



Alterations in the Sympathetic Nervous System Reflecting Challenge and Threat When Confronted with Failure or Success

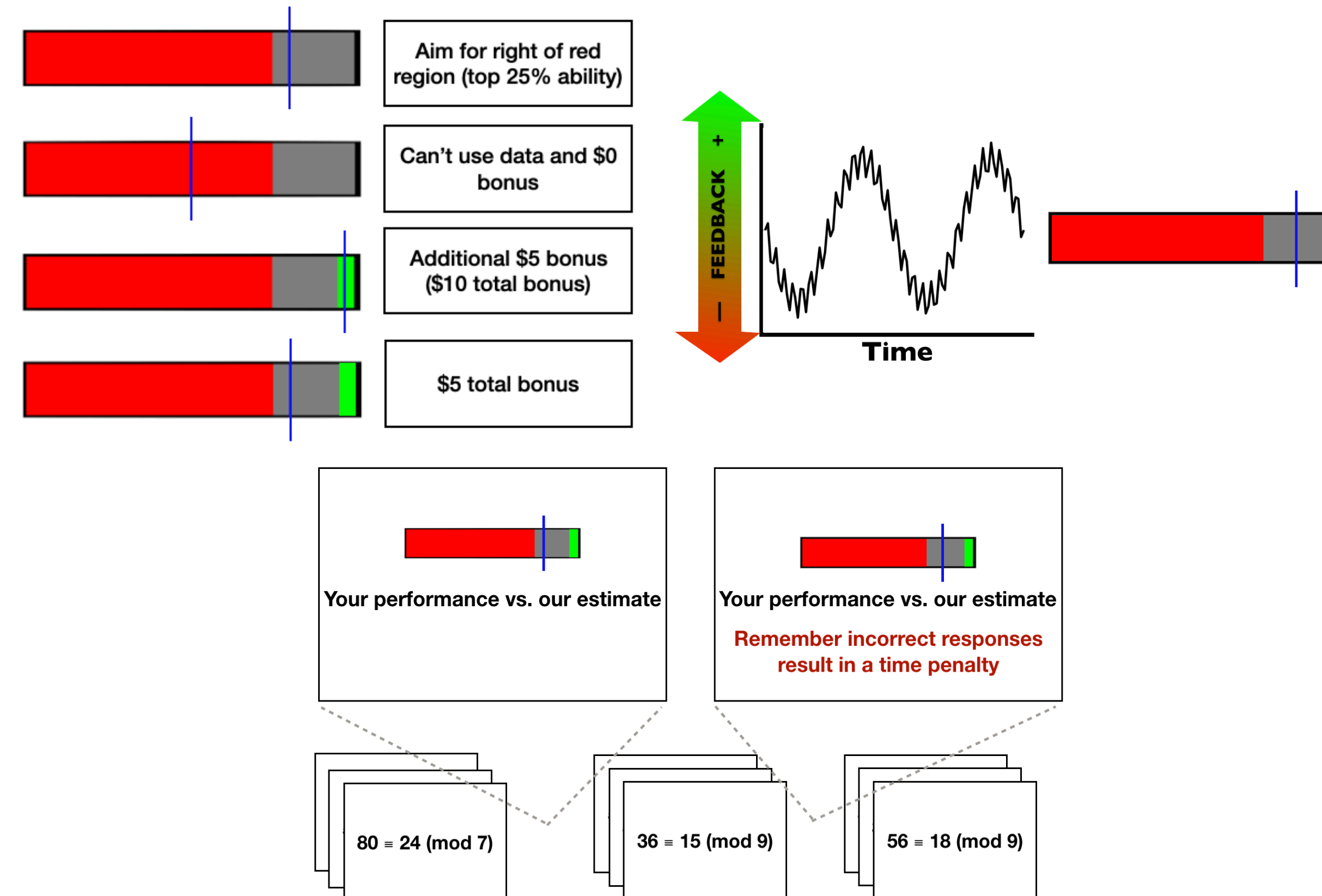
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BACKGROUND

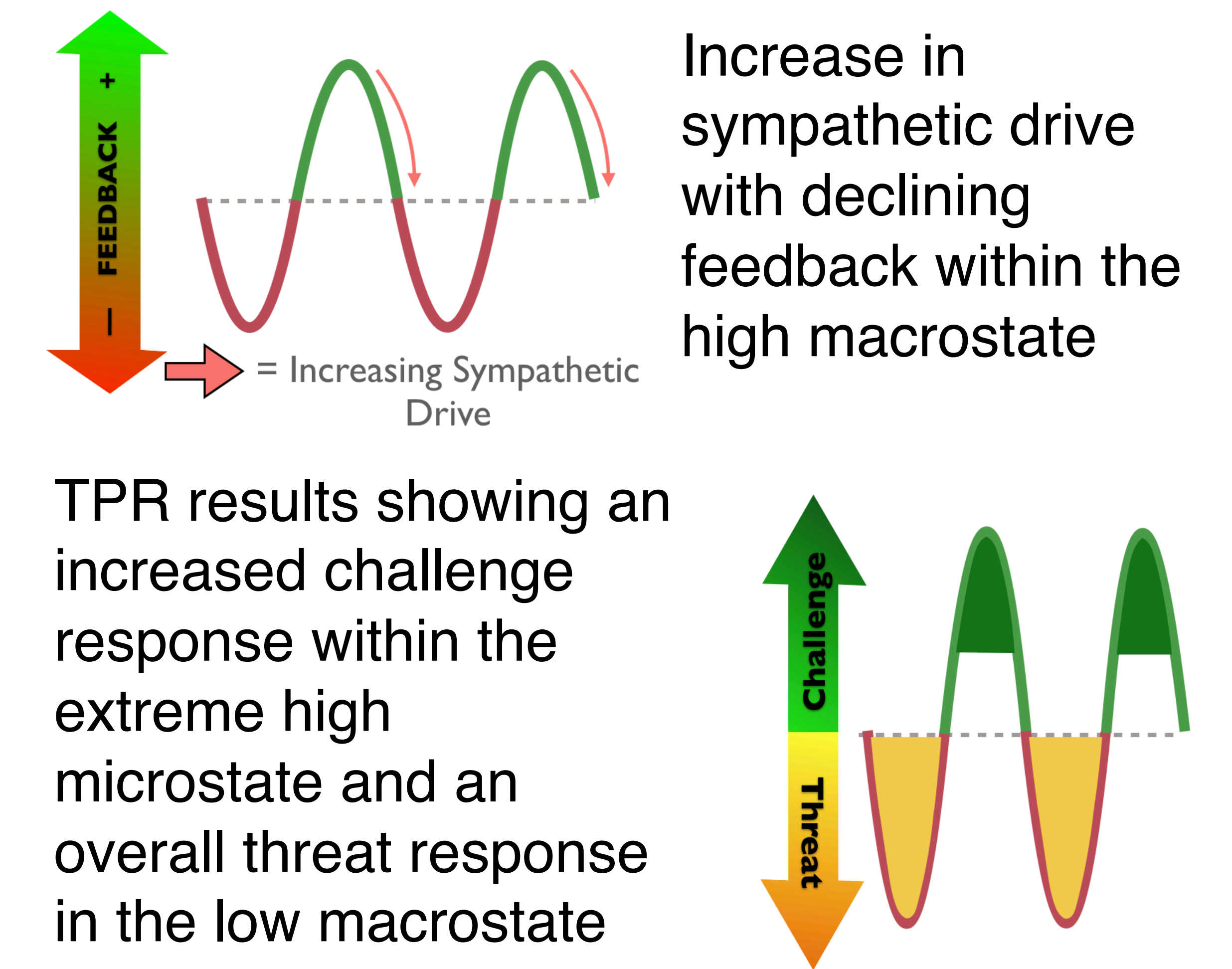
- The biopsychosocial (BPS) model of challenge and threat states that a change in perception of a situation and of a person's capabilities can lead to one of two physiological states, either 'challenge' or 'threat' (C vs T)
- These differing states, previously explained by individual differences and shown to alter with task difficulty, have been associated with task performance, anticipatory worry, and mindfulness.
- This study incorporates a false feedback manipulation to examine whether participants' sympathetic nervous system (SNS) response can be altered as a function of trial by trial performance feedback rather than reward or task difficulty

FEEDBACK MANIPULATION

Every participant received the same feedback, regardless of their performance

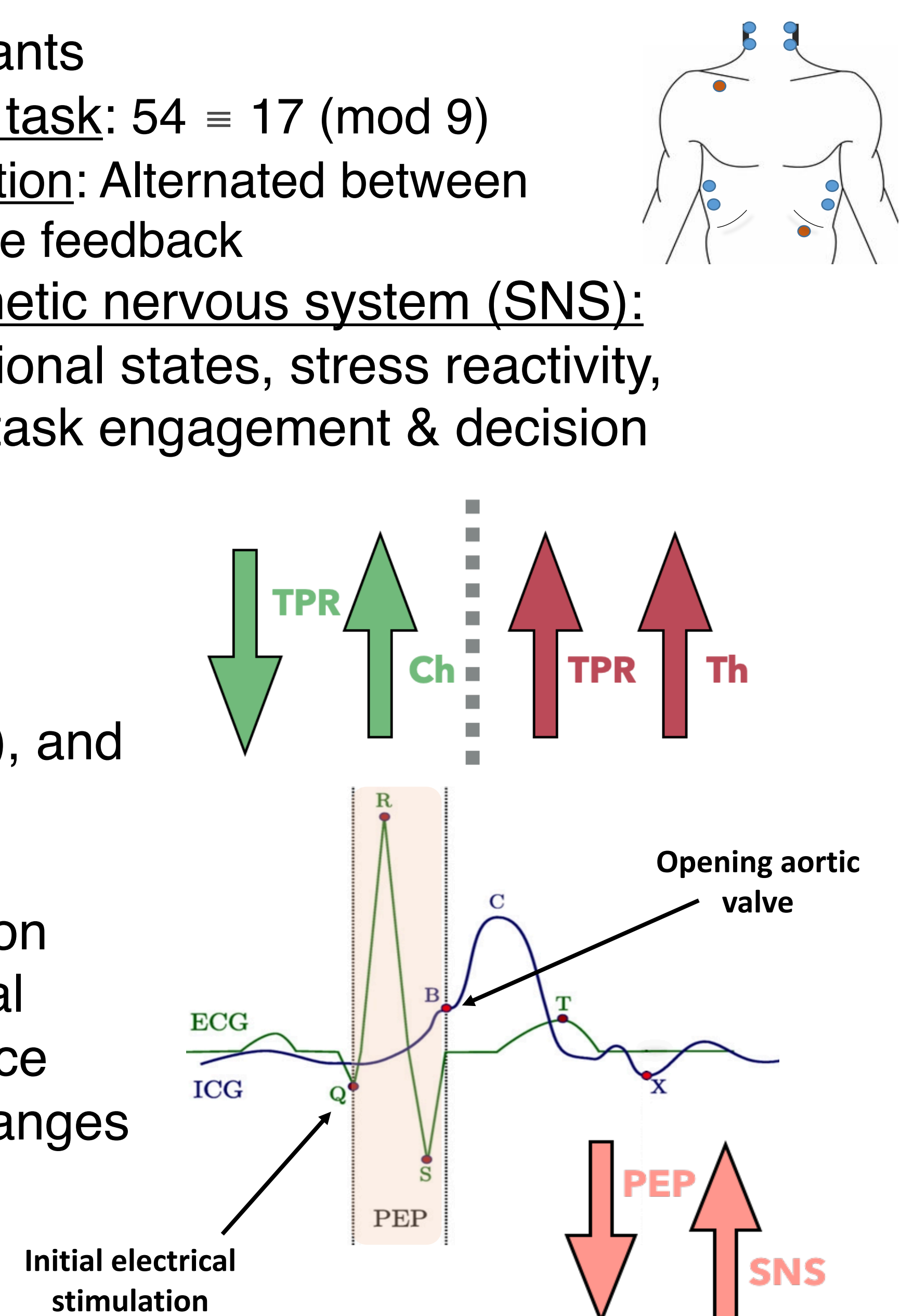


RESULTS (PART II)



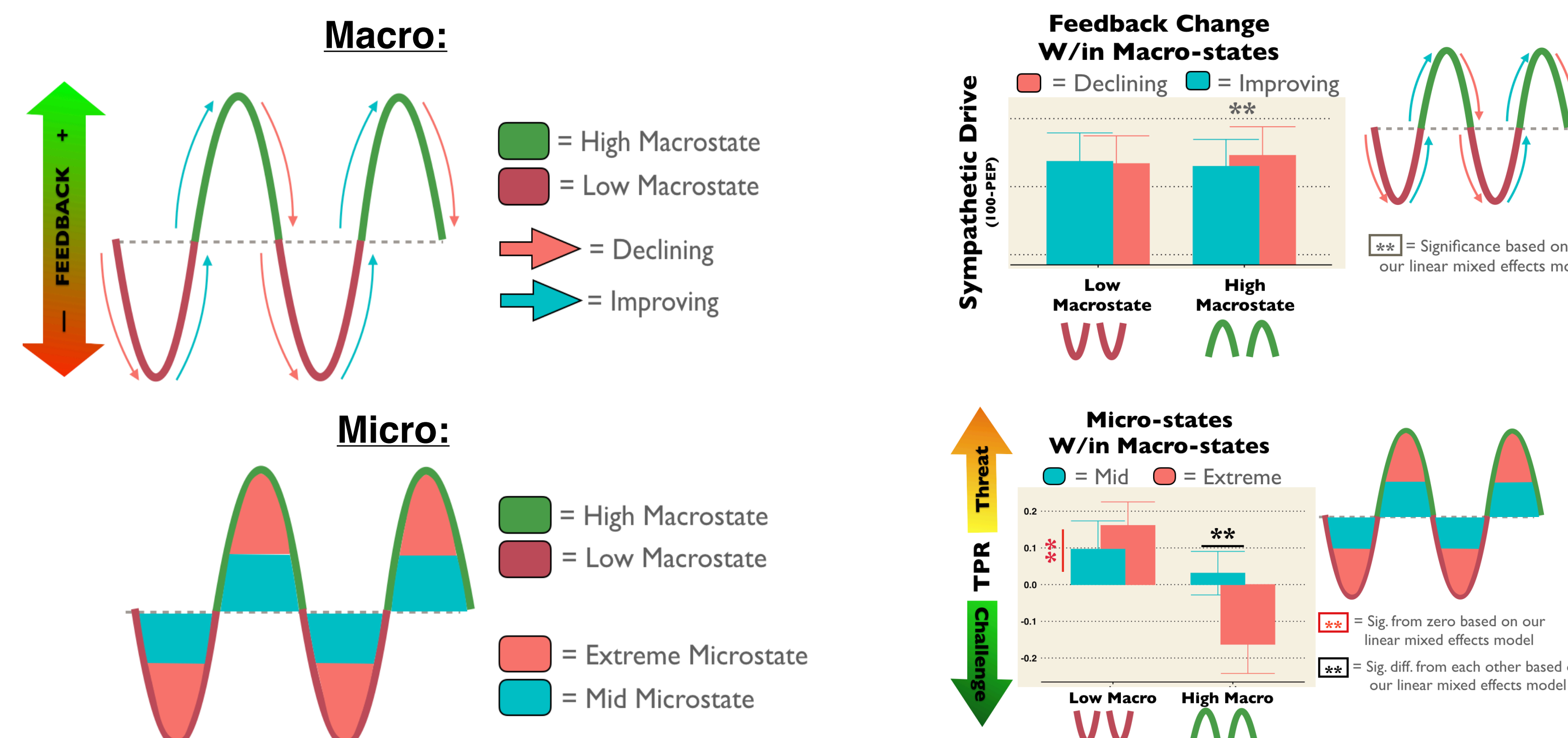
METHODS

- 25 healthy participants
- Modular arithmetic task: $54 \equiv 17 \pmod{9}$
- Feedback Manipulation: Alternated between positive and negative feedback
- Measured sympathetic nervous system (SNS): insight into motivational states, stress reactivity, reward sensitivity, task engagement & decision making
- Combination of electrocardiogram (ECG), impedance cardiography (ICG), and continuous blood pressure (CBP) to estimate pre-ejection period (PEP) & total peripheral resistance (TPR) to define changes in SNS activity and states of C vs T



RESULTS (PART I)

- Data was divided into separate macro and micro states
- Macro:** Assuming a center zeroing of the sinusoidal feedback wave, positive portions above the center line were considered high macrostates while negative portions below the center line were considered low macrostates
 - "**feedback change**": declining (moving closer to the red portion of the feedback bar), or improving (moving closer to the green portion of the feedback bar)
- Micro:** Further divided the macrostates into extreme and mid microstates. Extreme microstates were at the extreme ends of the feedback bar, whereas mid microstates were closer to the neutral center



DISCUSSION

- Results suggest sympathetic drive follows declining fortunes in an otherwise positive state, where a decrease in feedback received while doing well activates a sympathetic drive
- TPR results support a state-tracking system rather than perturbation tracking for states of challenge vs. threat, suggesting it was relatively easy to push participants into a state of threat, whereas pushing them into a state of challenge required extremely positive feedback
- With this study, we were able to detect trial by trial changes within an individual altering between states of challenge and threat.
- While these results may still suggest personality differences, the results show a state based difference within an individual that can fluctuate rapidly

References: Cieslak, M., Ryan, W. S., Babenko, V., Erro, H., Rathbun, Z. M., Meiring, W., ... & Grafton, S. T. (2018). Quantifying rapid changes in cardiovascular state with a moving ensemble average. *Psychophysiology*, 55(4), e13018.

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