Neural Sensitivity to Biological Motion versus Audio-visual Synchrony in Infants at Risk for Autism

Rachael Tillman, Max Rolison, Giulia Righi, Cora Mukerji, Adam Naples, Marika Coffman, Celine Cuevas, Jennifer Foss-Seig, Peter Hashim, & James McPartland

Yale Child Study Center, New Haven, CT

Neural Synchrony

Biological Motion Paradigm

- • Perceptual sensitivity to biological motion (BM) is critical to social function and evident in infants as young as 2 days old (Simion et al., 2008).
  - • Neural response to BM is marked by distinct event-related potentials (ERPs) and attenuation of EEG mu rhythm (5-9 Hz) in infants as young as 8 months.
  - • Behavioral studies reveal atypical BM perception by toddlerhood in autism spectrum disorder (ASD).

Audio-visual synchrony (AVS)

- • Detection of temporal contingency between auditory and visual events is also evident in infancy.
  - • Electrophysiological studies in typically developing adults and children reveal neural facilitation to audio-visual events, marked by greater response to audio-visual stimuli relative to the sum of auditory-alone and visual-alone events.

- • Toddlers with ASD display preferential attention to audio-visual synchrony (AVS) rather than the typical preference for biological motion (Klin et al., 2009).

Study Aims

- • To investigate the neural bases for observed hyposensitivity to BM and hypersensitivity to AVS in infants at high-risk (HR) for ASD.
- • To investigate neural specialization for BM in infants younger than 8 months.
- • Two experiments assessed electrophysiological brain responses to BM, scrambled motion (SM), and AVS in infants at elevated risk for ASD in the first year of life.

- • We predicted that, relative to normal risk (NR) infants, HR infants would display:
  - • Hyporesponsivity to BM, evidenced by reduced attenuation of EEG mu rhythm
  - • Intact or enhanced audiovisual integration in HR infants

PARTICIPANTS & METHODS

<table>
<thead>
<tr>
<th>Biological Motion Paradigm</th>
<th>Audio-visual Synchrony Paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 months</td>
<td>9 months</td>
</tr>
<tr>
<td>6 months</td>
<td>3 months</td>
</tr>
<tr>
<td>12 months</td>
<td>6 months</td>
</tr>
<tr>
<td></td>
<td>2 months</td>
</tr>
</tbody>
</table>

Results suggest pervasive perceptual anomalies in HR infants rather than isolated dysfunction in social or perceptual brain circuits. Both social processes and multi-sensory integration may represent neural endophenotypes marking early atypical development in ASD.

CONCLUSIONS

- • Rather than an imbalance in the processing of motion and audiovisual synchrony stimuli, HR infants demonstrated atypical neural responses to BM and reduced sensitivity to AVS.
- • Atypical responses to BM in HR infants related to distinct electrophysiological markers of social perception at different developmental points. At 6 months, reduced differentiation was observed at the P50, but at 9-12 months, attenuated EEG mu rhythm indicated weaker differentiation in the perception system.
- • Diminished responses to audio-visual contingency at 6 to 9 months in HR infants indicated co-existing anomalies in more basic processing, i.e., multi-sensory integration.
- • Results suggest pervasive perceptual anomalies in HR infants rather than isolated dysfunction in social or perceptual brain circuits. Both social processes and multi-sensory integration may represent neural endophenotypes marking early atypical development in ASD.

FUTURE DIRECTIONS

- • Ongoing data collection will follow infants through diagnostic outcomes at 36 months.
- • Changing patterns of group differences across time points emphasize the importance of considering developmental trajectories of high-risk infants.
- • Work in progress examines AVS in social versus non-social contexts and examines oscillatory activity across other cognitive processes (perceptual rhythm) and its relationship to clinical characteristics.

REFERENCES