

Anxiety and early stimulus processing: an ERP study analyzed with mass univariate statistics

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Introduction

Trait anxiety has been suggested to modulate cognitive control, reflected in altered stimulus-locked **N2 and P3** ERP components

- N2 (max. 150 – 300ms) reflects conflict processing [1]; positively correlated with anxiety [2].
- P3 (max. 300 – 500ms) reflects attention allocation [3]; inconsistent associations with anxiety [4, 5].
- Most previous studies focused on social threat stimuli like angry faces; unclear if anxiety modulates these ERPs in response to non-social, neutral stimuli.
- Studies used the STAI scale [6], which contains both anxiety and depression items; a more purer anxiety scale (STICSA [7]) may better reveal the anxiety modulations

Study Purpose:

- To examine anxiety modulation of the N2 and P3 in a neutral context flanker task [8], using a data driven mass-univariate analysis [9] to minimize Type I and II errors
- To test whether STAI [6] and STICSA [7] differ in their ERP correlations

Methods

Participants: 73 university students with no psychiatric diagnoses
Task: arrowhead version of the flanker task [8] with 50% congruency.

Trait anxiety measure: STAI [6] and STICSA [7]

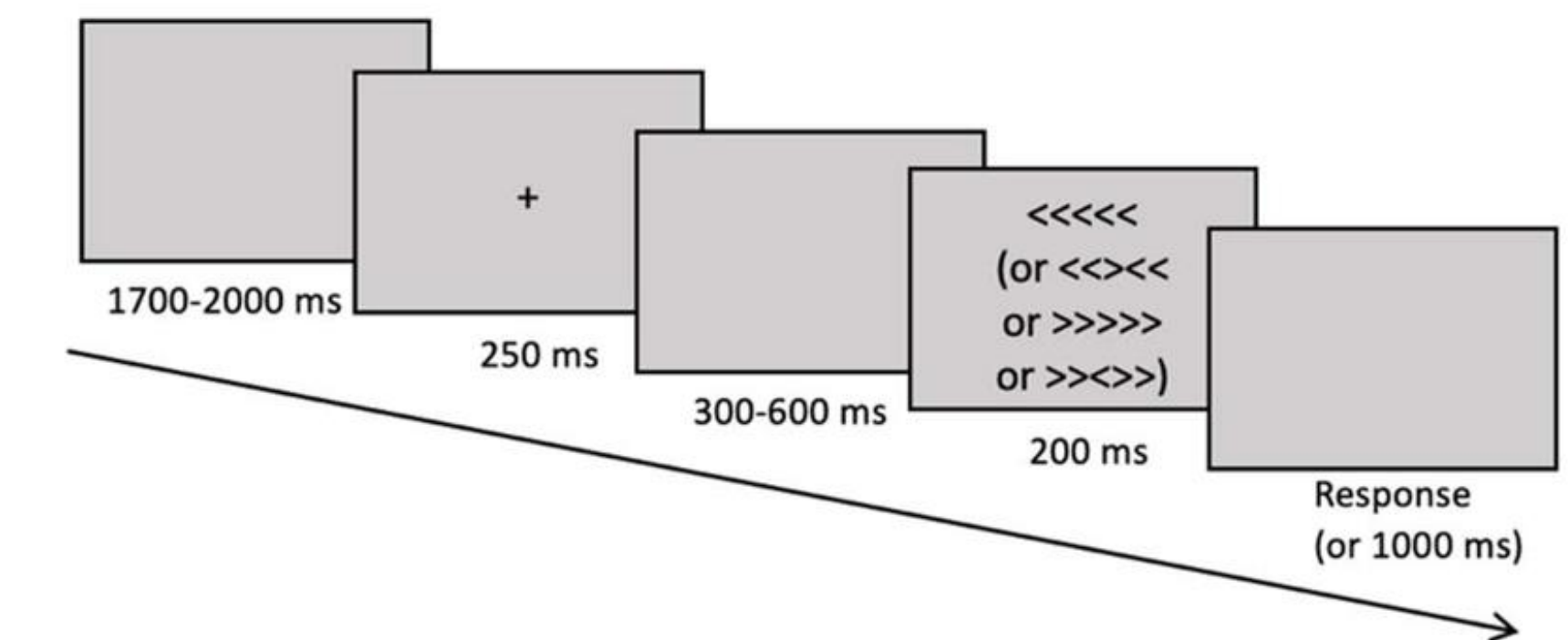
Study analysis:

Congruency effect

- t-test (Congruent, Incongruent) on:
 - ERP amplitude, with mass-univariate analysis
 - ERP latency, with classic analysis

Anxiety modulation

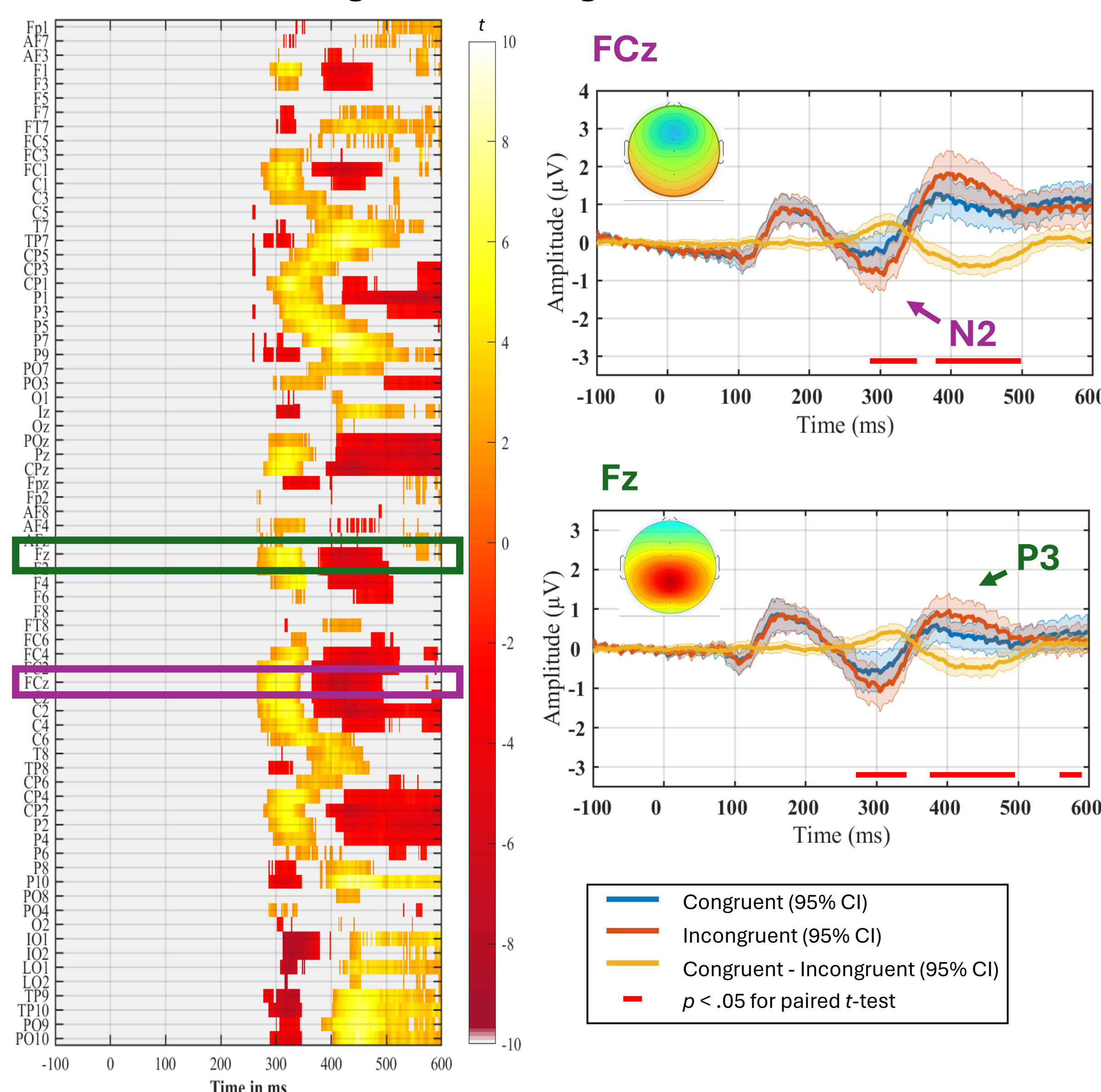
- Regression with STICSA predicting, for each congruency condition:
 - ERP amplitudes, with robust mass-univariate analysis
 - ERP latency, with classic analysis



Results

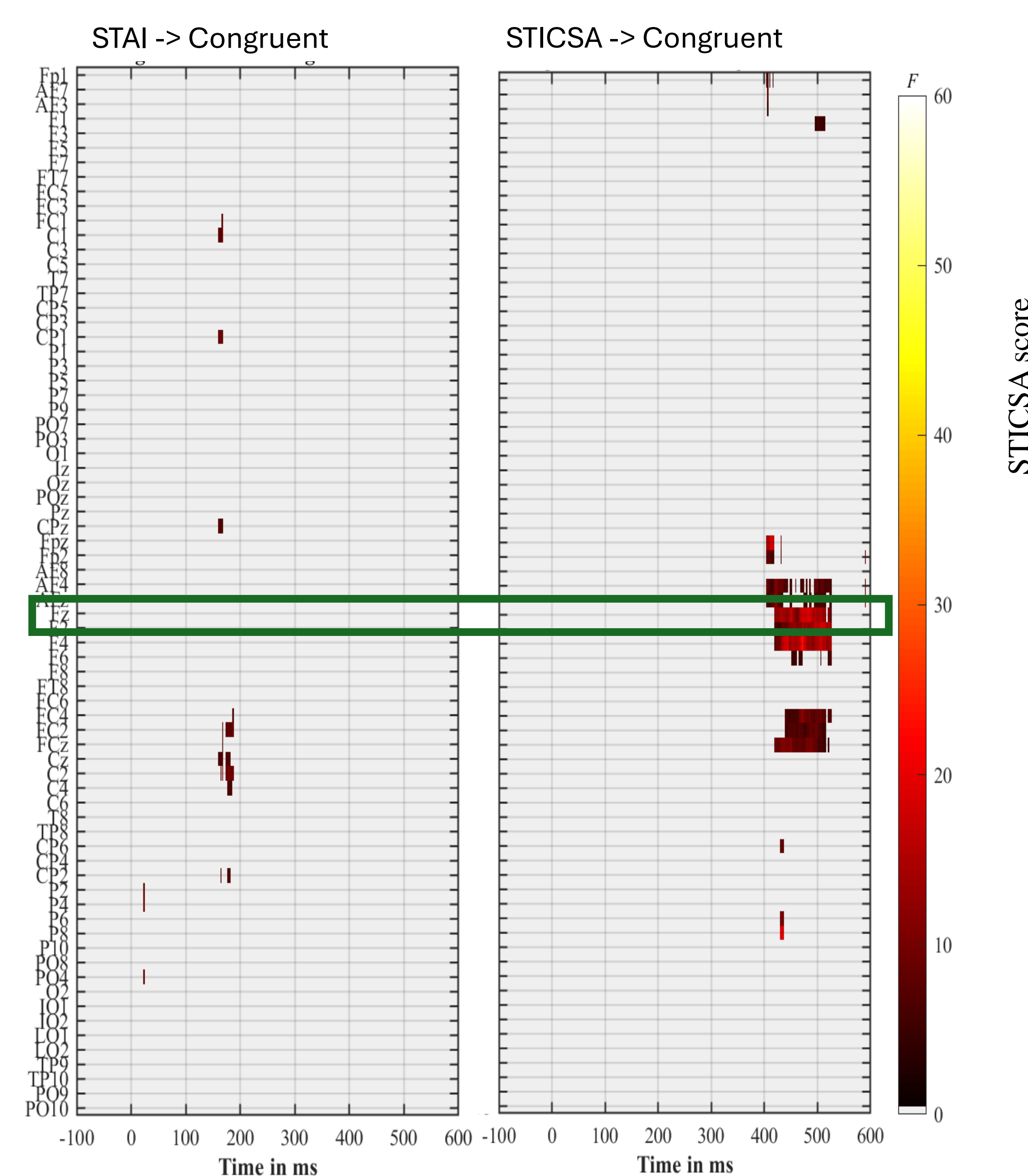
Enhanced amplitude for the N2 and P3 in incongruent relative to congruent trials.

Paired t-test: Incongruent vs Congruent



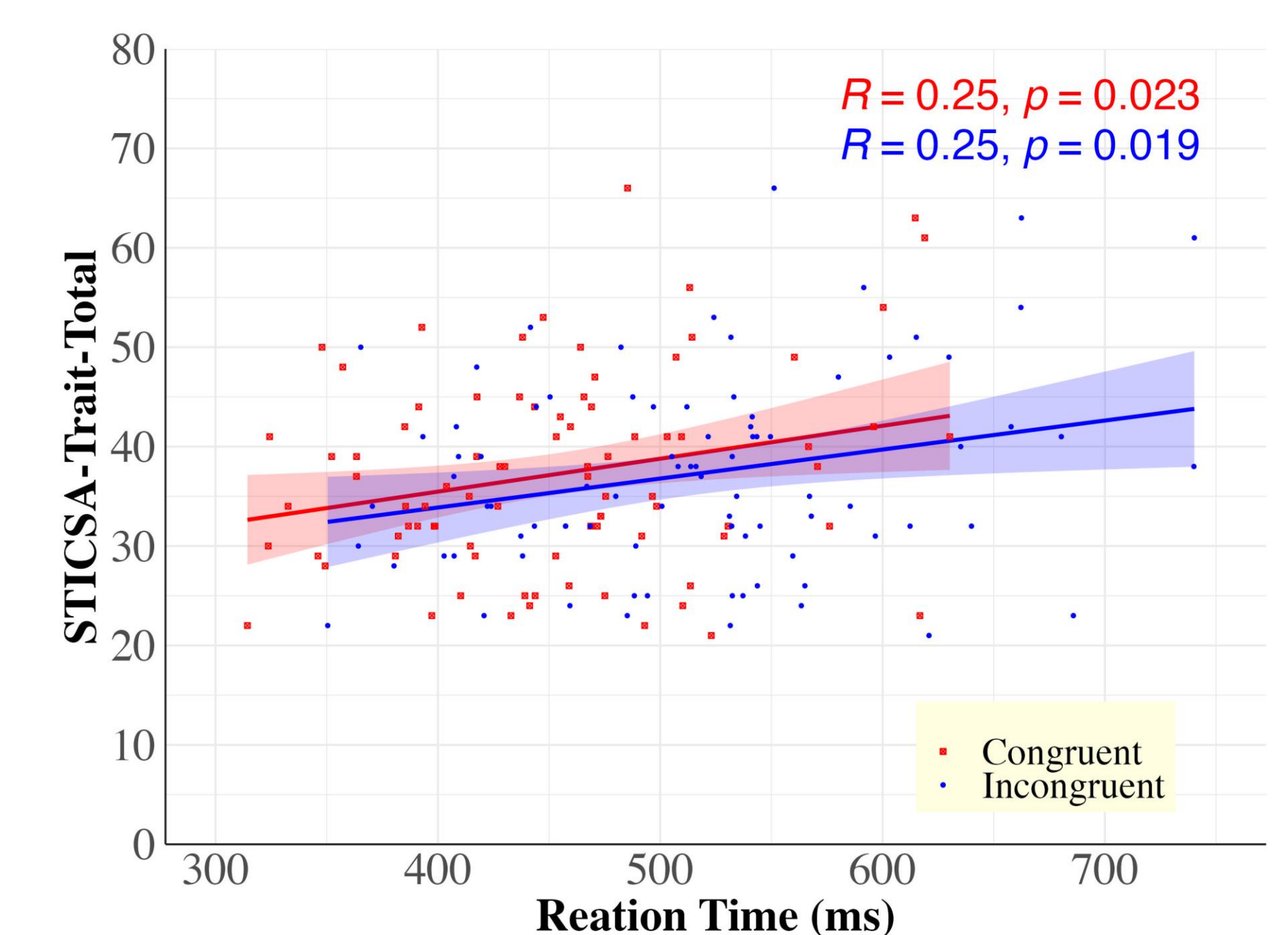
$t > 0$: more positive amplitude for congruent than incongruent trials
 $t < 0$: more positive amplitude for incongruent than congruent trials

STICSA negatively correlated with P3 amplitude in congruent trials; No reliable correlations for STAI.

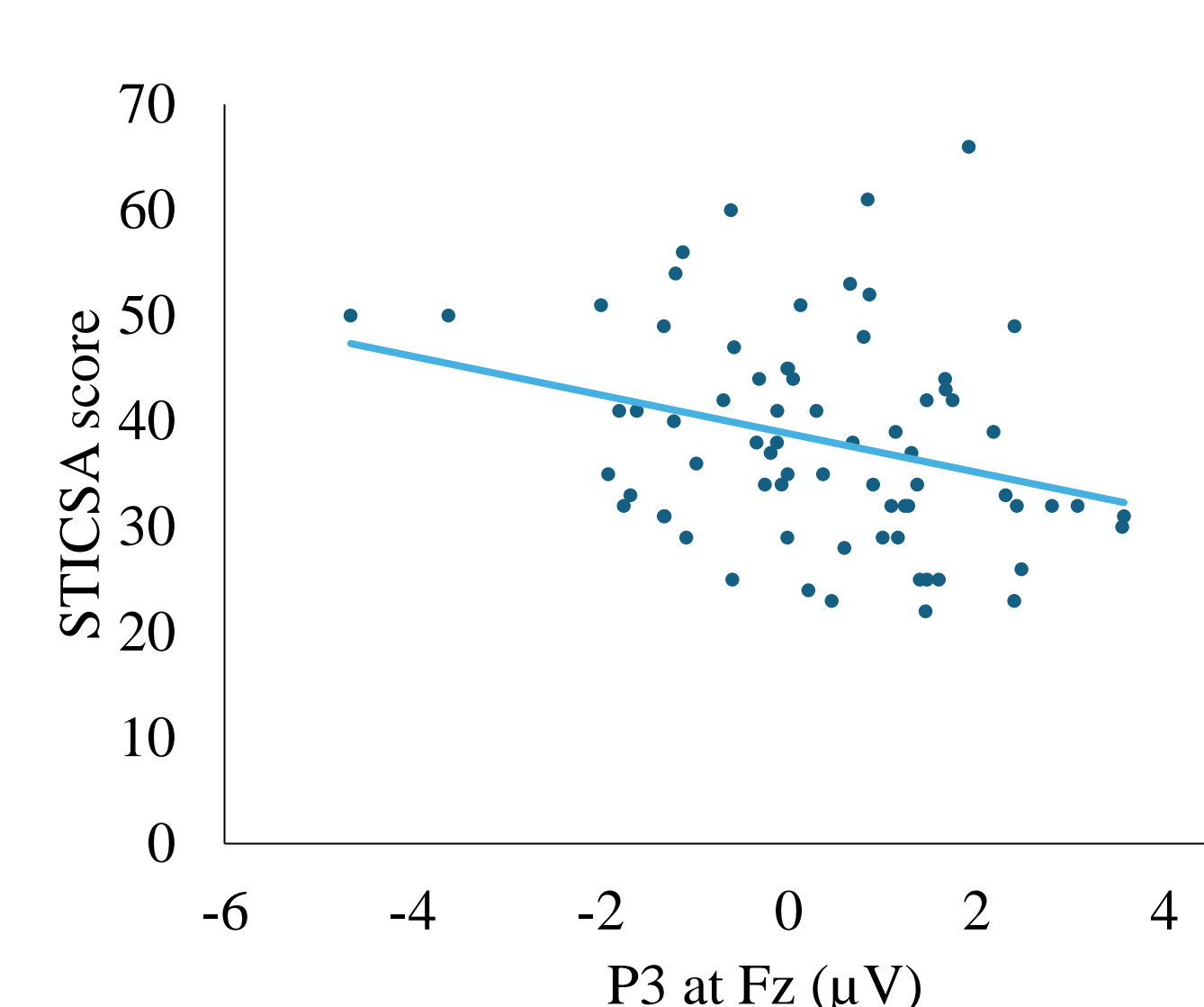


- No significant correlations between either STICSA or STAI with incongruent trial ERPs.
- No reliable, significant correlations in the N2 timeframe.

Anxiety positively correlates with response time, regardless of congruency.



P3 amplitude at Fz in congruent trials negatively correlates with STICSA



Latency effect:

- N2 analyzed at FCz, Fz, Cz
- P3 analyzed at Fz, Pz, POz

Significantly delayed N2 and P3 latency in incongruent relative to congruent trials

- Incongruent – Congruent mean difference: N2 FCz = 10ms, P3 Fz = 15ms
- **No significant correlations** between anxiety with N2 and P3 latency for either congruency condition or for the latency difference (Incongruent – Congruent).

Summary and Conclusion

Increased conflict processing and attention allocation in this neutral and non-social task:

- N2 and P3 amplitude: incongruent > congruent
- N2 and P3 latency: incongruent > congruent

Trait anxiety (STICSA scores) modulations:

- Attention allocation in **congruent** trials:
 - Negative correlation with P3 amplitude
 - No correlation with P3 latency or N2 amplitude and latency
- Correlates with longer RTs in both congruent and incongruent trials

Conclusion:

- Anxiety does not seem to alter processes involved in conflict monitoring (N2)
- Anxiety is associated with less efficient attentional allocation (P3)
- Anxiety is associated with slower behavioural responses in general

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Acknowledgments

This project was funded by:
NSERC (Natural Sciences and Research Council of Canada)
CFI (Canada Foundation for Innovation)

