

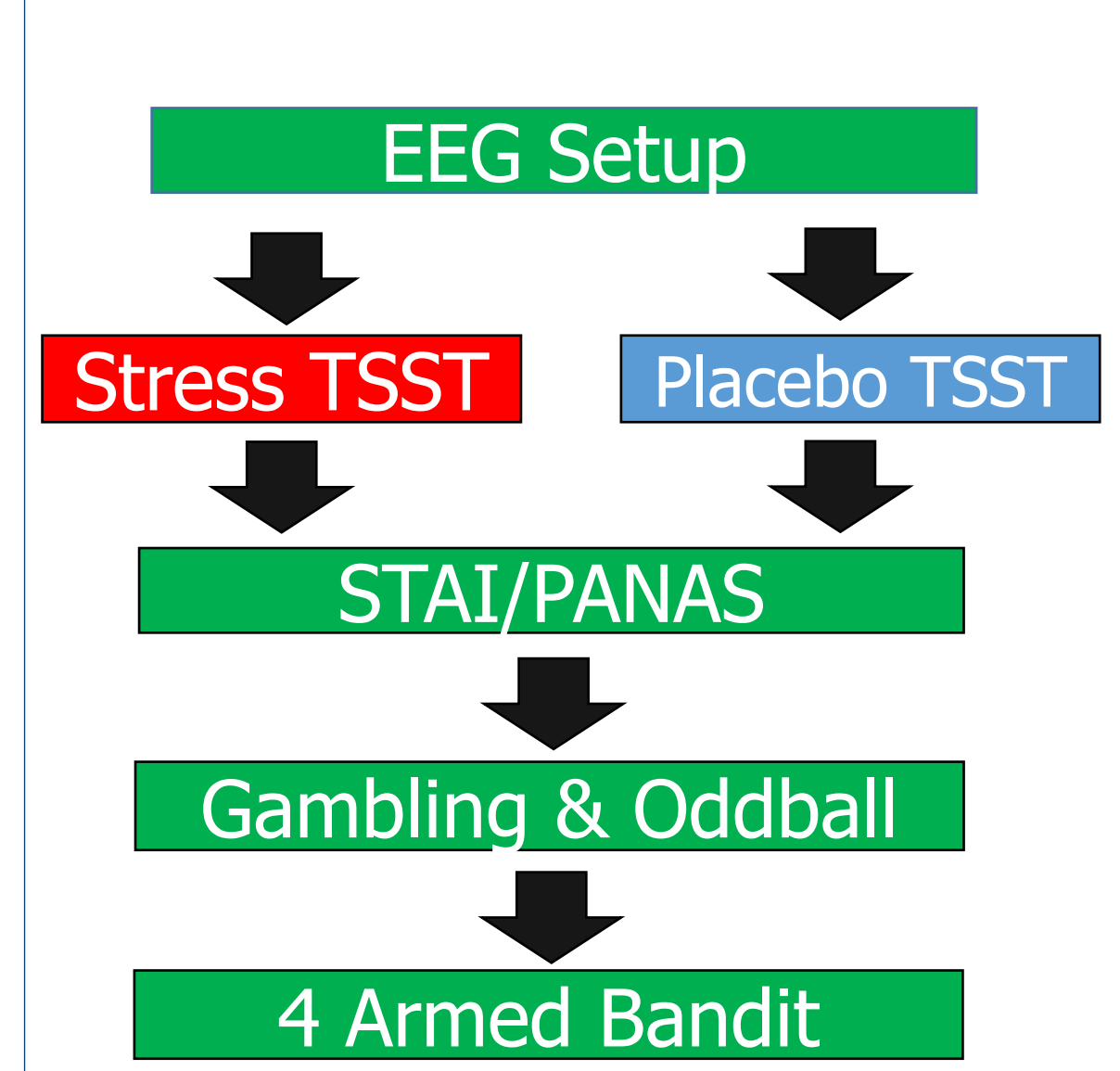
Using EEG to investigate the neuro-modulatory systems underlying stress and decision making

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INTRODUCTION

- Acute Stress impacts both norepinephrine and dopamine
- These same neuromodulators play a role in decision-making systems that underlie context updating (norepinephrine), reward learning (dopamine), and the explore-exploit dilemma (norepinephrine & dopamine)
- Goal:** To investigate how stress impacts these two systems using a combination of behaviour, neurophysiology (EEG), & computational modeling
 - Induced Stress using the Trier Social Stress Task (TSST)
 - Heart-rate, scores on the State-Trait anxiety Inventory (STAI), and Scores on the Positive and Negative Affect Schedule (PANAS) were measured as manipulation checks for the stressor

PROCEDURE



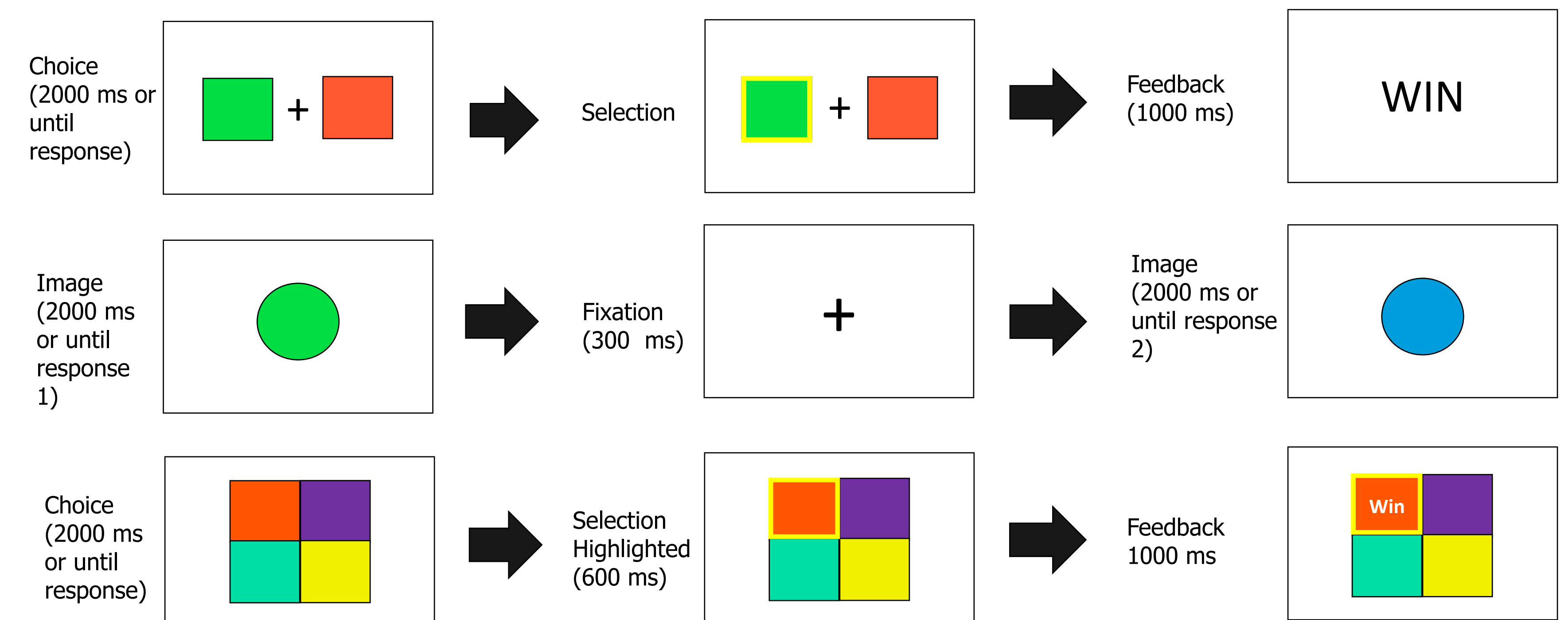
TASKS

Gambling
Reward learning

Oddball
Context Updating

4-armed Bandit
Explore-Exploit

METHODS



MANIPULATION CHECKS

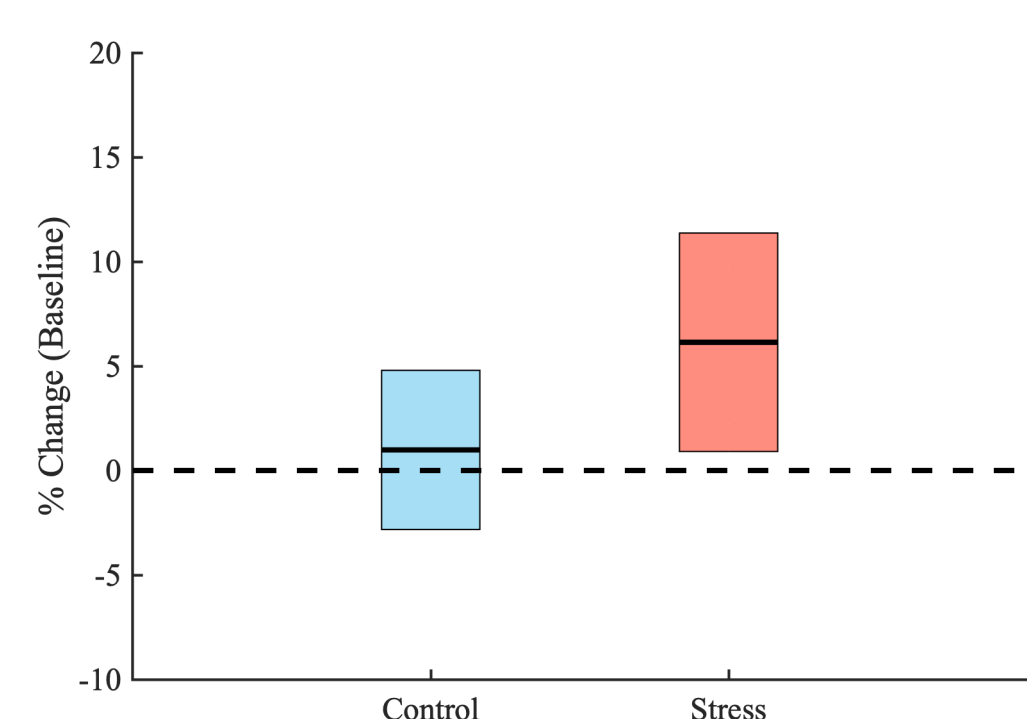


Fig 1. Heart Rate – Change from Baseline

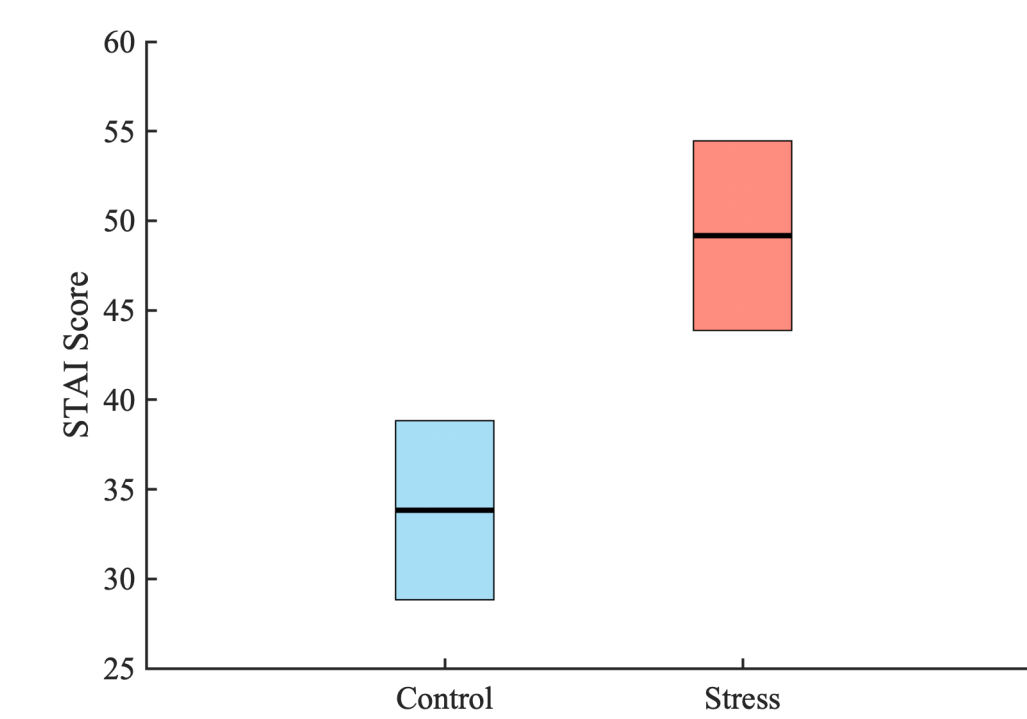


Fig 2. State-Trait Anxiety Inventory (STAI) Score

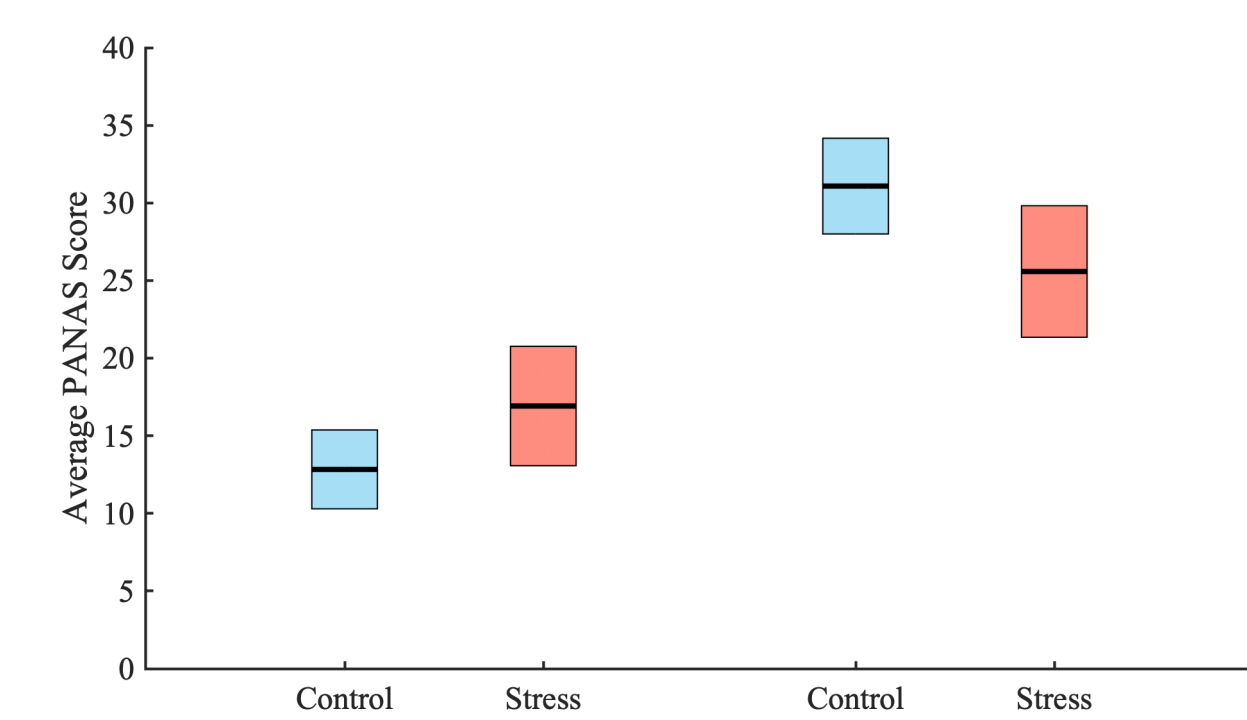


Fig 3. Positive and Negative Affect Schedule (PANAS) Score

Gambling Task

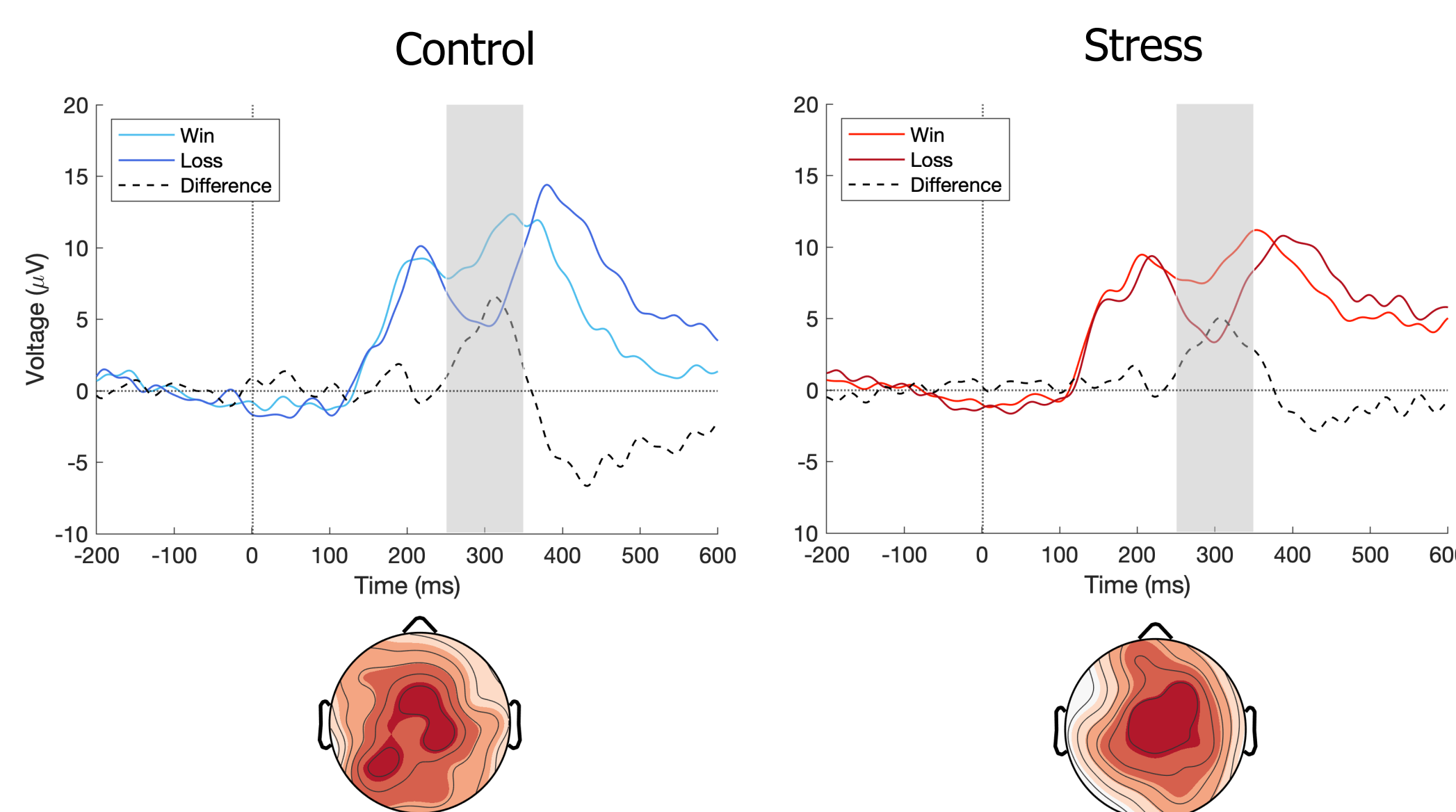


Fig 4. Reward Positivity for control (left) and stress participants (right)

Oddball Task

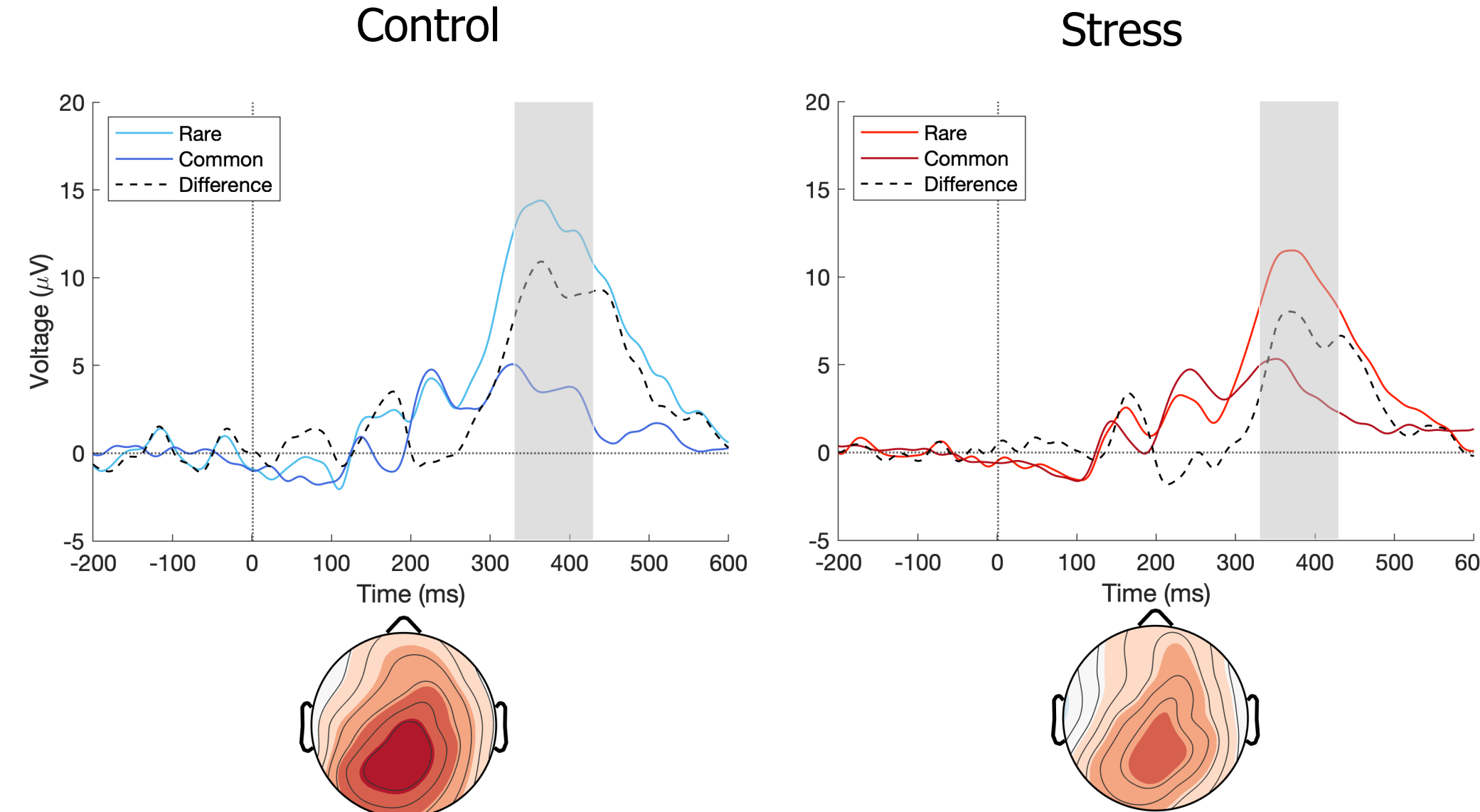


Fig 5. P300 for control (left) and stress participants (right)

RESULTS

4-armed Bandit

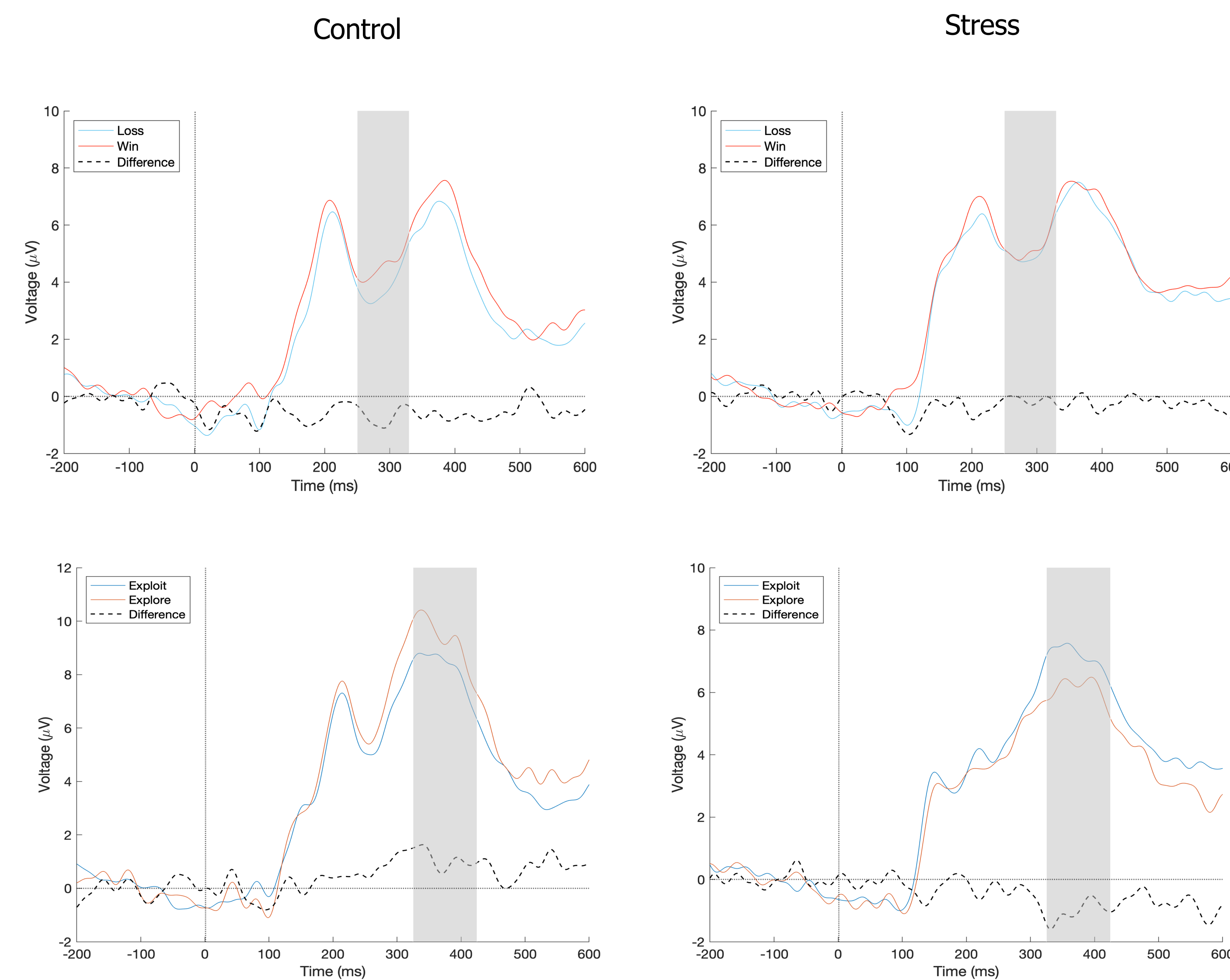


Fig 6. Reward Positivity (top) and P300 (bottom) for the 4 armed Bandit. Control (left) and stress (right). Explore trials were classified using a Win-Stay Lose-Shift Model

Model Performance

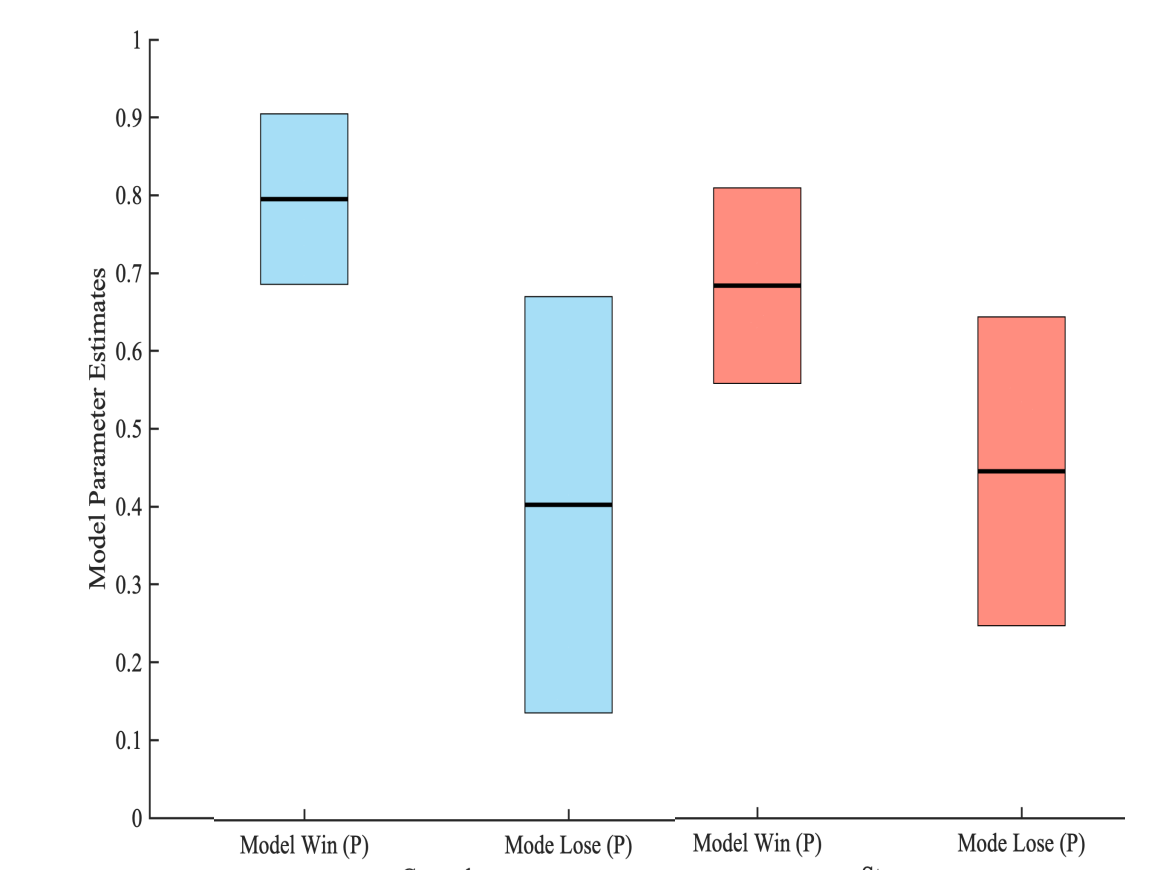


Fig 7. Win-Stay, Lose-Shift model parameter differences. Parameters are the probability of winning: **Win(P)** and the probability of losing: **Lose(P)**

Stress minus Control

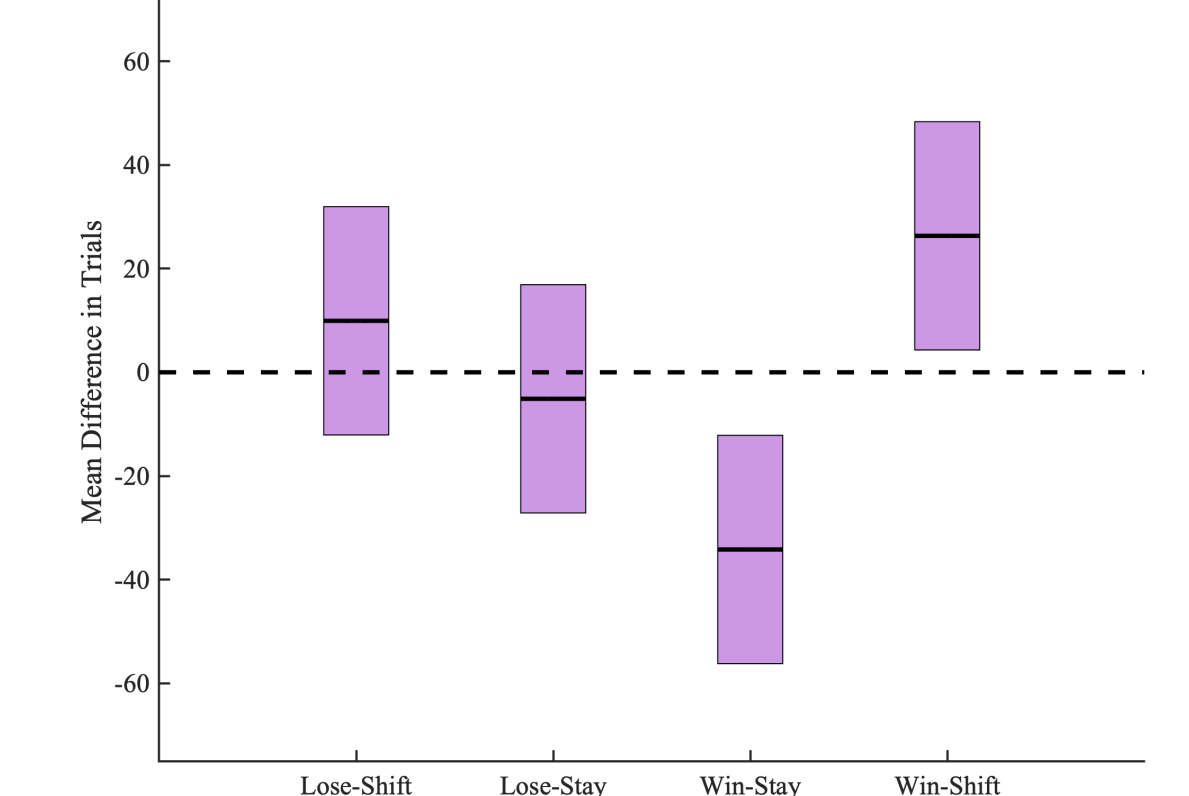


Fig 8. Differences in Win-Stay, Lose-Shift trial classifications. Difference is Stress minus Control

CONCLUSIONS

- Stress caused higher heart-rate, greater anxiety, less positive affect, and more negative affect.
- Stress reduced the P300 in the Oddball task but did not seem to impact the Reward Positivity in the Gambling Task
- Stress reduced the Reward Positivity in the 4-armed bandit while causing the P300 to flip on explore-exploit trials and stress reduced the win percent of the model and less optimal behaviour (more win-shift and less win-stay)
- EEG can provide an indirect measure of the time-course of the effects of acute stress on dopamine and norepinephrine

