Method

Behavioral Measures
• Woodcock-Johnson Tests of Achievement-III
  • Letter-Word Identification: Single word reading
  • Word Attack: Novel word decoding

Vineland Adaptive Behavior Scales, Communication subscale
• Expressive, receptive, and written communication behaviors
• Benton Facial Recognition Test
• Verbal component of IQ

Study Design
• Two blocks of stimuli presented in a counterbalanced and pseudo random order, with 92 stimuli from each category
  • Block 1: faces, houses, and invented houses (not included in current analysis)
  • Block 2: Roman letters and pseudoleters
  • Trial: Crouchair (250-750 ms) \rightarrow [500 ms] Stimulus (500 ms)

Statistical Analyses
• Repeated measures ANOVA for N170 amplitude in the left hemisphere with condition as within-subjects factor (letter vs. pseudoleter)
  • Bivariate correlations between Vineland Communication and difference scores for left N170 amplitude in letter and pseudoleter conditions

Results

Within-ASD Difference in Adaptive Communication
• Individuals with lower Vineland Communication scores exhibited a main effect for condition, F(1, 9) = 8.74, p < .05, such that letters elicited a more negative N170 amplitude
  • Individuals with higher scores on the Vineland Communication subscale did not exhibit a main effect for condition, F(1, 10) = .484, p > .05, such that N170 amplitude did not differ between letter and pseudoleter conditions
  • Those findings indicate increased specialization for letters among individuals with ASD and lower communication skills relative to those with stronger communication skills

Conclusions
• Children with ASD demonstrate intact specialization for letters relative to pseudoleters. However, the ASD group’s differentiation for letters and pseudoleters in both hemispheres suggests recruitment of right hemisphere regions typically involved in face perception
  • Across groups, neural specialization for letters in relation to pseudoleters predicts greater communication skills in the areas of expressive, receptive, and written communication skills
  • Within the ASD group, greater specialization for letters was most pronounced in individuals with lower adaptive communication skills
  • The paradoxical relationship between specialization and adaptive communication in ASD suggests that, for some children, enhanced specialization may reflect circumscribed interest rather than functional ability (e.g., hyperlexia)
  • Further research is required to determine whether specialization among children with ASD and lower adaptive communication abilities reflects a functional strength or neural specialization driven by non-functional interest in letters

Future Directions
• Explore neural correlates of reading fluency and comprehension in children with ASD with hyperlexic traits and specialized interests relating to words and letters
• Investigate neural specialization for words in pseudoleters in addition to letters and pseudoleters, given that the visual properties are more similar to faces and entail holistic processing

REFERENCES

Method

Participants
• 36 children with ASD as determined byADOS and DSM IV-TR diagnosis
  • 18 children with typical development matched for sex, handedness, age, and IQ

Table 1. Participant Demographics

<table>
<thead>
<tr>
<th>Measure</th>
<th>ASD Group</th>
<th>TD Group</th>
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<tbody>
<tr>
<td>Number Male (%)</td>
<td>25 (83.3)</td>
<td>32 (86.9)</td>
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<tr>
<td>Number Right-Handed (%)</td>
<td>16 (88.9)</td>
<td>31 (86.1)</td>
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<tr>
<td>Number White (%)</td>
<td>15 (83.3)</td>
<td>34 (94.4)</td>
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<tr>
<td>Mean Age (SD)</td>
<td>12.6 (1.4)</td>
<td>11.2 (1.4)</td>
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<tr>
<td>Mean Full Scale IQ (SD)</td>
<td>112.9 (13.4)</td>
<td>102.5 (15.8)</td>
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ERP Data Acquisition
• ERPs recorded continuously at 250 Hz
• 256-electrode Geodesic sensor net
• Data averaged across eight electrodes over left (95, 96, 107, 108, 116, 117) and right (151, 152, 153, 160, 161, 162, 170, 171) lateral posterior scalp
• Extracted N170 peak amplitude

ERP Data Extraction
• Artifact detection and replacement of bad channels
• Segmentation window set at 100ms pre-stimulus onset to 500ms post-stimulus onset

Results

Figure 2. N170 amplitude indicates differentiation between letters and pseudoleters for the ASD group across both hemispheres, and for the TD group only in the left hemisphere

Results

Figure 3. Grand averaged waveforms for children with ASD demonstrate increased amplitude for letters in the left hemisphere

Figure 4. Grand averaged waveforms for children with ASD demonstrate increased amplitude for letters in the right hemisphere

Figure 5. N170 amplitude and Vineland Communication Scores

Figure 6. Correlations show that greater ERP difference scores for left N170 amplitude between letter and pseudoleter conditions predict higher Vineland Communication scores