Effect Of Eye Contact And Anxiety Symptoms On ERPs In Autism Spectrum Disorder And Schizophrenia

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Introduction

- Individuals with ASD often have high levels of comorbid anxiety. The neural correlates of this anxiety are not well understood.
- The P100 component, which is associated with early sensory processing, and the N170 component, which is typically stronger during facial processing, are atypical in response to social stimuli in ASD.
- We examined brain response to faces in an interactive social context and compared it to anxiety symptoms in participants with ASD and schizophrenia, which is also associated with social impairment and anxiety.

Method

Participants were adults who were either typically developing (TD) or had a diagnosis of autism spectrum disorder (ASD) or schizophrenia (SZ). Participants completed the Beck Anxiety Inventory (BAI), a self-report measure of anxiety symptoms.

Sample Characteristics

DX	Age	IQ	BAI Total	N
ASD	23.90 (5.9)	102.3 (13.0)	13.5 (11.0)	12 (8 male)
TD	26.70 (6.0)	97.1 (7.0)	1.3 (2.1)	23 (13 male)
SZ	23.69 (2.8)	113.3 (15.9)	4.3 (4.5)	8 (8 male)

EEG and ET Data Acquisition and Collection
- EEG was recorded at 1000 Hz with a 128-channel Hydrocel Geodesic Sensor net.
- ET data was collected using an Eyelink-1000 remote camera system.

Trial Structure
- Participants were cued to look at the eyes or mouth of a subsequently appearing face.
- In response to participant gaze, the mouth or eyes of the face opened (Figure 1). The eye contact condition occurred when the participant fixated on the eyes and the eyes opened. The mouth condition occurred when the participant fixated on the mouth and the mouth opened.
- Data were filtered from 0.1-100 Hz, referenced to average reference, segmented from -100-275ms relative to shift in stimulus gaze, baseline corrected, and artifact detected. Trials were excluded if they contained eye movement exceeding .75° of visual angle.
- P100 (80-130ms) and N170 (130-250ms) were extracted from occipitotemporal electrodes (Figure 2).

Analysis
- ANOVAs were run with ERP component as dependent and diagnosis and condition as independent variables.
- Correlations were run between ERP components and BAI Total.
- Difference scores were calculated for P100 and N170 amplitude by subtracting Mouth from Eye Contact amplitude.
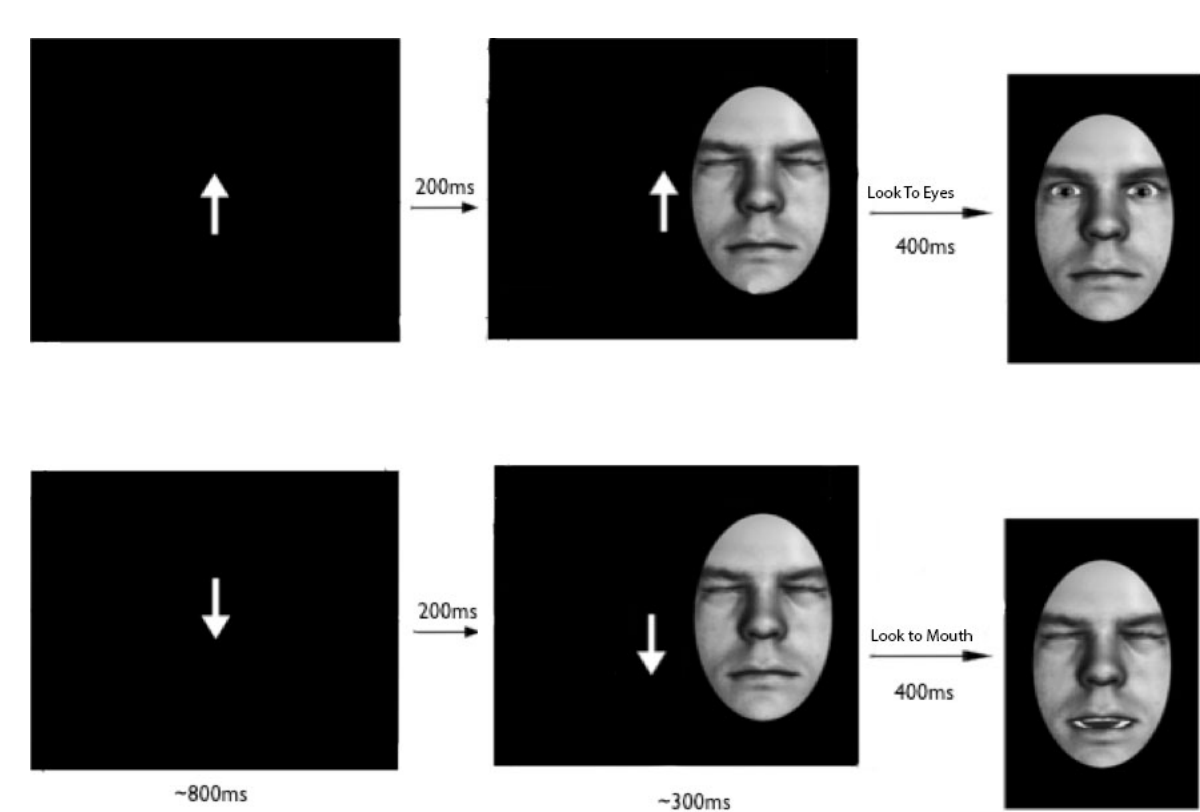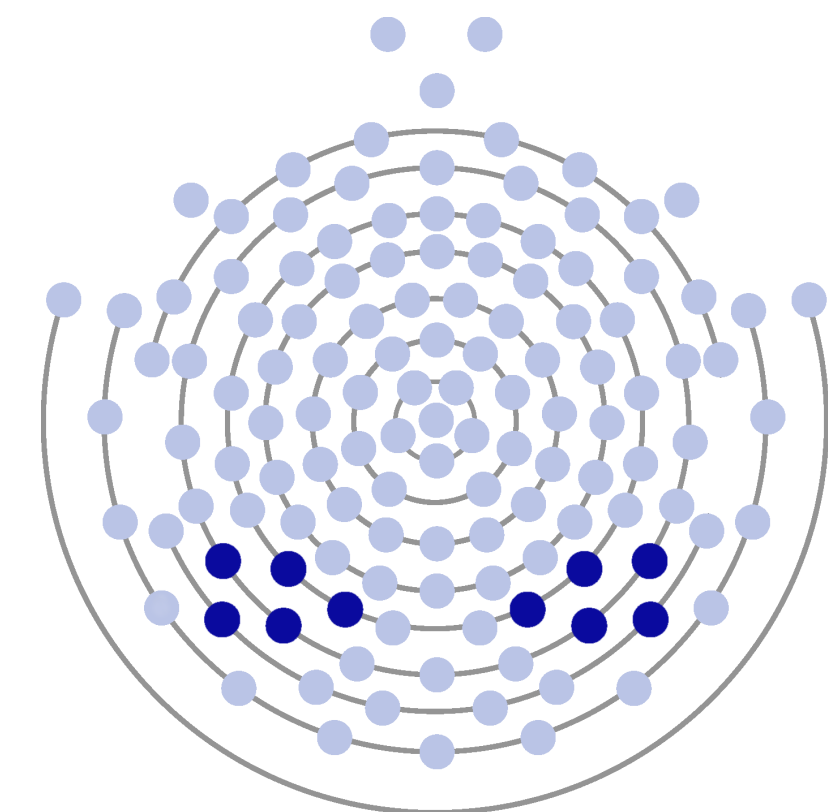
Figure 1. Trial structure

Figure 2. Electrodes for analysis

Results

Waveforms

There were significant main effects of condition in both hemispheres, but no significant main effect or interactions involving diagnosis.
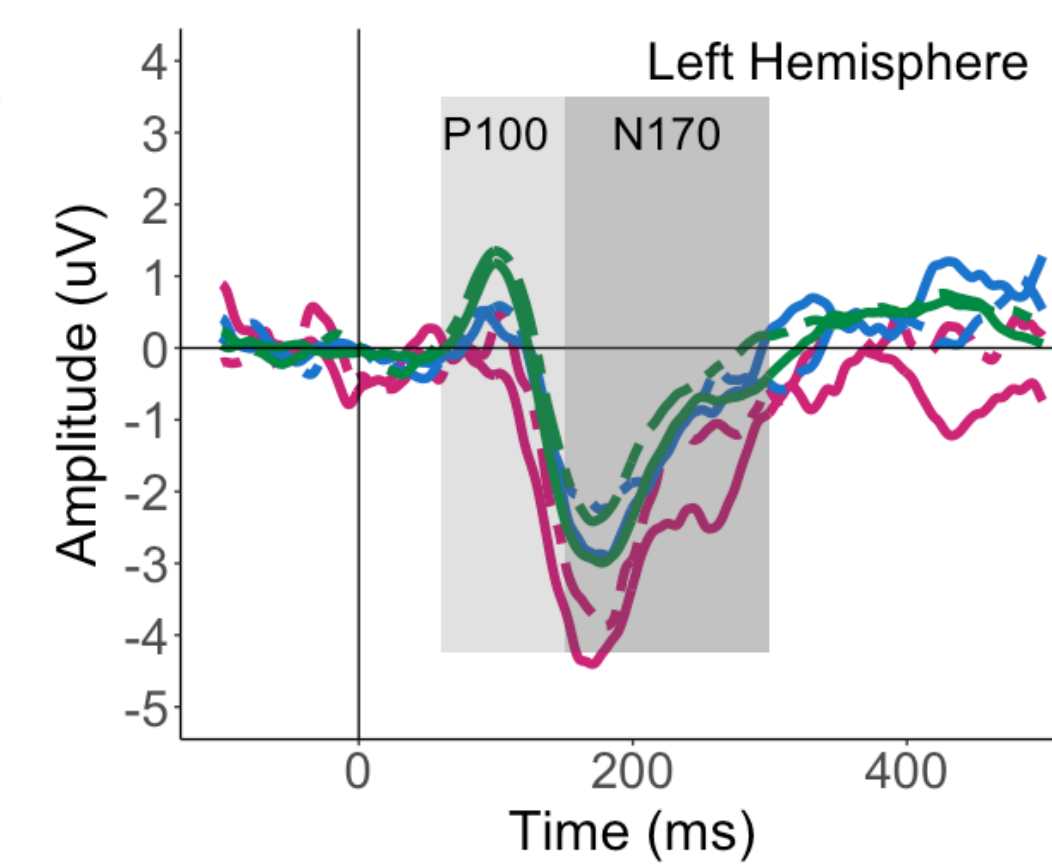
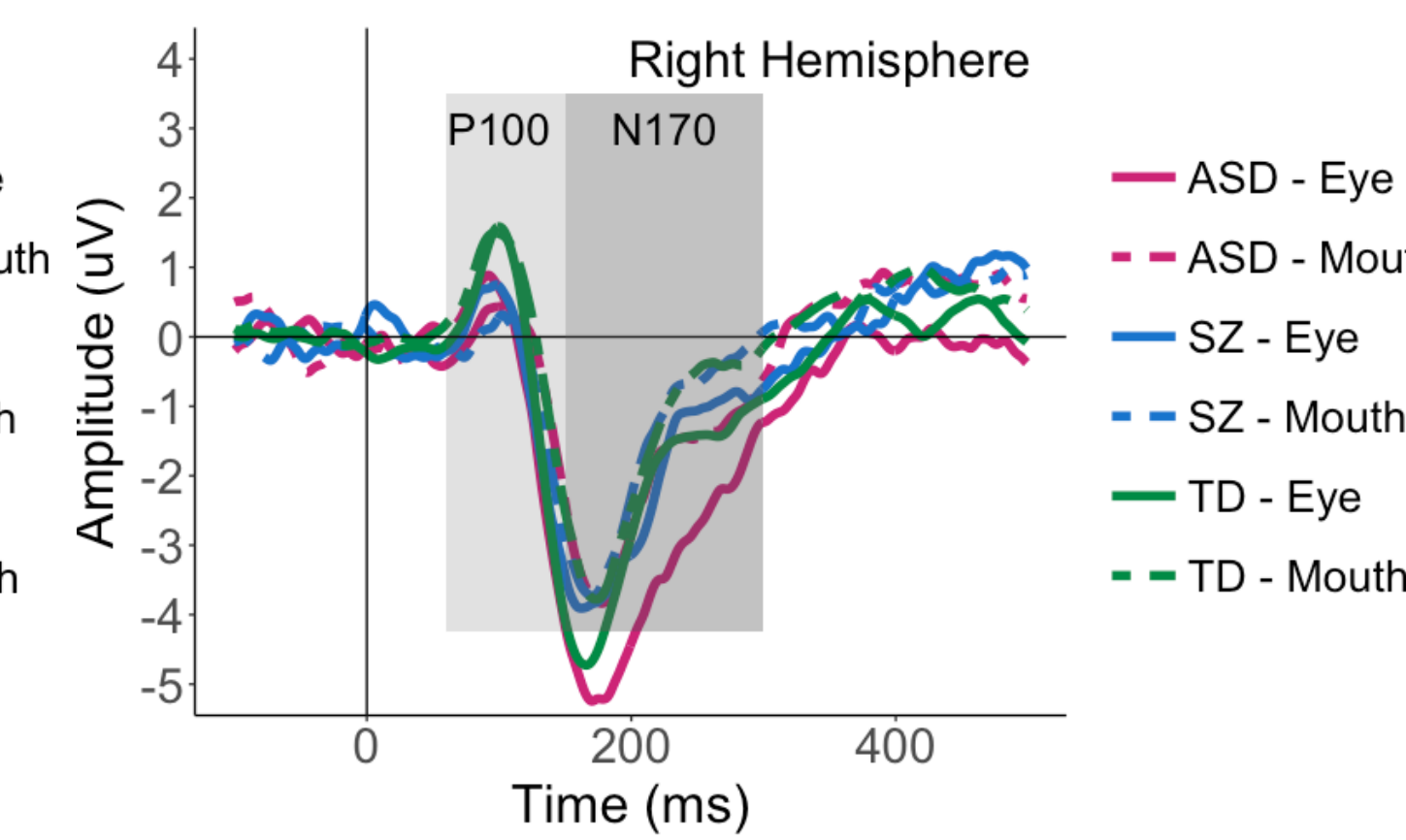**Figure 3**. Grand average waveforms by condition and diagnosis in the left hemisphere.

Figure 4. Grand average waveforms by condition and diagnosis in the right hemisphere.
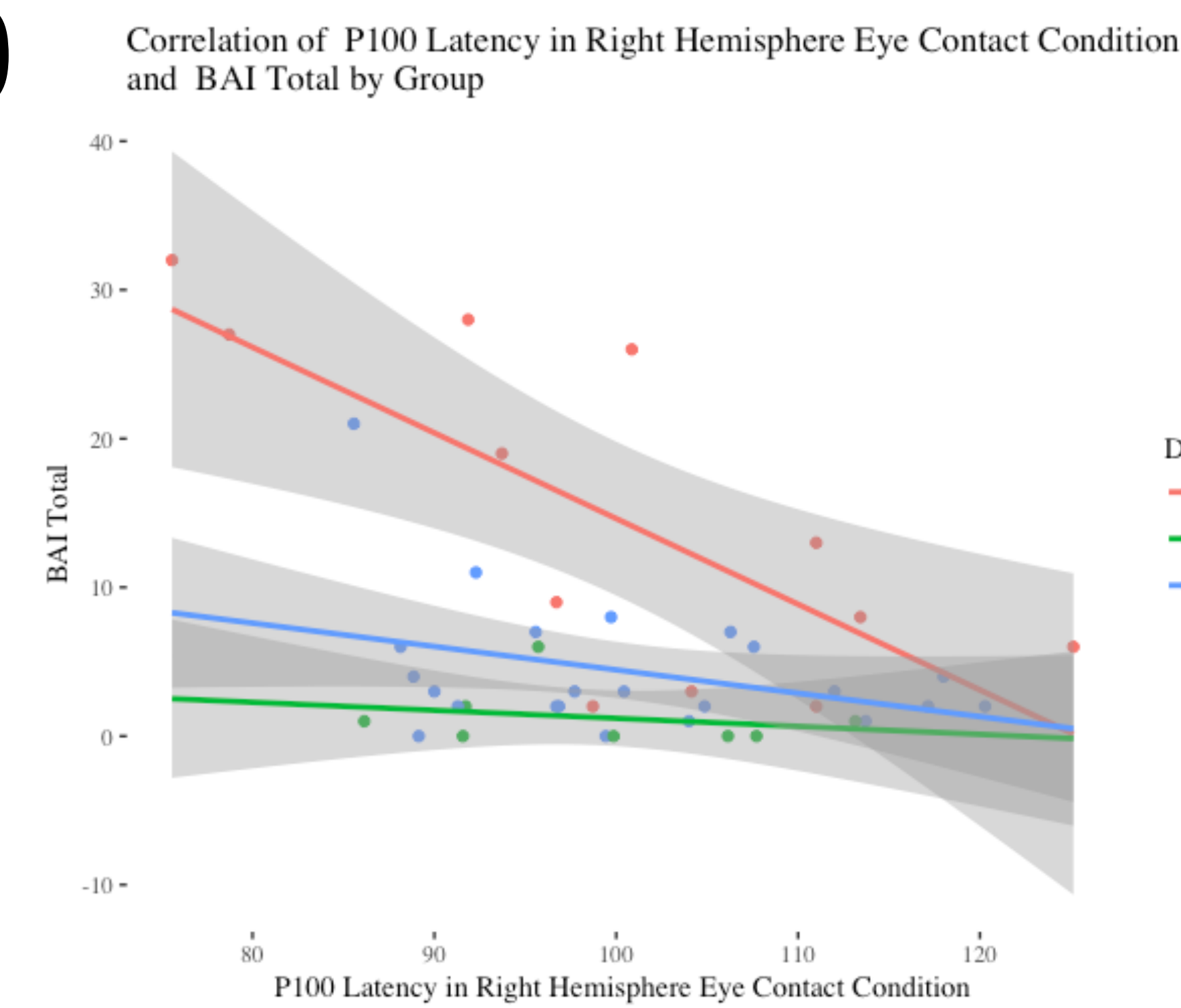
P100

Figure 5. Shorter P100 latency to Eye Contact in the right hemisphere was associated with greater levels of anxiety in the ASD group [$r(11)=-0.73$, $p=0.007$]. Correlations in SZ and TD groups were not significant.
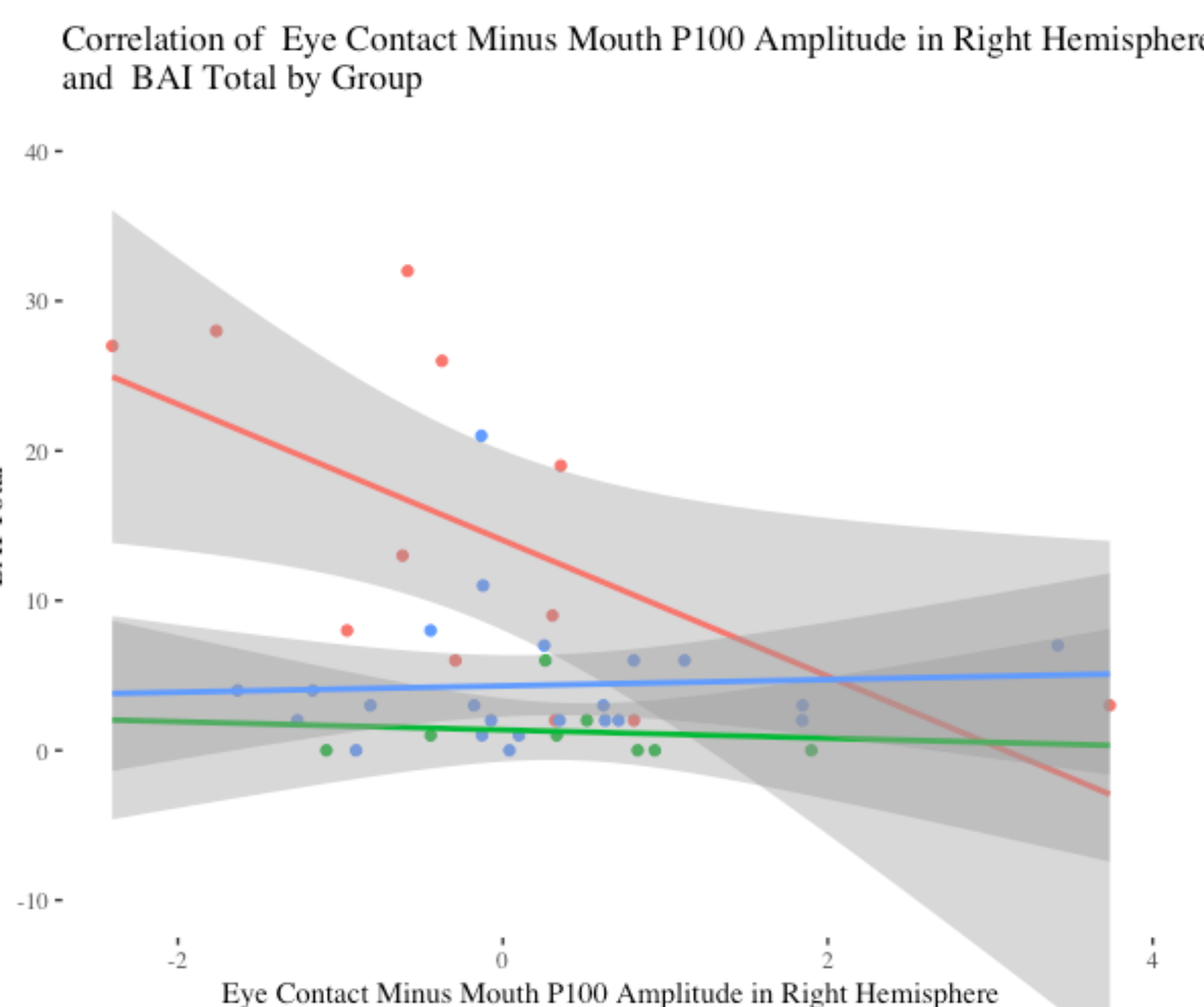
Figure 6. In the ASD group, lower anxiety was associated with larger P100 amplitude to Eye Contact relative to Mouth [$r(11)=-0.62$, $p=0.033$]. Correlations in SZ and TD groups were not significant.
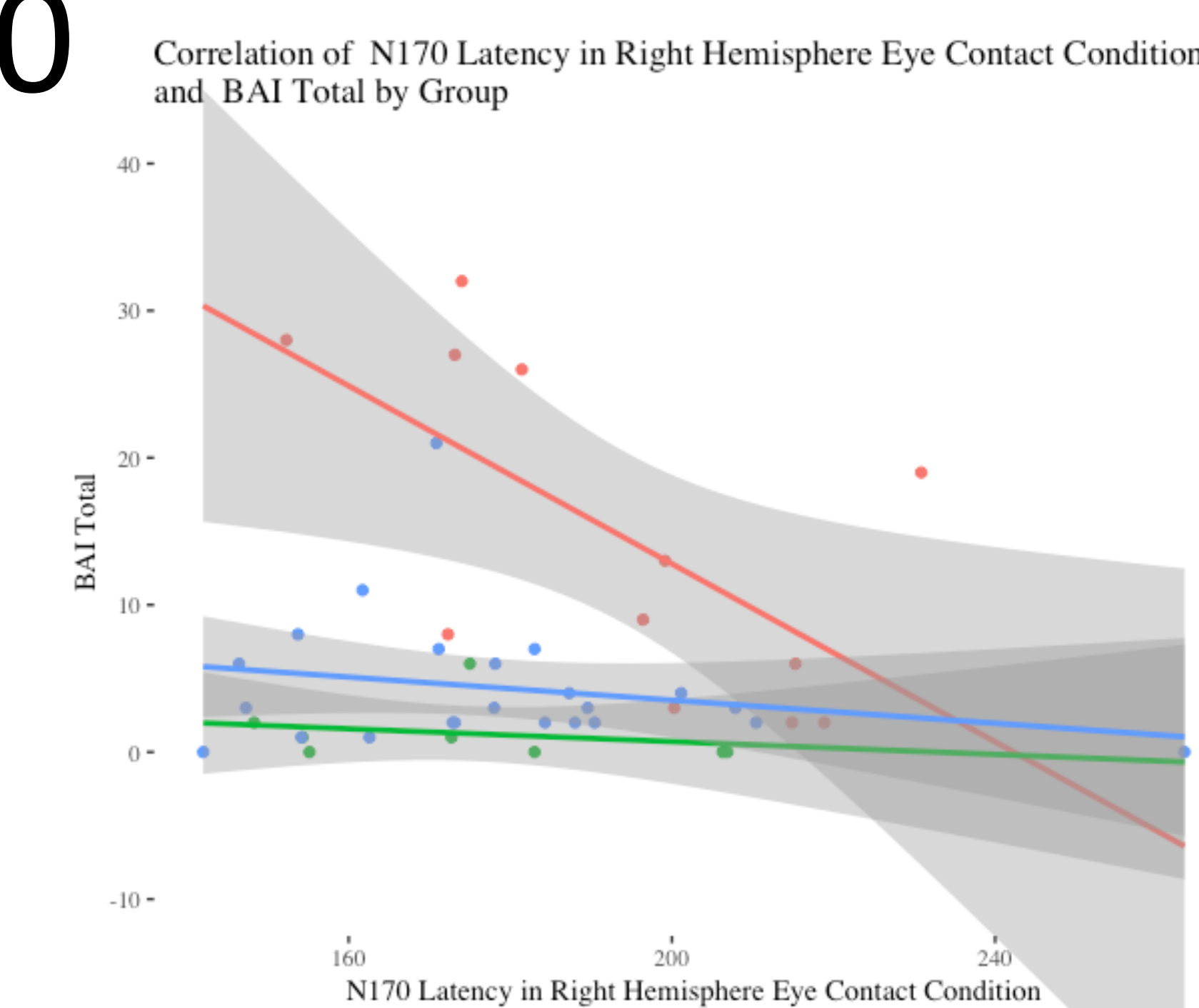
N170

Figure 7. Shorter N170 latency to Eye Contact in the right hemisphere was associated with greater anxiety in the ASD group [$r(11)=-0.64$, $p=0.026$]. Correlations in SZ and TD groups were not significant.
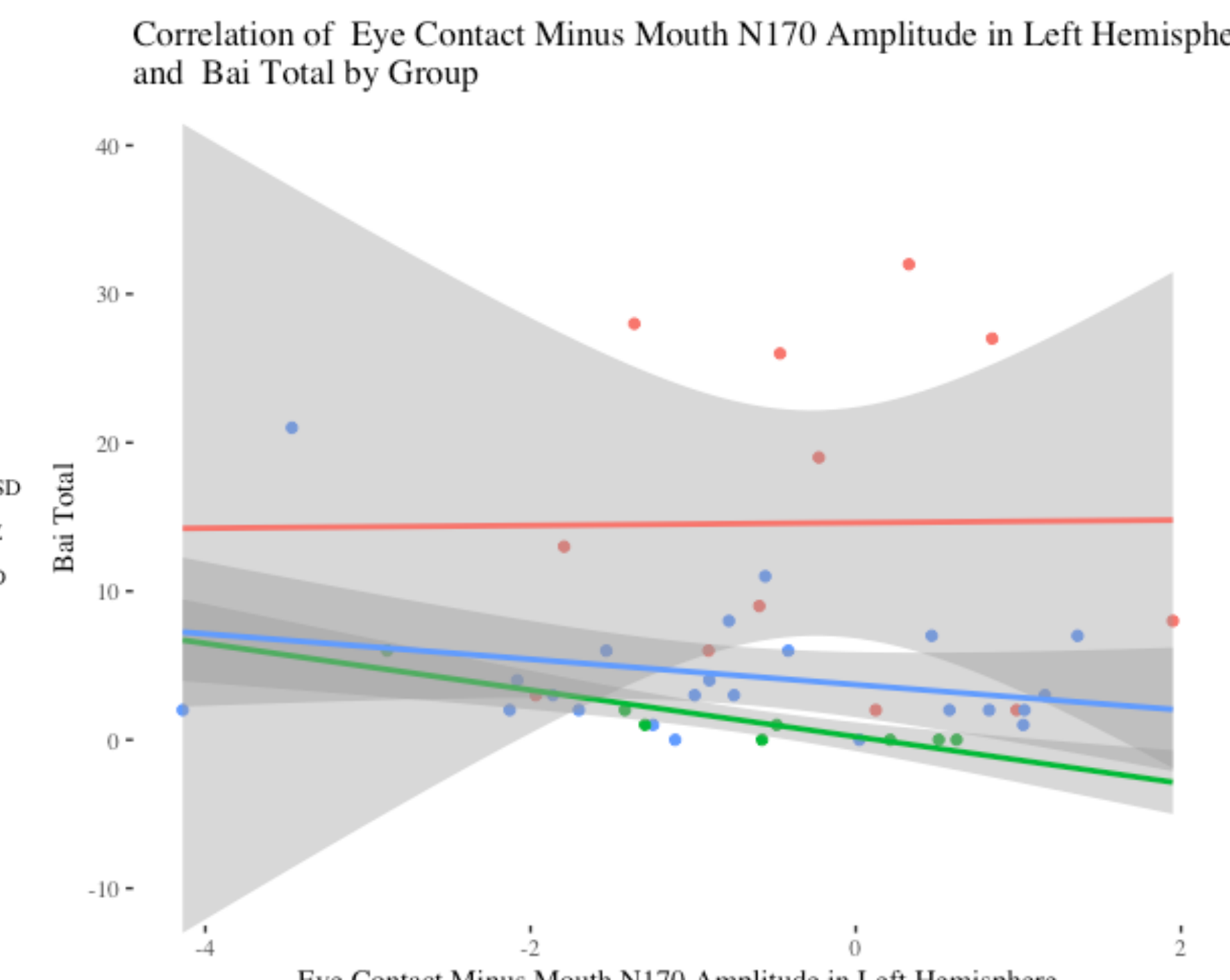
Figure 8. In the SZ group, greater anxiety was associated with a larger N170 amplitude to Eye contact relative to Mouths in the left hemisphere [$r(6)=-0.90$, $p=0.002$]. Correlations in the ASD and TD groups were not significant.

Conclusions

- Symptoms of anxiety modulate the P100 in ASD and the N170 in ASD and SZ.

- Greater anxiety was related to faster P100 and N170 in the right hemisphere in the ASD group only in the Eye Contact condition but not in the Mouth condition.

- This suggests that individuals with ASD and comorbid anxiety process reciprocal social gaze differently than individuals with other social impairments or individuals with ASD and no anxiety.

- Greater anxiety in the ASD group was also associated with differences between P100 amplitudes in the Eye Contact and Mouth conditions. Those with stronger anxiety had a more negative Eye Contact minus Mouth score. This indicates that individuals with ASD and greater anxiety may be more sensitive to the mouth than the eyes in social gaze.

- There was a significant correlation between difference in N170 amplitude between Eye Contact and Mouth conditions and anxiety in the SZ group. Differences were more negative in those with high anxiety, suggesting that individuals with SZ and elevated anxiety may be more sensitive to the eyes during social gaze.

- These results suggest that anxiety modulates the processing of social information differently in SZ and ASD. Those with high levels of anxiety may represent distinct subgroups in these populations.

Acknowledgments

References

1. van Steensel, F. J., Bögels, S. M., & Perrin, S. (2011). Anxiety disorders in children and adolescents with autistic spectrum disorders: a meta-analysis. Clinical Child and Family Psychology Review, 14(3), 302.

2. White, S. W., Schry, A. R., & Maddox, B.B. (2012). Brief report: The assessment of anxiety in high-functioning adolescents with autism spectrum disorder. Journal of Autism and Developmental Disorders, 42(6), 1138-1145.

3. Tibbo, P., Swainson, J., Chue, P., & Lemelledo, J. (2003). Prevalence and relationship to delusions and hallucinations of anxiety disorders in schizophrenia. Depression and Anxiety,17(2), 65-72. doi:10.1002/da.10083

4. Naples, A. J., Wu, J., Mayes, L. C., & McPartland, J. C. (2017). Event-Related Potentials Index Neural Response to Eye Contact. Biological Psychology.

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