



# Interoceptive sensitivity & sympathetic reactivity differentially predict emotional vs. somatic experiences



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## Untangling the Confound between Sympathetic Reactivity & Interoception

- **Sympathetic reactivity** (how intensely the sympathetic nervous system reacts from a neutral baseline) is an established predictor of self-reported emotional intensity (e.g., Derryberry & Rothbart, 1988; Levenson, 2014)
- **Interoceptive sensitivity** (accurately detecting internal bodily cues) also predicts emotional intensity, but is less well understood (e.g., Barrett et al., 2004; Pollatos et al., 2007)

Most studies do not include both measures simultaneously to determine which best predicts emotional intensity. Most studies also fail to contrast emotional intensity with how intensely one experiences the physiological concomitants of emotion (somatic intensity), further muddying how sympathetic reactions and interoceptive sensitivity to these reactions relate to the embodiment of emotional experience.

### The Present Study

**40 participants** (52% female, 53% white) completed a stress induction with continuous sympathetic recording, reporting how intensely they experienced 30 different emotions and 40 different somatic sensations during the stress induction. In a separate session, participants also completed a measure of interoceptive sensitivity.

### Measuring Sympathetic Reactivity

- **Trier Social Stress Test** (Kirschbaum et al., 1993) to induce robust sympathetic & emotional changes
- **Sympathetic reactivity** measured as mean change from 5-min baseline in *heart rate* (HR), *inter-beat interval* (IBI), *cardiac output* (CO), *pre-ejection period* (PEP), & *stroke volume* (SV) using MindWare's BioLab Software

Immediately after the TSST, participants then reported:

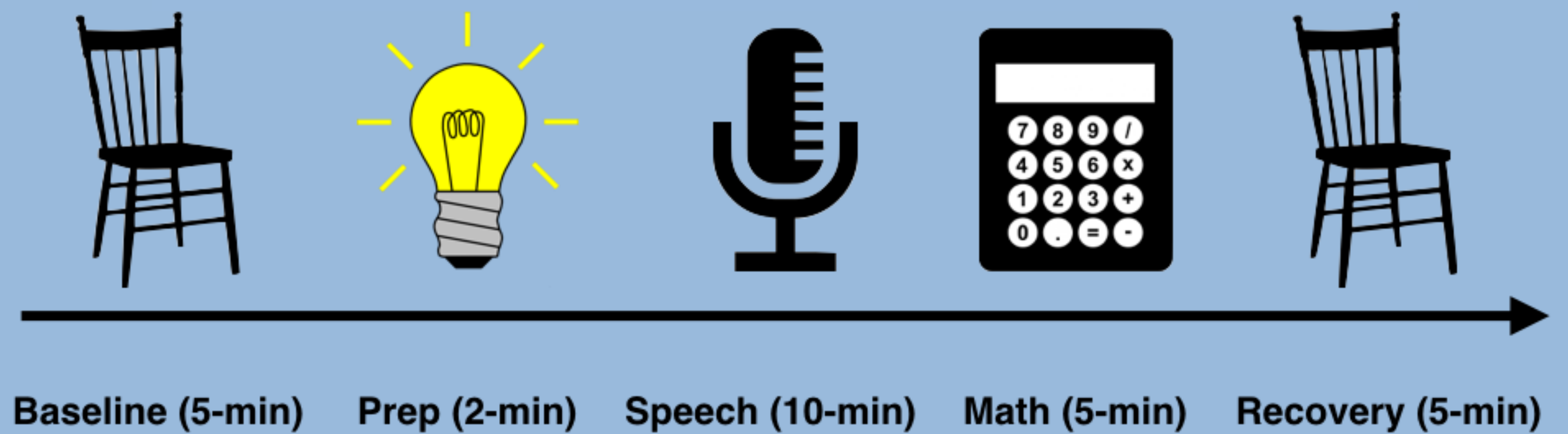
- **Emotional Intensity** (based on Watson, Clark, & Tellegen, 1988; 30 emotions;  $\alpha=.76$ ; Likert 0=Not at All, 6=Extremely)
- **Somatic Intensity** (40 sensations;  $\alpha=.91$ ; Likert 0=Not at All, 6=Extremely)

### Measuring Interoceptive Sensitivity

In a prior lab visit, participants completed:

- **Modified Whitehead heartbeat detection task** (Kleckner et al., 2015; Barrett et al., 2004; 60 trials). Assesses whether individuals can accurately detect when a series of tones are coincident vs. non-coincident with their actual in-the-moment heartbeats.

## The Trier Social Stress Test



## Heartbeat Detection Task

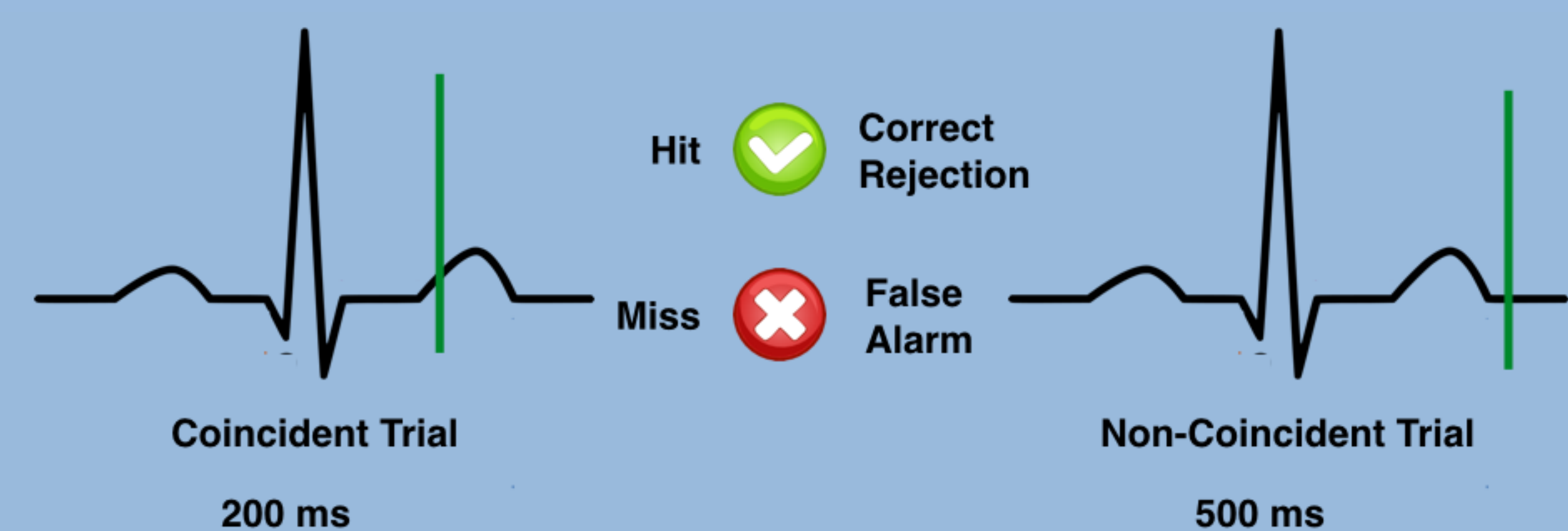


Figure 1. Mean change in heart rate (bpm) from baseline with confidence intervals—manipulation check.

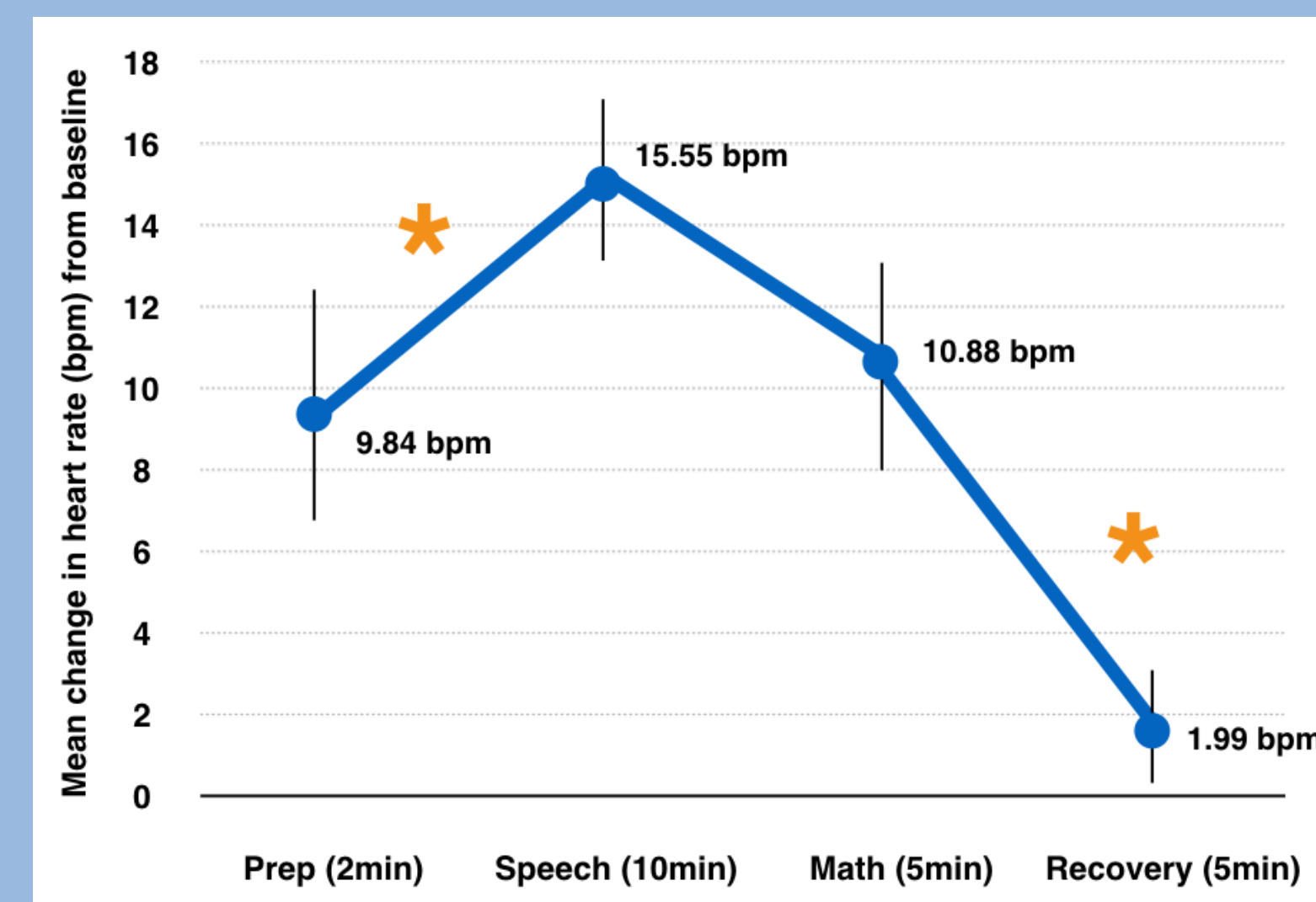


Figure 3. Lack of interaction across all regression models between Sympathetic reactivity x Interoceptive sensitivity predicting Emotional Intensity, with cardiac output (CO) as an example.

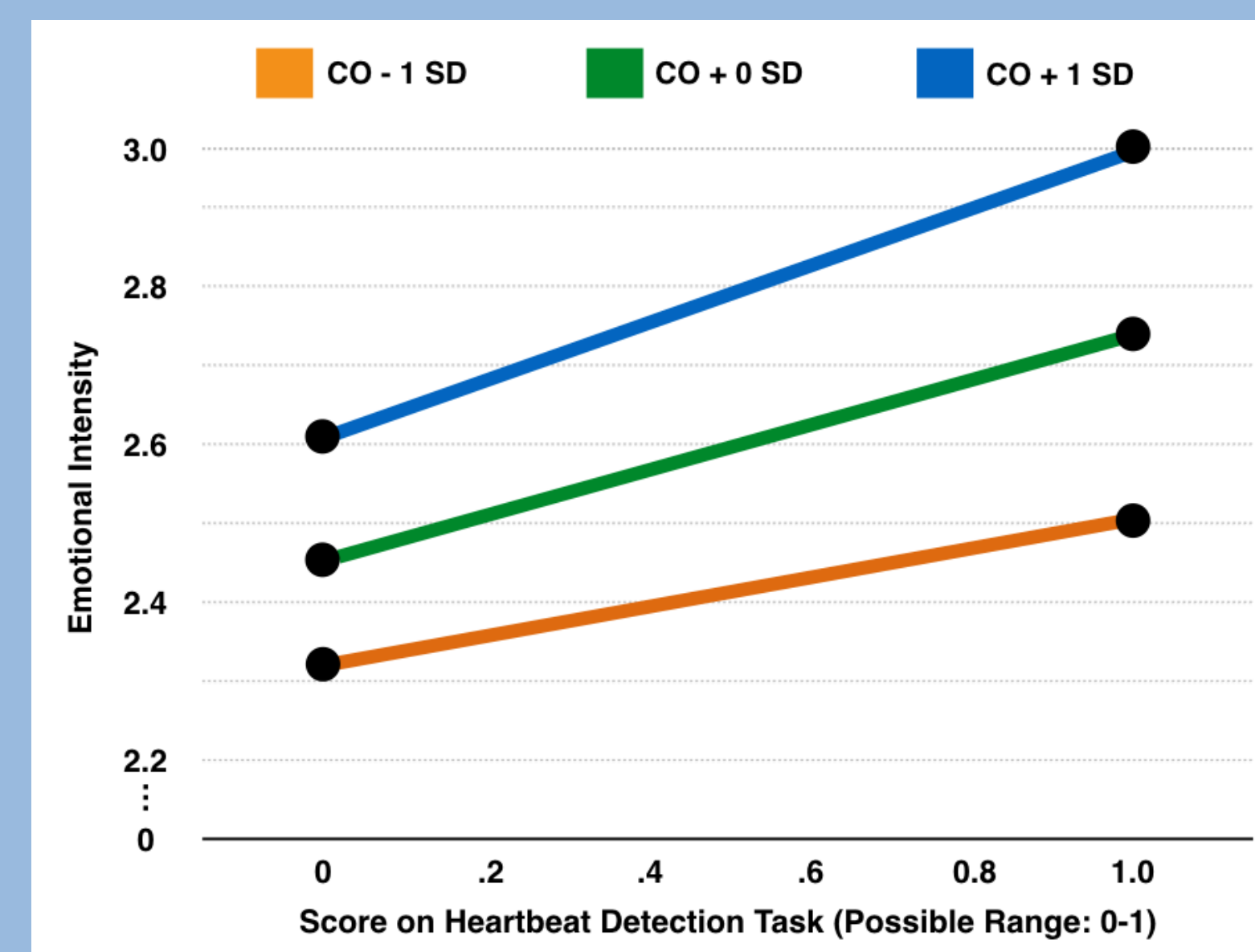


Figure 2. Mean change in PEP (ms) - reverse coded, with confidence intervals.

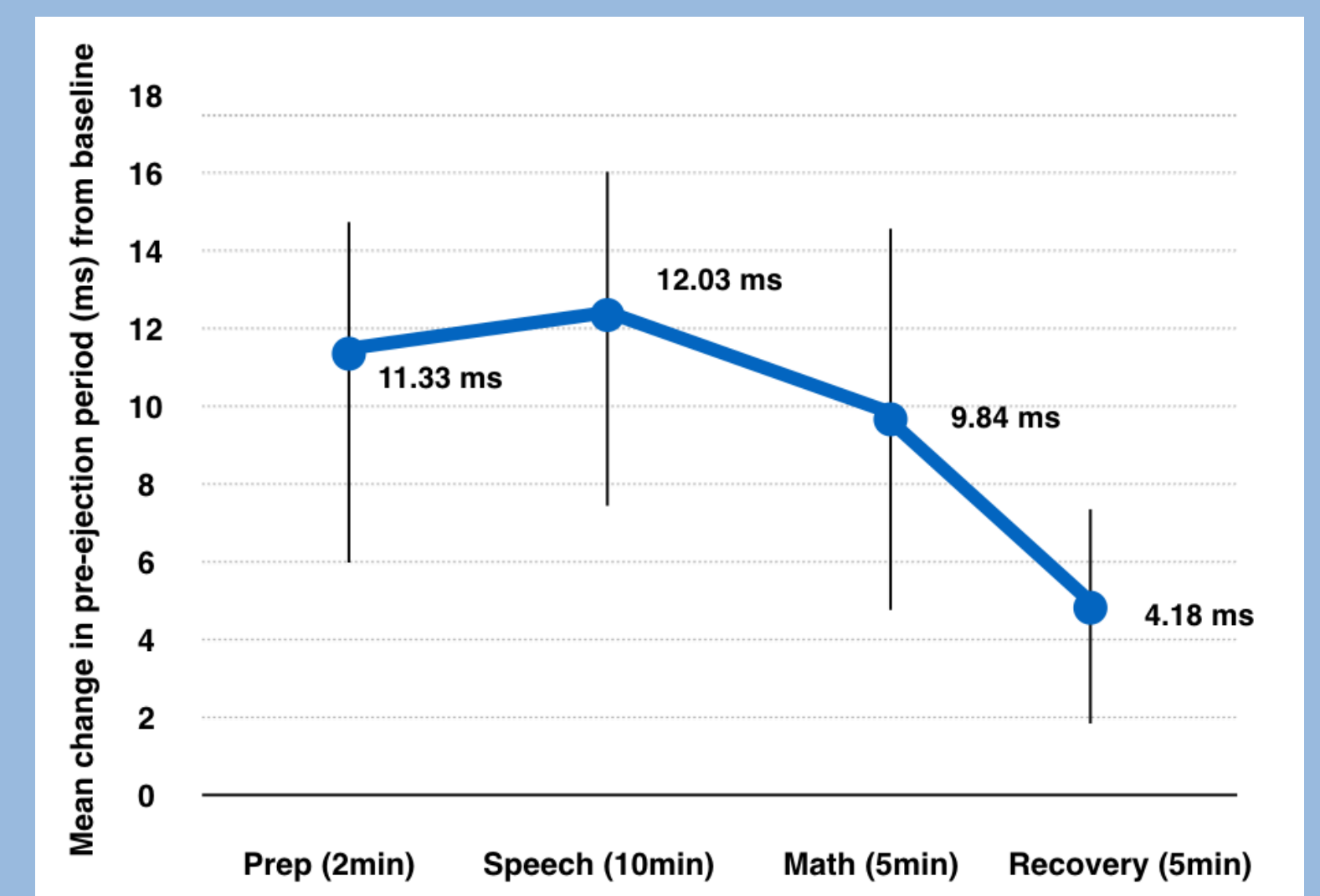
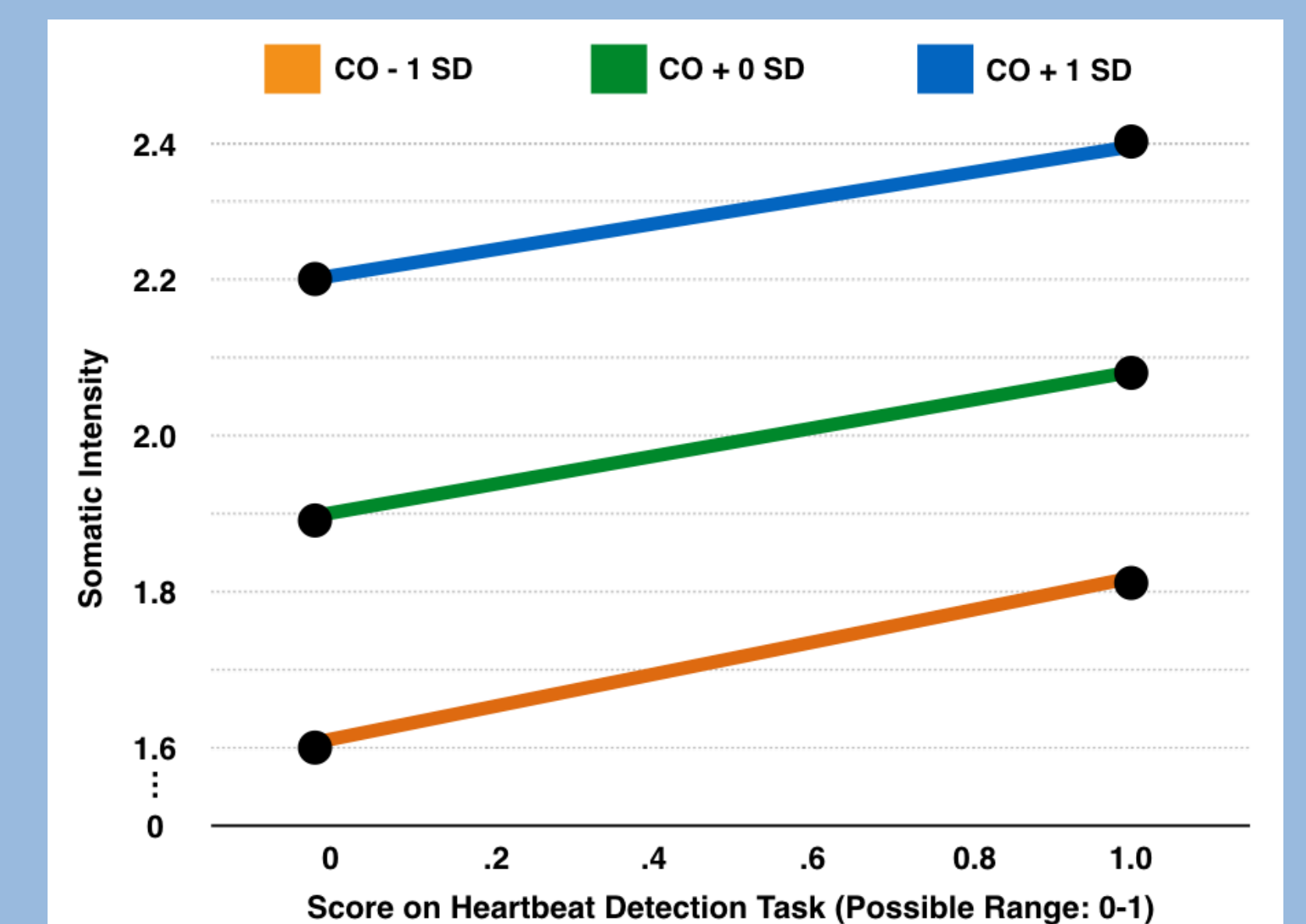


Figure 4. Lack of interaction across all regression models between Sympathetic reactivity x Interoceptive sensitivity predicting Somatic Intensity, with cardiac output (CO) as an example.



## Assessing Independent vs. Differential Models

### Linear regression models revealed that:

- Some sympathetic reactivity indices predicted emotional intensity [ $b_{PEP} = -.01, p = .021$ ]
- All sympathetic reactivity indices predicted somatic intensity [ $bs = -.01-.05, ps = .021-.096$ ]
- Interoceptive sensitivity predicted emotional intensity [ $b = .22, p = .021$ ]
- Interoceptive sensitivity however did not predict somatic intensity [ $b = .14, p = .256$ ]

### Hierarchical regression models showed that:

- Interoceptive sensitivity was a better predictor of emotional intensity [ $bs = .23-.46, ps = .001-.02$ ] but sympathetic reactivity dropped from significance  $ps > .10$ , except for PEP [ $b = -.30, p = .001$ ]
- Sympathetic reactivity was a better predictor of somatic intensity [ $bs = -.01-.05, ps = .021-.096$ ], while interoceptive sensitivity only emerged as marginally significant for CO and SV [ $bs = .26, .25, ps = .066, .052$ ].
- No interactions in any model were significant  $ps$  ranged from .13-.95 (e.g., cardiac output in Figs 3-4).

## Conclusion: Related But Different

Previous research linking sympathetic reactivity with emotional intensity may be confounded with interoceptive sensitivity, which appears more important for how intensely someone experiences emotions. Sympathetic reactivity instead predicts the physiological concomitants of emotion. Future research should include both measures to clarify the embodied nature of emotion.

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