Aversive Distracter Words and Working Memory Filtering

Richard Ward, Sofia Mattson, Joseph Kornkven, Salahadin Lotfi, Han-Joo Lee, & Christine L. Larson

UNIVERSITY of WISCONSIN
UWMILWAUKEE

Anxiety Disorders Laboratory

Affective Neuroscience Laboratory
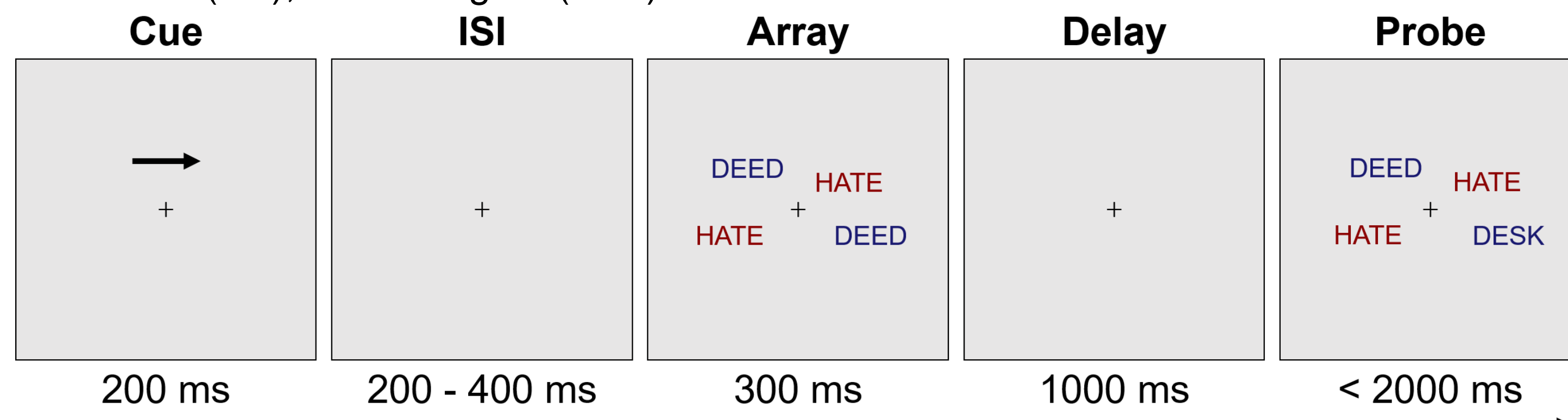
Introduction

Threatening stimuli attract attention, even when they are task-irrelevant[1]. The attentional prioritization of threatening information can subsequently affect downstream cognitive systems, such as working memory, which allows for the active representation of information over a brief interval[2,3]. Prior work indicates that task-irrelevant threatening information gains access to working memory[4,5,6]. Others have also found attentional bias towards aversive words[7].

Using the contralateral delay activity (CDA), an event-related potential (ERP) that serves as an index of working memory capacity and filtering efficiency[8,9,10], we examined how aversive distracter words impact working memory filtering compared to neutral distracter words. In addition, we examined how individual differences in working memory capacity and attentional control impact these filtering abilities.

Task & Procedure

Sample: 52 (37 Female) undergraduates following artifact rejection

Conditions: 1 target (NT1), 1 target & 1 neutral distracter (ND), 1 target & 1 threat distracter (TD), and 2 targets (NT2)

Cue	ISI	Array	Delay	Probe
→ +	+	DEED HATE + HATE DEED	+	DEED HATE + HATE DESK
200 ms	200 - 400 ms	300 ms	1000 ms	< 2000 ms

EEG Processing & CDA Quantification

32 Ag-Agl electrode cap recorded at a 512 Hz sampling rate.

Offline Butterworth bandpass filter (0.01 - 30 Hz), & ICA used to identify blinks.

Artifact rejection thresholds +/-75 µV (All EEG and VEOG), +/- 60 µV (HEOG), & visual inspection.

Channel clusters O1/O2, P3/P4, & P7/P8 were averaged together and CDA calculated as contralateral minus ipsilateral waveforms for each condition.
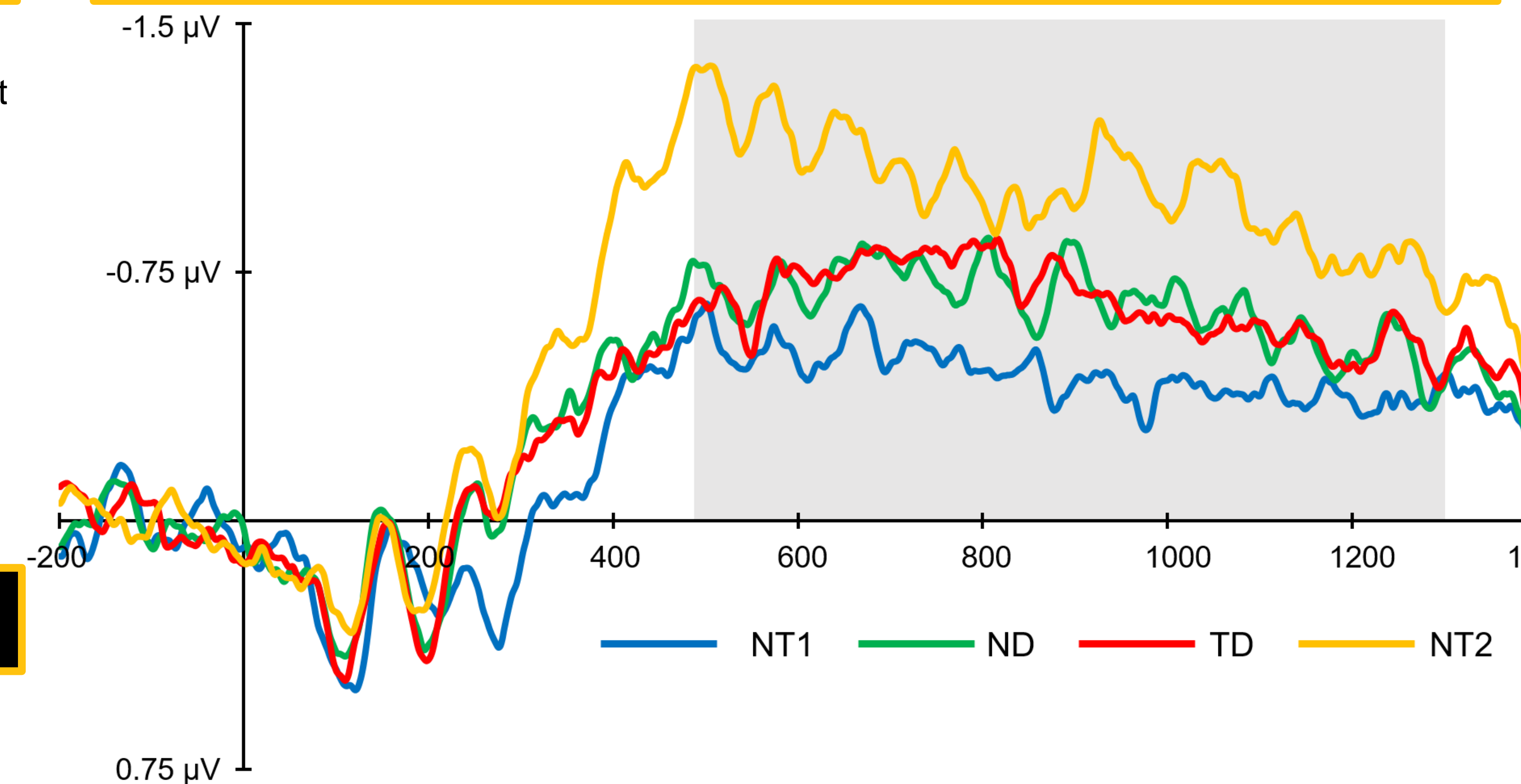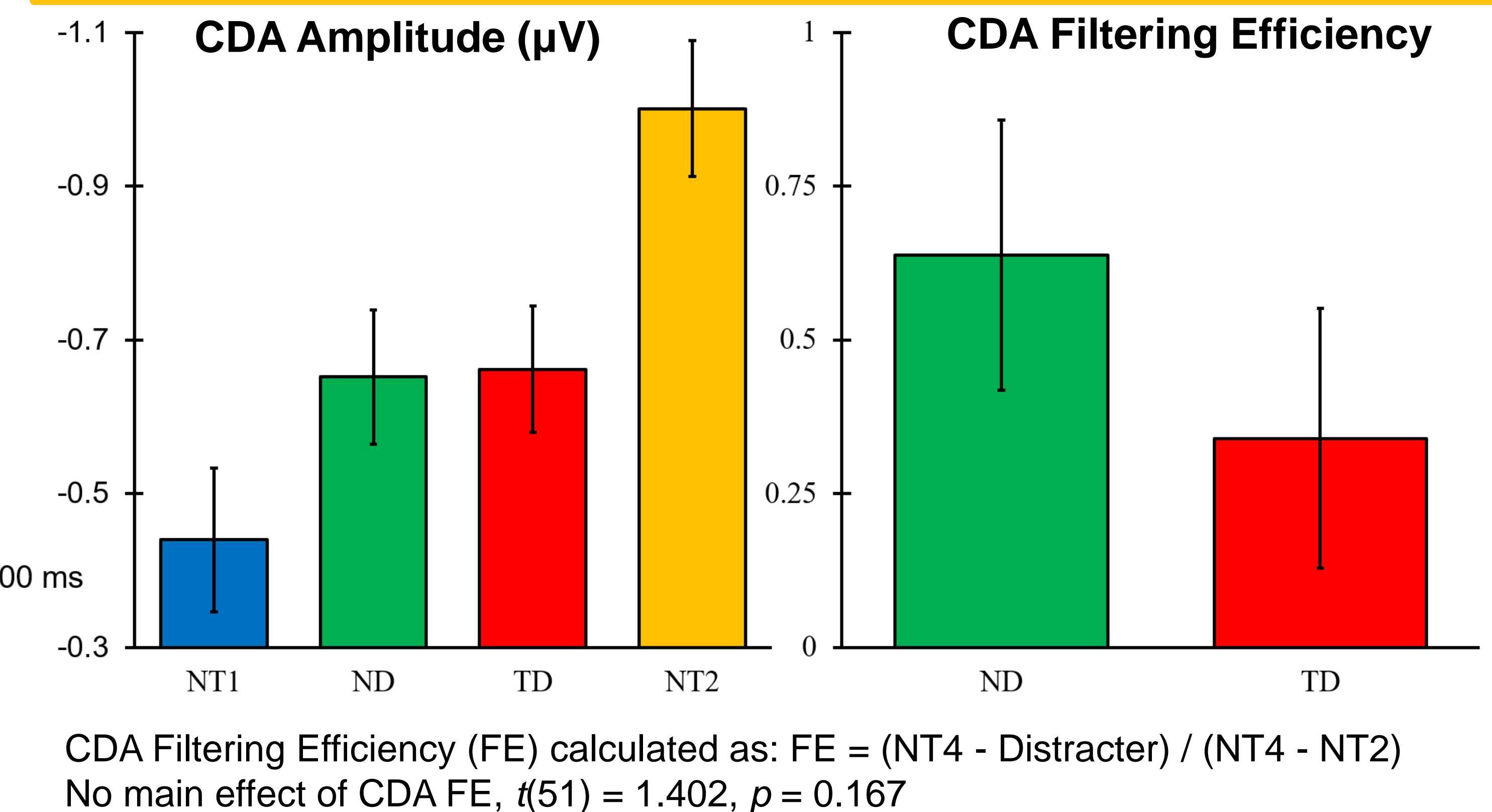
Contralateral and Ipsilateral Waveforms

- - - Ipsilateral to array
—— Contralateral to array
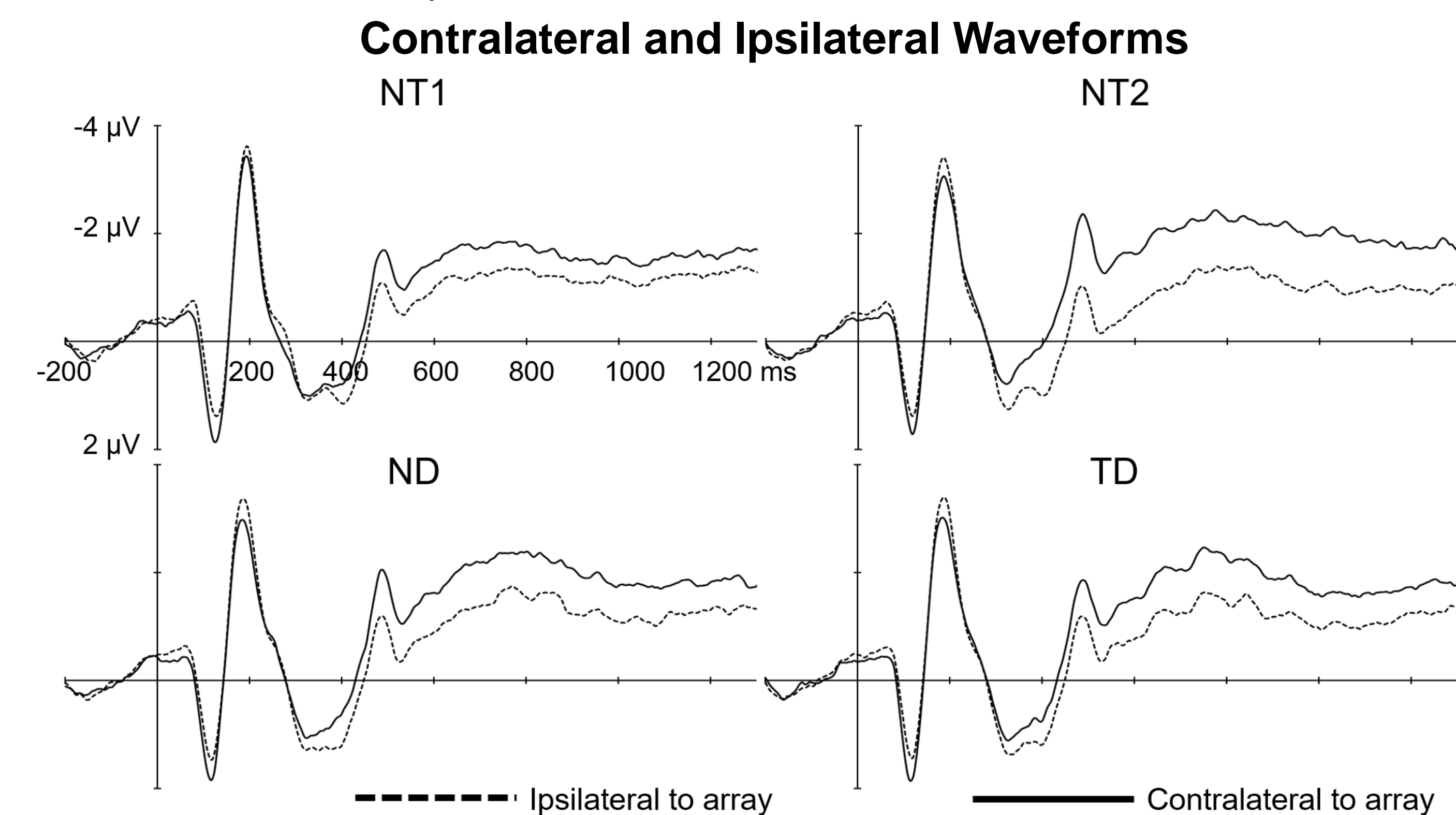
Behavioral Results
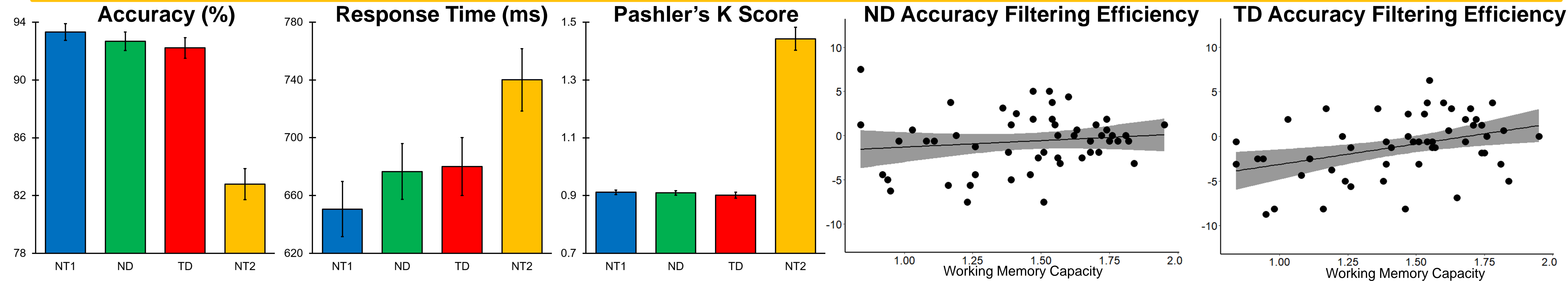
Accuracy Filtering Efficiency (FE) calculated as: FE = NT1 − Distracter
Accuracy FE multiplied by -1 to aid in visual interpretation

Working Memory Capacity associated with Threat Word FE, $r(50) = 0.377$, $p < 0.01$
Working Memory Capacity *not* associated with Neutral Word FE, $r(50) = 0.129$, $p = 0.36$
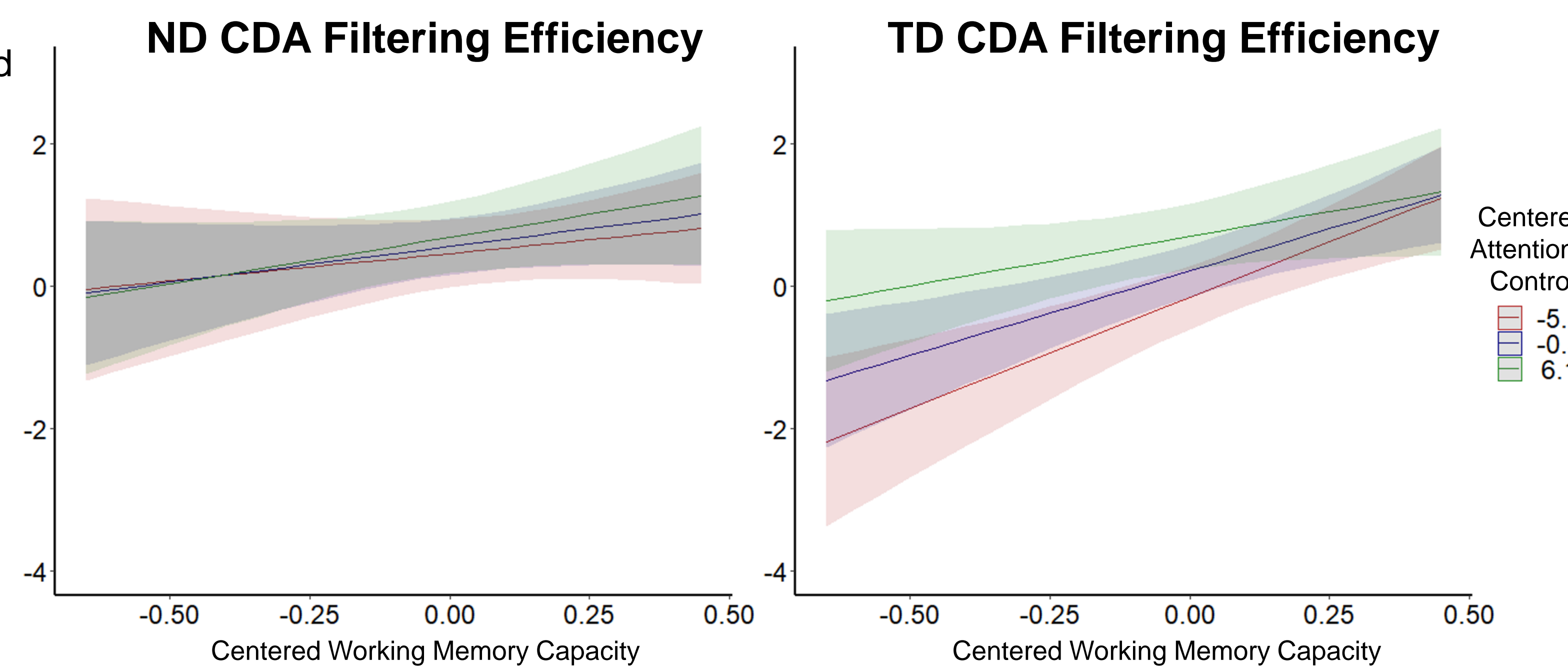
CDA Waveforms

—— NT1 —— ND —— TD —— NT2

Attentional Control Moderation

Centered Attentional Control
-5.33
-0.33
6.17

Attentional Control moderation of Working Memory Capacity and Threat Word CDA FE, $F(3, 47) = 4.356$, $p < 0.05$

No moderating effect of Attentional Control on Working Memory Capacity and Threat Word CDA FE, $F(3, 47) = 0.356$, $p = 0.554$

CDA Results

CDA Filtering Efficiency (FE) calculated as: FE = (NT4 - Distracter) / (NT4 - NT2)
No main effect of CDA FE, $t(51) = 1.402$, $p = 0.167$

Conclusions

The presence of distracter words impacted all of our measures. However, we did not find any main effects in filtering efficiency between neutral and threatening word distracters. Despite these results, we did identify that individual differences in working memory capacity predict the degree that threatening distracters impact accuracy filtering efficiency. Specifically, individuals with greater working memory capacity demonstrated enhanced accuracy filtering efficiency. This same observation was not found for neutral distracter words. In addition, we found that attentional control moderates the association between working memory capacity and CDA filtering efficiency for threat, but not neutral, distracter words.

These results suggest that the ability to efficiently filter threatening words may be intact at a group level, but that deficits in working memory and attentional control yield failures in filtering threat-related words.

References

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