# MODULATION OF THE FACE SENSITIVE N170 EVENT RELATED POTENTIAL BY EMOTIONAL EXPRESSION AND VISUAL ATTENTION IN ADULTS WITH AUTISM, SCHIZOPHRENIA, AND A NON-CLINICAL COMPARISON GROUP

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Background

- Differences in **social cognition and communication** compared to non-clinical (NC) controls are observed in autism spectrum disorder (ASD) and schizophrenia (SZ).
- Atypical neural response to faces as quantified by the face sensitive **N170 event-related potential** (ERP) is seen in both ASD and SZ (delayed N170 latencies in ASD and attenuated N170 amplitudes in SZ compared to NC controls).[1,2]
- **Emotional valence** and patterns of **visual attention** to faces may modulate amplitude and latency of the N170.[3]
- Little is known about the interplay between visual attention, emotional valence of the face, and neural response to faces in ASD, SZ, and NC controls.

Objective: To investigate how neural processing of faces relates to emotional valence and/or visual attention to faces to clarify processes underlying social differences in ASD and SZ compared to NC controls.
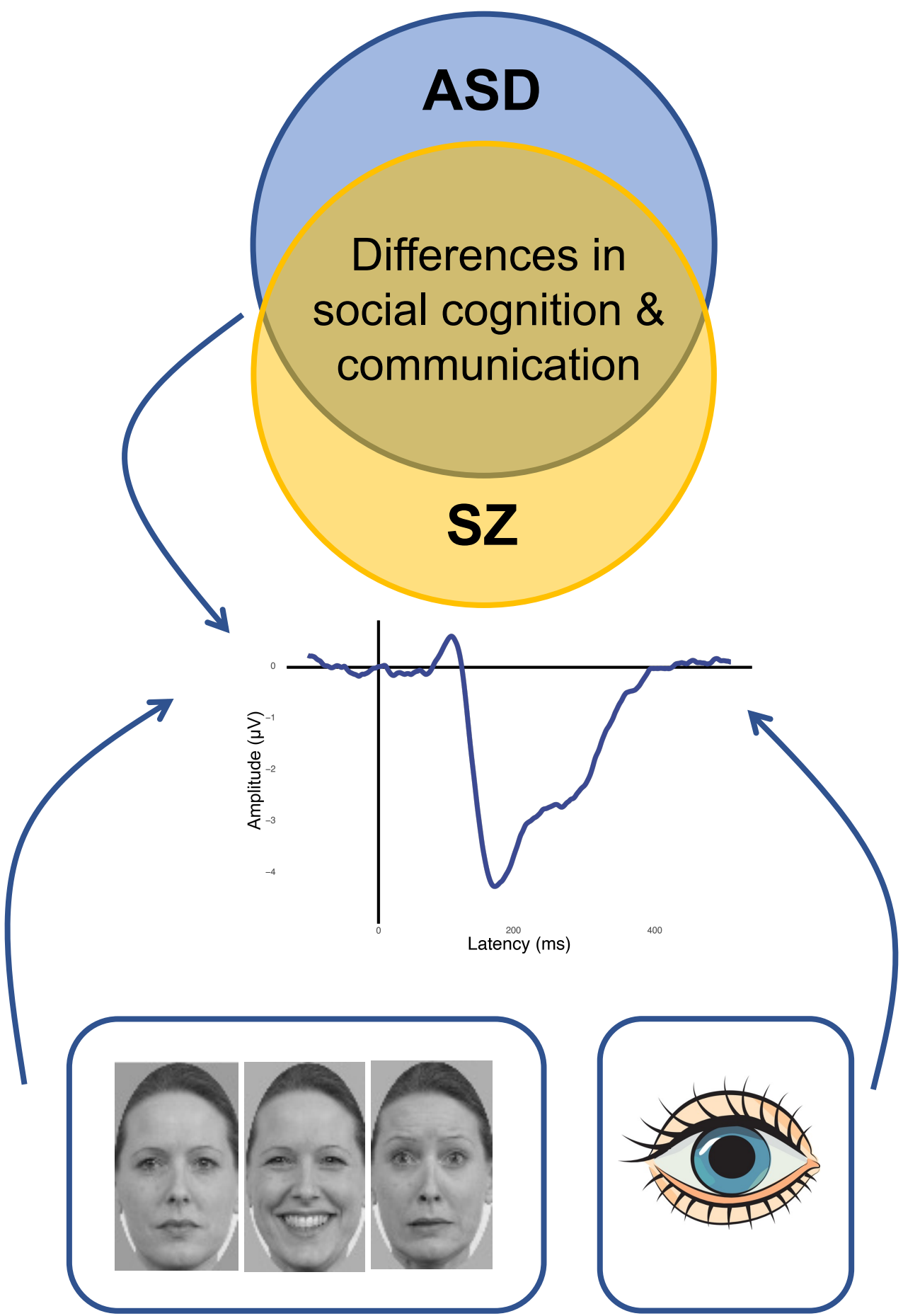
Methods

Participants

	ASD (N=29)	SZ (N=23)	NC (N=40)	Overall (N=92)
Age				
Mean (SD)	24.1 (5.55)	26.5 (7.50)	27.4 (6.75)	26.1 (6.68)
Sex				
Female	6 (20.7%)	4 (17.4%)	17 (42.5%)	27 (29.3%)
Male	23 (79.3%)	19 (82.6%)	23 (57.5%)	65 (70.7%)

Table 1. Participants included adults with confirmed diagnoses of ASD or SZ via gold-standard tools and expert clinician assessment.

### Gaze-Contingent Face Processing Task

- Following a crosshair, participants viewed a neutral face that shifted to an emotional (fearful or happy) face after 500 ms of fixation on the neutral face (Figure 1). Visual attention was operationalized as % of time looking to the emotional face and was normalized via logit transform for analyses.

600 ms → **Happy**
~500 ms fixation → **Fearful**

Figure 1. Trial structure with sample stimuli.

EEG Acquisition and ERP Analysis

- EEG was recorded at 1000 Hz with a 128-channel Hydrocel Geodesic sensor net.
- Data were segmented from -100 to 500 ms relative to emotional face presentation and averaged separately for happy and fearful faces.
- N170 latency and N170 peak amplitude were extracted from electrodes over right occipitotemporal scalp (Figure 2).

Figure 2. Electrodes included in analysis.

Statistical Analysis

Separate mixed model ANOVAs were conducted to assess the main and interactive effects of diagnostic group, face valence, and visual attention on N170 amplitude and latency, including the three-way Diagnosis (ASD, SZ, NC) x Emotion (happy, fearful) x Visual Attention (%looking) interaction and all lower order effects.
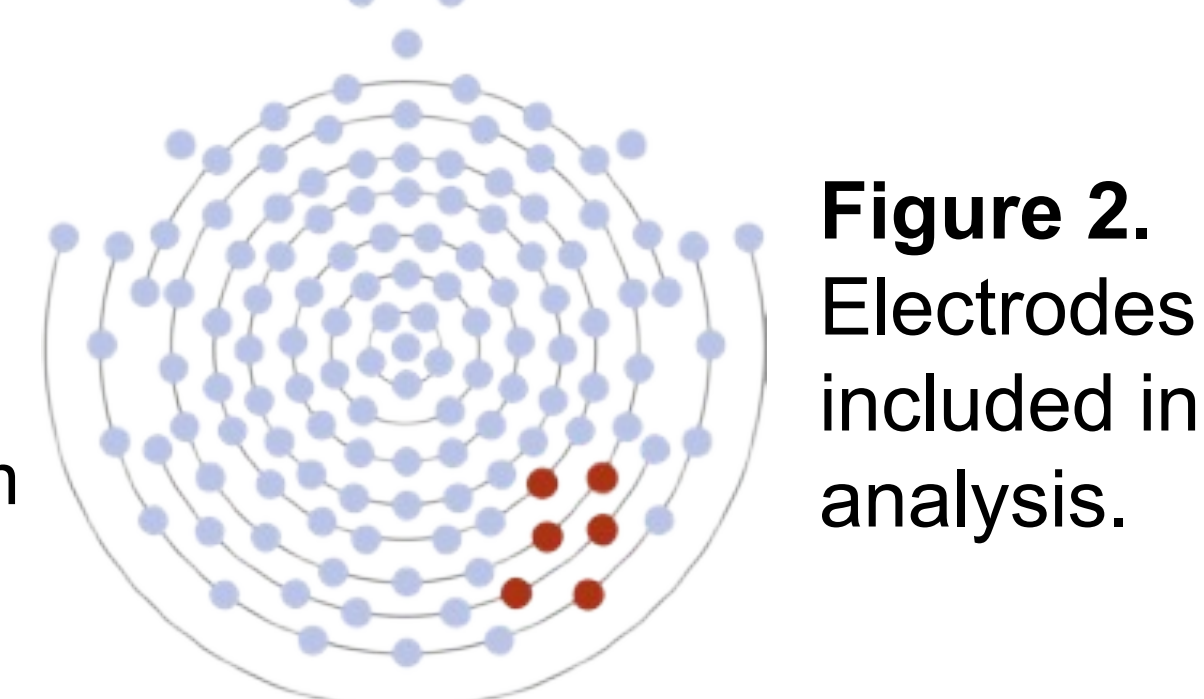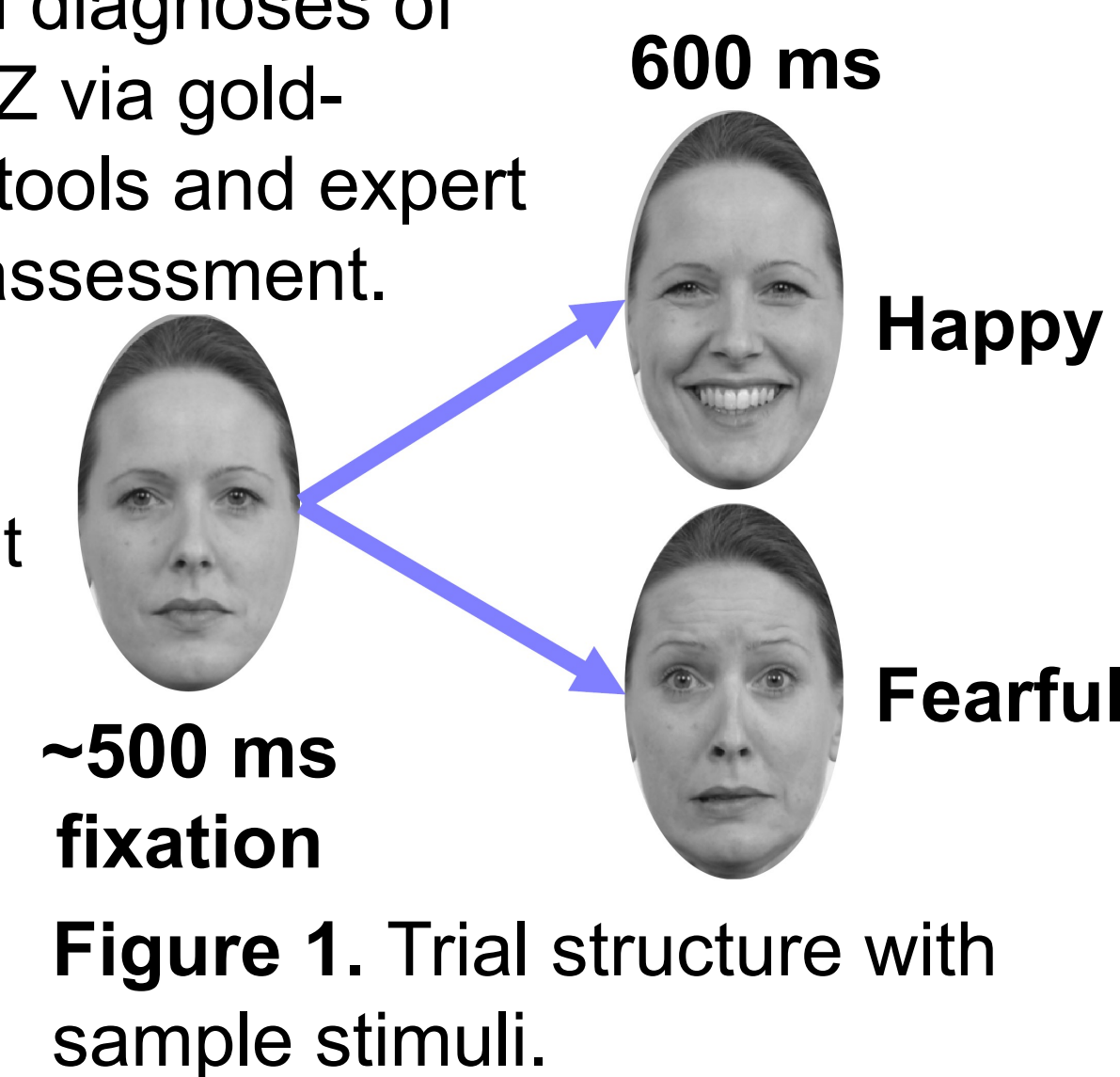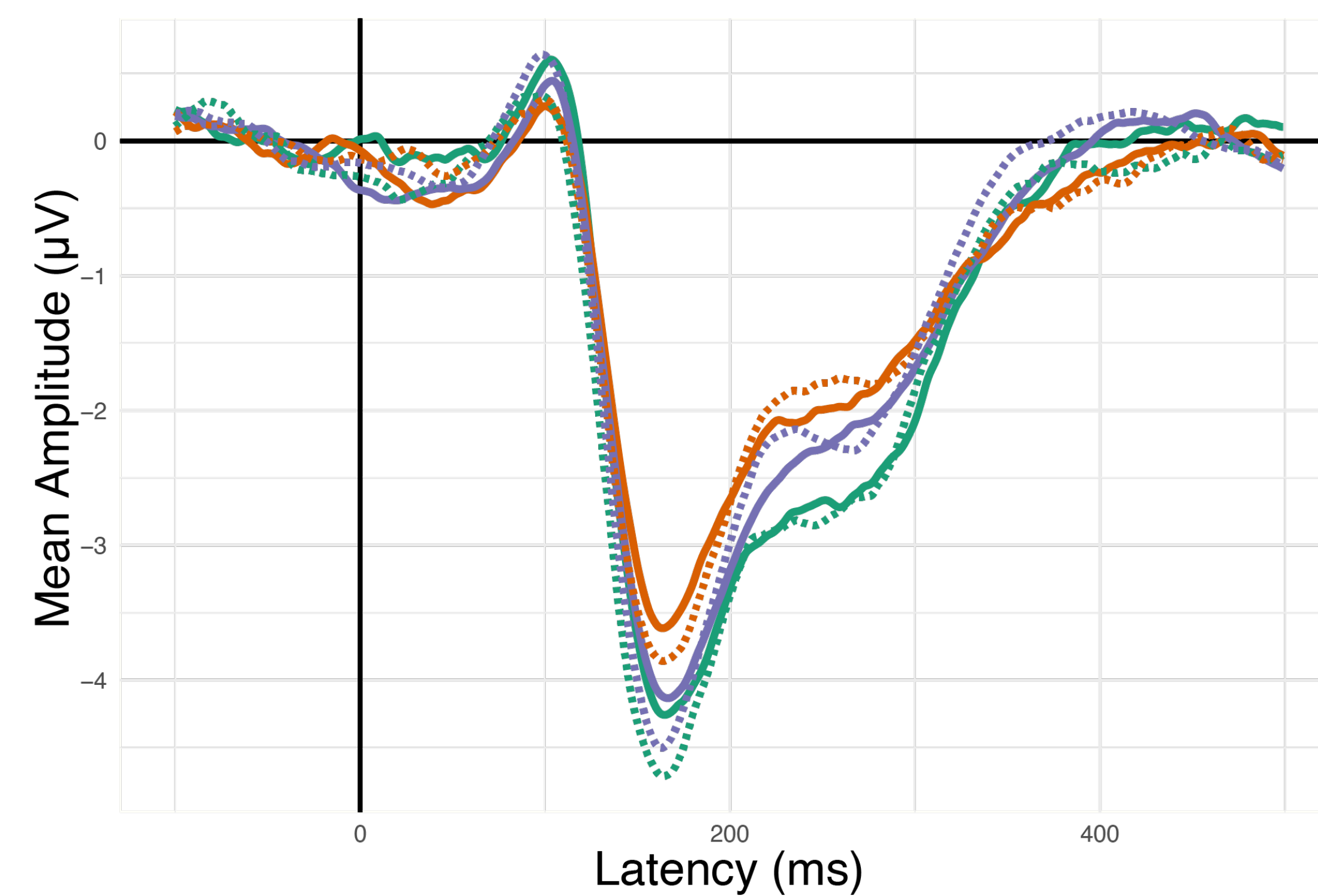
Results

Figure 3. Grand averaged N170 ERP waveforms in response to happy and fearful faces by diagnostic group.

Emotion: — fear · · · happy
Group: ASD, SZ, NC

Significant Main Effect of Diagnostic Group on N170 Amplitude
$[F_{(2, 83)}=3.64, p=0.03]$

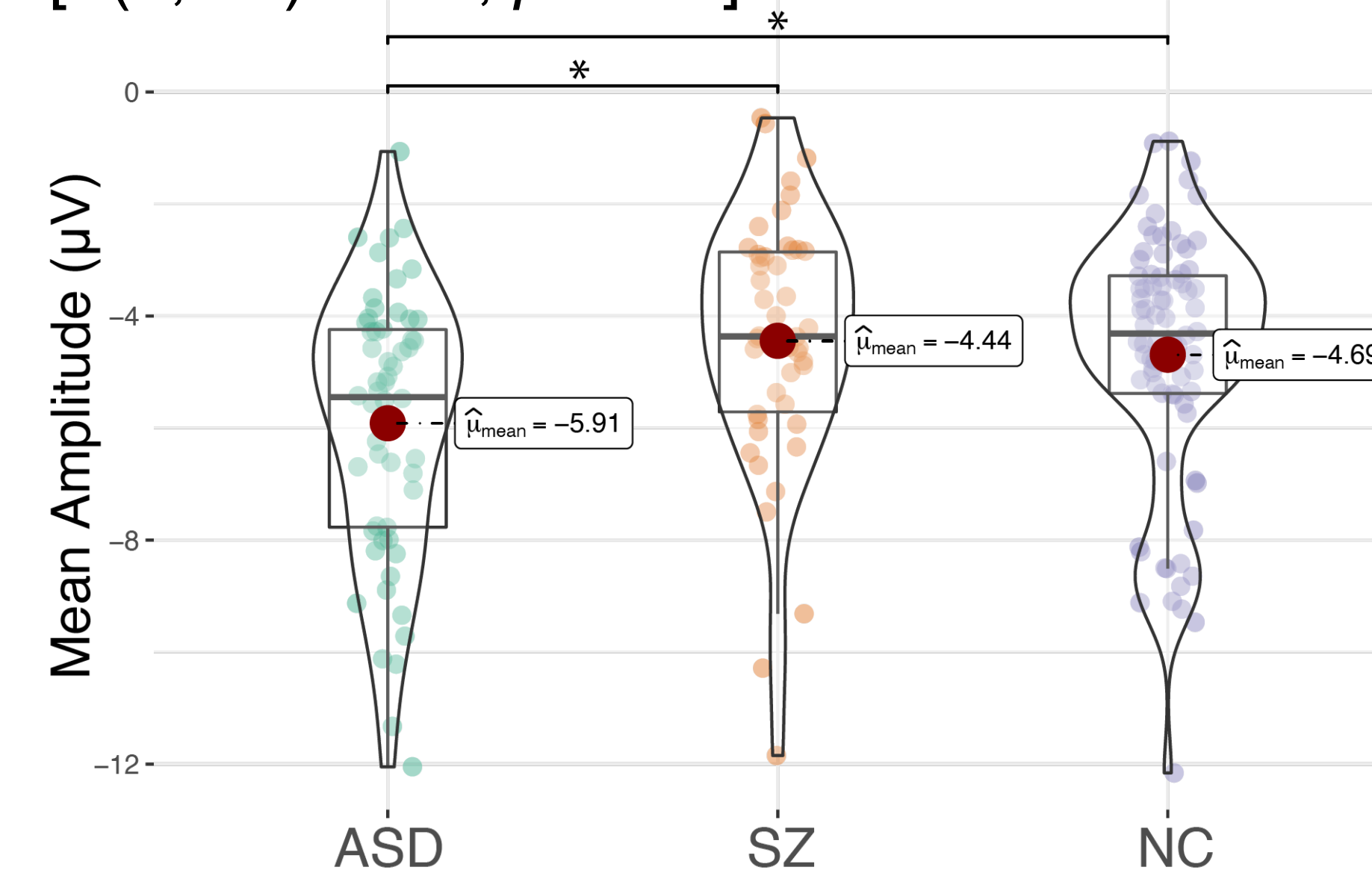$\hat{\mu}_{mean}=-5.91$ (ASD), $\hat{\mu}_{mean}=-4.44$ (SZ), $\hat{\mu}_{mean}=-4.69$ (NC)

Figure 4. ASD exhibited significantly greater N170 amplitude compared to SZ $[t(83)=-2.10, p=0.04]$ and NC $[t(83)=-1.98, p=0.05]$, which were not significantly different from each other. Groups did not differ with respect to N170 latency.
* = p<0.05

Significant Main Effect of Face Valence for N170
A) Amplitude $[F_{(1, 83)}=7.80, p<0.01]$ **and B) Latency** $[F_{(1, 83)}=19.74, p<0.001]$

$\hat{\mu}_{mean}=-4.82$, $\hat{\mu}_{mean}=-5.21$

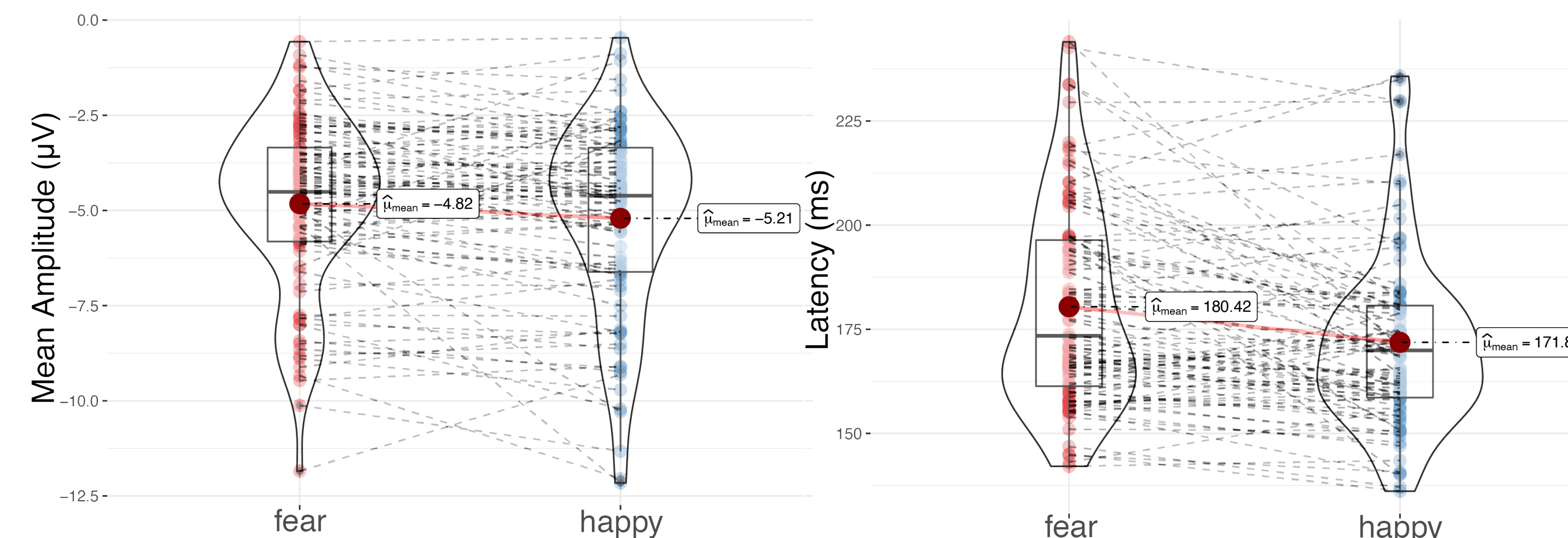**Figure 5a.** Overall, greater amplitude was observed for happy (M=-5.21μV) compared to fearful (M=-4.82μV) faces [difference=0.39μV, $t(83)=4.40$, $p<0.001$].

$\hat{\mu}_{mean}=180.42$, $\hat{\mu}_{mean}=171.87$

Figure 5b. Overall, faster latencies were observed in response to happy faces (M=171.87ms) compared to fearful faces (M=180.42) [difference=8.55*ms*, $t(83)=4.17$, $p<0.01$].

Results

Significant Group x Emotion x Visual Attention interaction
$[F_{(2, 83)}=8.57, p<0.001]$

Fearful Faces — Happy Faces
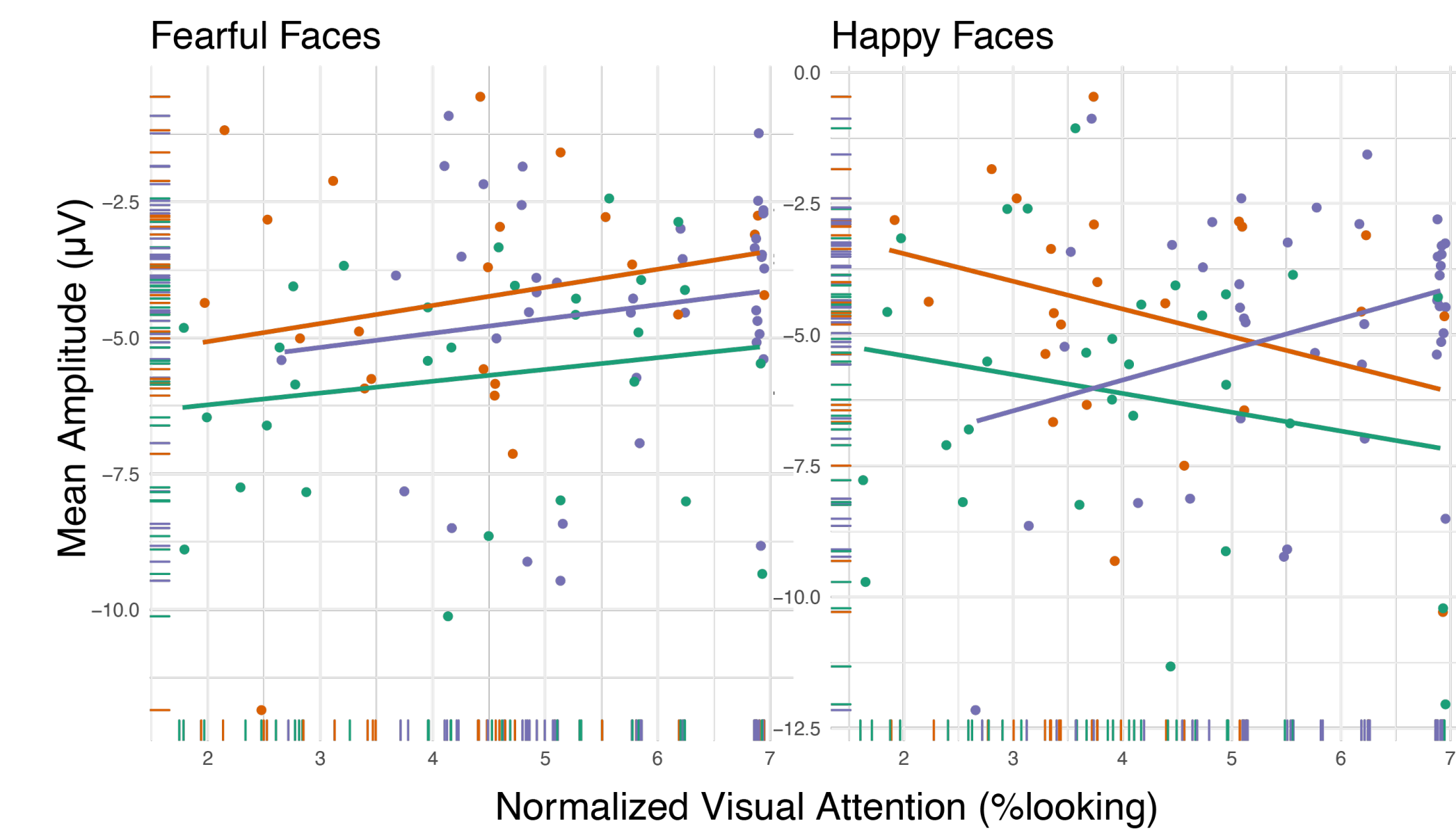*Group:* ASD, SZ, NC
Normalized Visual Attention (%looking)

Figure 6. For happy faces, there was a positive association between visual attention (%looking) and amplitude in NC that was not evident in ASD and SZ. For fearful faces, more visual attention was positively associated with N170 amplitude across all groups.

Conclusions

- Though prior work has primarily indicated delayed N170 latency in ASD and attenuated N170 amplitude in SZ compared to NC controls, the only significant between-group difference was found for N170 amplitude (ASD > NC, SZ). This may reflect the idiosyncratic nature of the gaze-contingent paradigm.
- Greater amplitude and faster latency in response to happy faces demonstrates differences in neural response to faces based on emotion valence.
- The significant Group x Emotion x Visual Attention demonstrates the importance of considering both face valence and %looking to the face to understand between-group differences in N170 amplitude:
  - A positive relation between visual attention and N170 amplitude was only seen for NC participants in response to happy faces, suggesting shared differences in early perceptual processing of particularly *prosocial* information in ASD and SZ that may underly reduced social approach and/or downstream social difficulties.
- Future work may examine how individual differences in symptom presentation (e.g., social communication, restricted interests/repetitive behaviors, cognitive-perceptual symptoms) further moderate neural response to social information (e.g., faces with varying emotions, social scenes).

References

1. Kang, E., Keifer, C. M., Levy, E. J., Foss-Feig, J. H., McPartland, J. C., & Lerner, M. D. (2018). Atypicality of the N170 event-related potential in autism spectrum disorder: a meta-analysis. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, 3(8), 657-666.
2. McCleery, A., Lee, J., Joshi, A., Wynn, J. K., Hellemann, G. S., & Green, M. F. (2015). Meta-analysis of face processing event-related potentials in schizophrenia. *Biological psychiatry*, 77(2), 116-126.
3. Schindler, S., & Bublatzky, F. (2020). Attention and emotion: An integrative review of emotional face processing as a function of attention. *Cortex*, 130, 362-386.

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