = Startle Probe ⚡ = Shock

**Certain Threat**

**Predictable Shock**

All three tasks include the same certain threat condition that consists of 5 sec cue presentations co-terminating with electric shock on 100 percent of trials.

**Uncertain Threat**

**Predictability Task (Fully Unpredictable Shock)**

Includes blocks in which shocks could occur during any 5 sec cues as well as variable inter-trial intervals.

**Probability Task (20 Percent Shocks)**

Includes blocks in which shocks only occur on 20 percent of the 5 sec cues presented.

**Duration Task (Variable Time Shocks)**

Includes blocks in which shocks occur with all cues however the duration of each cue is unknown.

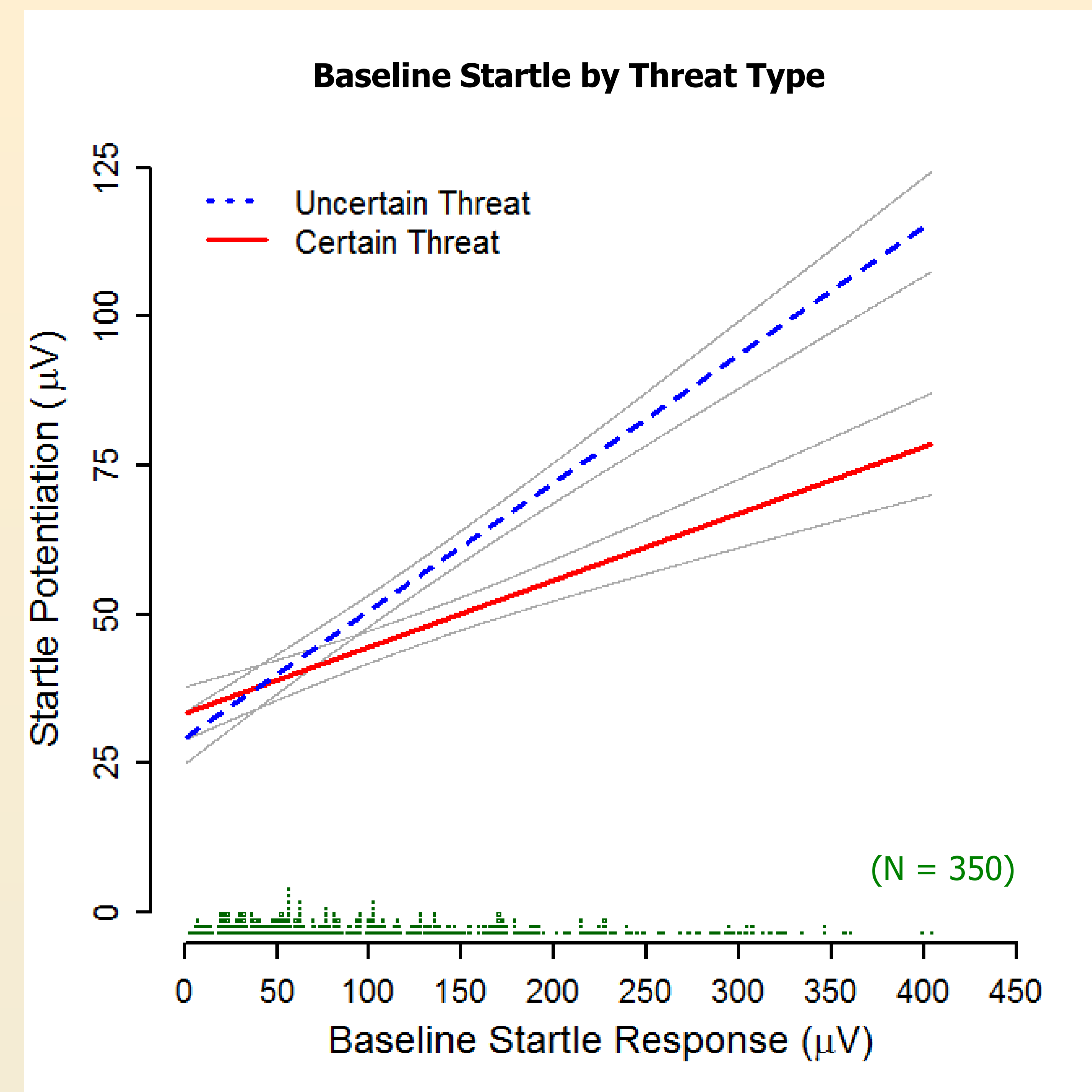
## MEASURE

• The startle reflex is often used to assess affective response to threat (e.g., electric shock).

• EMG eyeblink startle response to noise probes was measured during cue presentation in all tasks.

• Startle potentiation is defined as the increase in startle response (to an acoustic "probe") during threat vs. no-threat. Analyses of startle potentiation to each threat block, relative to matched cue (vs. no shock blocks) was conducted across all tasks.

## RESULTS

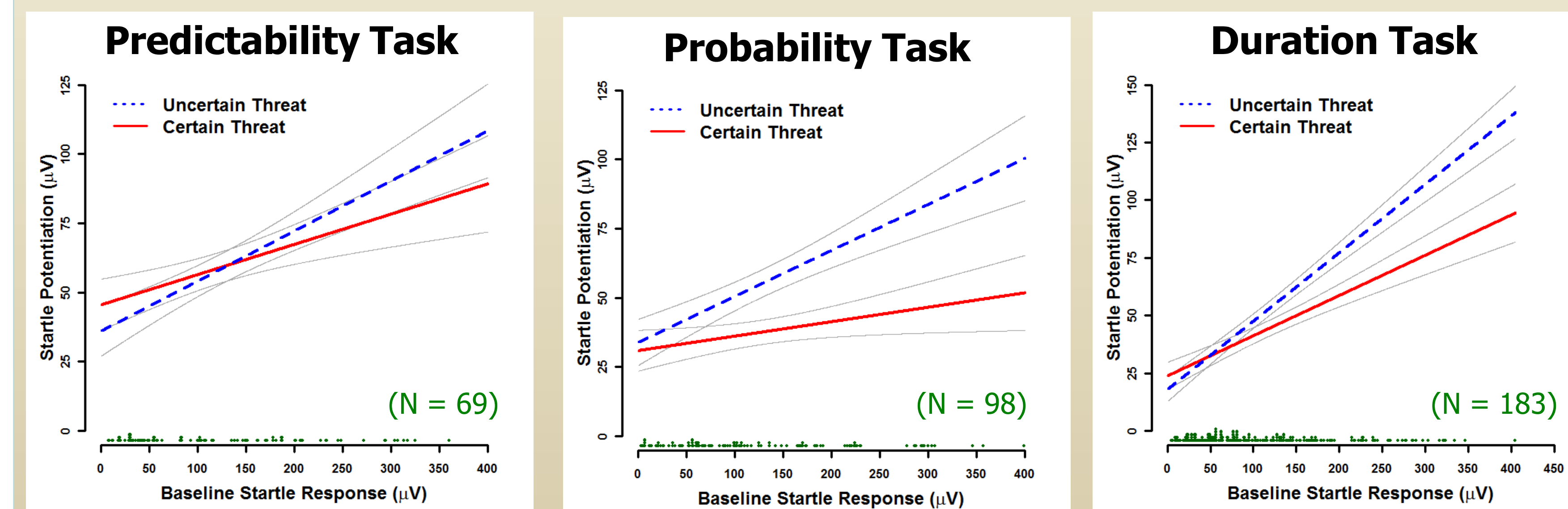


• The final sample consisted of 350 participants (162 female) from 6 separate experiments collapsed across 3 tasks (2 experiments per task). Participants reported no axis I or II disorder.

• Potentiated startle was analyzed in a General Linear Model with Baseline Startle and Task as interactive between subject factors and Threat (Certain vs. Uncertain) as a within subject factor.

• The effect of baseline startle on overall startle potentiation was significant ( $t(344) = 6.34, p < .001$ ). For every  $1\mu\text{V}$  increase in baseline startle, startle potentiation increased by  $.16\mu\text{V}$ .

**\*A significant interaction between baseline startle and threat type confirmed that baseline startle was differentially related to certain vs. uncertain threat ( $F(1,344) = 16.85, p < .0001$ ). For every  $1\mu\text{V}$  increase in baseline startle, startle potentiation increased  $.10\mu\text{V}$ 's more in the uncertain condition than the certain condition.**



• The baseline startle X threat interaction observed in the aggregate was represented in all three tasks.

• The greater effect of baseline startle on uncertain threat was statistically significant in the probability and duration tasks ( $p$ 's  $< .01$ ) but failed to reach significance in the predictability task ( $p = .16$ ).

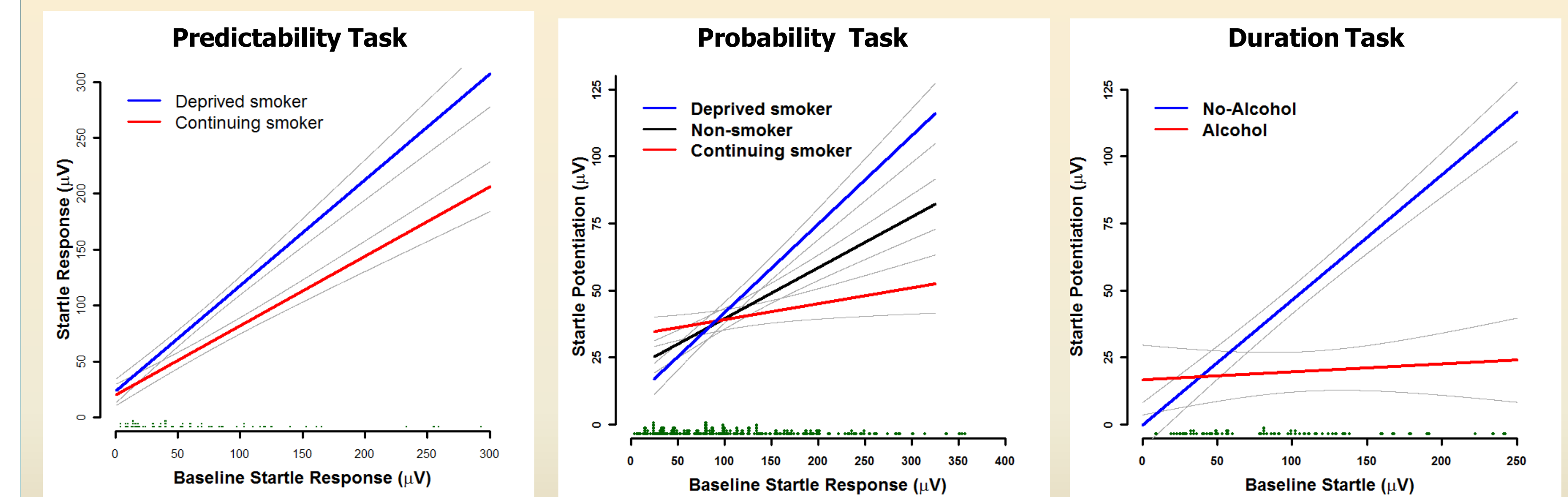
## SELF REPORT ANXIETY MEASURES

• Individual difference measures relevant to trait anxiety were administered at each experiment. No significant correlations were found with baseline startle or potentiated startle despite large sample sizes.

Individual Difference Questionnaire	Baseline Startle	Uncertain Threat Potentiation	Certain Threat Potentiation
<b>Spielberg Trait Anxiety Inventory (N = 311)</b>	$r = -.02$	$r = .03$	$r = .16$
<b>Behavioral Inhibition Scale (N = 307)</b>	$r = .06$	$r = -.01$	$r = .08$
<b>Fear Survey Schedule (N = 277)</b>	$r = -.03$	$r = .02$	$r = .04$
<b>PANAS: Negative Emotionality (N = 311)</b>	$r = .07$	$r = -.01$	$r = .02$
<b>MPS: Harm Avoidance (N = 307)</b>	$r = -.04$	$r = -.03$	$r = -.04$

## BASELINE STARTLE AS A MODERATOR OF DRUG EFFECTS

• The importance of baseline startle is further accentuated by unpublished data in our laboratory showing it as a significant moderator of drug deprivation and intoxication effects in uncertain (anxiety) conditions.



• Deprived tobacco smokers with higher baseline startle show greater startle potentiation to uncertain threat.

• Deprived marijuana smokers with higher baseline startle show greater startle potentiation to uncertain threat.

• Alcohol intoxicated individuals with higher baseline startle show greater startle attenuation to uncertain threat.

## SUMMARY

• Baseline startle significantly predicted startle potentiation during threat. However, the relationship between baseline startle and startle potentiation was significantly stronger during uncertain than certain threat. This differential relationship was comparable across all tasks.

• As uncertain threat is thought to elicit anxiety in humans, the current findings provide empirical support that baseline startle may index state anxiety in healthy individuals.

• These data underscore the importance of including baseline startle as a regressor in linear models that examine startle potentiation during affective tasks. In fact, data from our laboratory show that baseline startle is a moderator of intoxication and withdrawal effects of various drugs.

## REFERENCES AND SUPPORT

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