Conscious and Nonconscious Emotional Processing and Level of Autistic Traits

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BACKGROUND

- Autism spectrum disorder (ASD) is a neurodevelopmental disorder involving a wide range of socio-emotional difficulties.
- Emotional processing is affected in ASD, and aberrant neural activity in response to emotional faces has been observed (Dawson et al., 2005).
- When viewing faces, individuals with ASD showed decreased neural efficiency (McPartland et al., 2004).
- Previous studies of face processing in ASD have largely utilized consciously presented stimuli that are likely processed through central areas (e.g., frontal face area).
- Studies on the neural basis of non-conscious (e.g., stimuli presented too quickly to be consciously perceived) processing suggest that, even without conscious awareness of stimuli, emotion processing in brain areas are activated (Morris et al., 1998).
- Emotional faces presented too briefly to enter conscious awareness are thought to be processed by the amygdala and related limbic structures through a direct pathway from the thalamus (Morris et al., 1998).
- Few studies have explored non-conscious emotion processing in ASD.
- Investigating non-conscious emotion processing in ASD can provide important information about whether subcortical face processing differentiates individuals with ASD compared to their TD peers (similar to cortical face processing).
- In the present study, emotion processing in ASD can provide important information about whether subcortical face processing differentiates individuals with ASD compared to their TD peers (similar to cortical face processing).
- Stimulus processing exists on a continuum spanning both typical and atypical development.
- The present study investigated three event-related potential (ERP) components. The P100 is thought to index low-level face processing of faces as a function of level of autistic traits.
- The Autism Quotient (AQ) (Baron-Cohen et al., 2001) and stimulus salience.
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METHODS

Present Study

- The present study investigated three event-related potential (ERP) components. The P100 is thought to index low-level face processing of faces as a function of level of autistic traits.
- The Autism Quotient (AQ) (Baron-Cohen et al., 2001) and stimulus salience.

Participants

- 25 typically developing (TD) right-handed adults (Age: M = 22.68 yrs, SD = 1.67; Sex: 13 females)
- 50 item forced choice self-report
- Participants divided into two groups (high/AQ score) based on median split

Statistical Analysis

- **Data Acquisition and Extraction**
  - 360 trials in six conditions (fearful/conscious, fearful/conscious, neutral/conscious, neutral/conscious, sad/conscious, and sad conscious).
  - EEG recorded continuously at 512 Hz using 128-channel Hydrogel Geodesic Sensor Net.
  - ERPs segmented to 100 ms pre-stimulus baseline, 600 ms post-stimulus, and average referenced.
  - Peak amplitude and latency for the P100 and N170 were extracted from occipitotemporal sites over right and left hemispheres. Peak amplitude and latency for the P300 were extracted from central-parietal electrode sites.

- **P100 and N170**
  - 2 within-subjects factors
  - Emotion (fearful/conscious)
  - Stimulus Type (conscious/nonconscious)
  - Hemisphere (left/right)
  - 1 between-subjects factor
  - AQ score (high/low, calculated with median split)

- **P300**
  - 2 within-subjects factors
  - Emotion (fearful/conscious/unconscious)
  - Stimulus Type (conscious/nonconscious)
  - 1 between-subjects factor
  - AQ score (high/low)

- **ERP Results:**
  - **P100 Amplitude:**
    - Grand averaged waveforms of the P100 and N170 components for individuals with high and low AQ scores are shown in Figure 1.
  - Main effect of Stimulus type, F(2,22) = 4.19, p = .019 such that nonconsciously presented faces elicited larger P100s vs. consciously presented faces.
  - Significant Emotion * Hemisphere interaction, F(2,22) = 4.73, p = .019 such that the P100 was larger for fearful faces in the right vs. left hemisphere (p = .031).
  - Significance of Stimulus type * Hemispheric “A” score interaction, F(2,22) = 5.95, p = .006.
    - In individuals with low AQ scores, larger P100s in the right hemisphere to nonconsciously presented vs. consciously presented fearful faces (p = .006).
    - Individuals with low AQ scores, larger P100s elicited in the left hemisphere to nonconsciously presented neutral faces vs. consciously presented neutral faces (p = .007).
    - In individuals with high AQ scores, larger P100s elicited in the right hemisphere for nonconsciously presented neutral faces vs. consciously presented neutral faces (p = .015).
  - **P100: Latency**
    - Significant effect of AQ score, F(2,22) = 6.28, p = .02 such that individuals with high AQ scores had longer P100 latency than those with low AQ scores.
  - **N170: Amplitude**
    - No significant main effects or interactions (all p’s > .1).
  - **N170: Latency**
    - Significant interaction between Emotion * AQ score, F(2,22) = 4.81, p = .018.
    - Pairwise comparisons revealed that individuals with low AQ scores had significantly faster N170s versus those with high AQ scores to neutral faces (p = .002) and marginally faster N170s to fearful faces (p = .07). No differences between groups were present for sad faces.
    - Individuals with high AQ scores had significantly faster N170s to sad faces vs. neutral faces (p = .001) and fearful (p = .052) faces, whereas individuals with low AQ scores did not have significant differences in latency between emotion types (Figure 4).
    - Marginally significant effect of AQ score, F(2,22) = 3.64, p = .046 such that individuals with low AQ scores had faster N170 latency vs. those with high AQ scores.
  - **P300 Amplitude**
    - Main effect of Stimulus type, F(1,23) = 7.80, p = .01 such that nonconsciously presented faces elicited larger P300 vs. consciously presented faces.
  - **P300: Latency**
    - Emotion * AQ score interaction, F(2,22) = 3.60, p = .044.
    - Pairwise comparisons revealed individuals with high AQ scores had marginally longer P300 latency to neutral faces vs. those with low AQ scores (p = .096, Figure 5).

CONCLUSIONS

- Increased latency to facial processing in individuals with high levels of autistic traits is consistent with previous findings in individuals with ASD (O’Connor et al., 2005; McPartland et al., 2004).
- Individuals with high levels of autistic traits evidence inefficient face processing (as indexed by P100 and N170 latency).

IMPLICATIONS

- The current study suggests that inefficient face processing is not only present in individuals with ASD but is also observed in TD individuals with high levels of autistic traits.
- Like the ASD phenotype, face processing is highly heterogeneous, and efficiency of face processing exists on a continuum spanning both typical and atypical development.
- Future studies should examine levels of autistic traits in control groups to understand relationships among subthreshold autistic symptomatology and the neural substrates of social perception.

REFERENCES


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