# Sex Differences in Response to Emotional Faces in Children with ASD

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## Background

- Females with autism spectrum disorder (ASD) exhibit more social motivation and have a greater tendency to mimic peers in social interactions than males with ASD[1,2].
- The differences in neural activity that underpin observed sex differences in social function are poorly understood[3,4].
- The N170 is an event-related potential (ERP) observed ~170 ms after a face is presented. It reflects the structural encoding of faces and may index emotional facial information.
- Prior work indicates that females with ASD show decreased N170 amplitude in response to static, neutral faces[3].
- Sex differences in neural response to dynamic, emotional faces have not been assessed.

**Objective:**

- To characterize the relationship between sex and N170 response to dynamic, emotional faces in children with ASD and typically developing (TD) children.

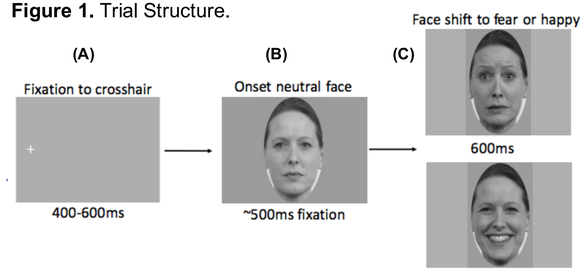
## Method

**Participants**

| | n | Age (SD) | Full Scale IQ (SD) |
|---|---|---|---|
| ASD males | 24 | 13.94 (2.66) | 105.95 (21.07) |
| ASD females | 6 | 13.13 (3.63) | 113.4 (19.14) |
| TD males | 14 | 13.48 (2.98) | 108.64 (13.28) |
| TD females | 10 | 11.92 (2.78) | 111.30 (8.23) |

All groups were matched on age and full-scale IQ, $p < .05$

**Figure 1.** Trial Structure.




Participants were presented with 80 distinct photographs of faces matched for low-level visual features. Trials began with a counterbalanced fixation crosshair at the left or right side of the screen for 400- 600ms **(A)**, followed by a centrally presented neutral face **(B)**. After the participant directly fixated on the eyes of the neutral face for ~500ms, the face shifted to the fear or happy condition for 600ms **(C)**. A 500ms blank screen separated each trial.

## Method

**EEG and ET Data Acquisition and Collection:**

- EEG recorded at 1000Hz with 128 channel Geodesic Sensor Net.
- ET data collected using an SR Eyelink-1000 remote camera.

**ERP Processing:**

- Data were filtered from 0.1-30Hz, re-referenced to the average reference, segmented from -100 to 500ms relative to shift in stimulus expression, baseline corrected, and artifact detected.
- ERP components were extracted from occipitotemporal electrodes (Figure 2).
- Difference scores were calculated as fear minus happy condition.

**Figure 2.** Left and right occipitotemporal electrodes.

**Clinical Measures:**

- The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) and the Autism Diagnostic Interview-Revised (ADI-R) were administered by research-reliable clinicians with expertise in ASD.
- The Differential Abilities Scale, Second Edition (DAS-II) was used to assess cognitive functioning.

**Statistical Analyses:**

- Participants with fewer than 10 valid trials per condition were excluded from analysis.
- A two-way ANOVA was performed for each hemisphere to detect any significant main effect of sex or diagnosis or interaction between the two. Post-hoc independent samples T-tests were performed with Bonferroni correction.

## Results

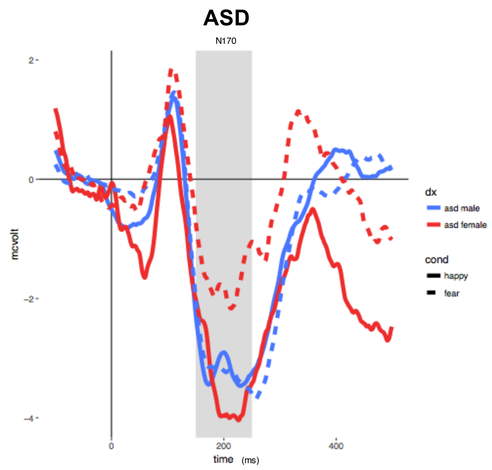



**Figure 3.** Differential N170 amplitudes in males vs. females with ASD in the left hemisphere

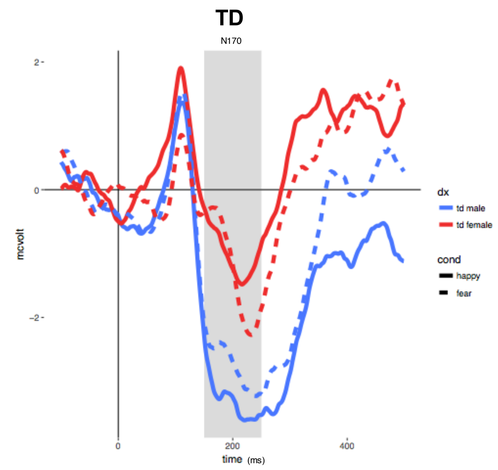



**Figure 4.** Differential N170 amplitudes males vs. females with TD in the left hemisphere

- A two-way ANOVA indicated a significant interaction between diagnosis and sex, $F(1, 63) = 5.57$, $p = .022$, $\eta^2 = 0.10$, with a medium effect size, on N170 amplitude difference in the left hemisphere.
- Females with ASD showed a greater differential N170 amplitude to fear vs. happy in the left hemisphere ($M = 2.37$, $SD = 3.58$) than males with ASD ($M = -.41$, $SD = 1.91$), $t(28) = -2.66$, $p = .013$.
- There was no significant difference between typically developing females and typically developing males in differential N170 amplitude to fear vs. happy.
- There were no significant differences in N170 amplitude in the right hemisphere between groups.

## Conclusions

- Females with ASD showed a larger response to fearful relative to happy faces than males with ASD, but no sex differences were found in typically developing individuals' response to emotional faces.
- It is notable that sex differences were only observed in the left hemisphere, given that the N170 is lateralized and traditionally most prominent in the right hemisphere.
- These results may reflect sex differences in social motivation and behavior that are observed in children with ASD but not typically developing children.
- Sex differences in neural activity when viewing emotionally salient stimuli may help in identifying new, specific therapeutic targets for individuals with autism of both sexes.
- One of the current study's limitations is its small sample size, particularly of females with ASD.
- Future studies should:
  - Confirm these results in a larger sample of participants.
  - Explore associations between sex differences in neural response to emotionally salient stimuli and factors such as ADOS calibrated severity and social affect scores.

**References**

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