Visual Latency as an Early Indicator of ASD in High-Risk Infants

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Background
Autism Spectrum Disorder (ASD) is a developmental disorder that is characterized by deficits in social interaction, behavior, and language (APA, 1994). Previous research suggests that atypical visual attention, which results in difficulty with social processing, is also an indicator of ASD (van der Geest, Kemner, Camfferman, Verheeren, & Van Engeland, 2001). Furthermore, it has been proposed that younger siblings of children with ASD are at higher risk for developing behavioral patterns associated with autism (Zwaigenbaum et al., 2005). Specifically, abnormalities in visual orientation may be seen in these high-risk infants (Elsabbagh, 2009). We compared performance in a visual attention task between low-risk and high-risk twelve-month-olds to determine whether previous findings are consistent at this age. Particularly, we examined the facilitation effect, which occurs when a gap precedes the appearance of a peripheral stimulus, resulting in a faster orientation to the stimulus (Elsabbagh, 2009). If abnormal gaze behavior is determined to be an early indicator of ASD, earlier diagnosis and interventions would be made possible, perhaps leading to better outcomes later in life.

Participants
Participants were 12 month old infants. Data was available at Visit 1 for 63 infants, and at Visit 2 for 59 infants.

<table>
<thead>
<tr>
<th></th>
<th>Visit 1</th>
<th>Visit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (Female)</td>
<td>Age in Days</td>
<td>N (Female)</td>
</tr>
<tr>
<td>High Risk</td>
<td>21 (7)</td>
<td>19.5</td>
</tr>
<tr>
<td>ABD Sibling</td>
<td>205-408</td>
<td>364-438</td>
</tr>
<tr>
<td>Low Risk</td>
<td>20 (7)</td>
<td>18.5</td>
</tr>
<tr>
<td>N (Female)</td>
<td>205-408</td>
<td>364-438</td>
</tr>
</tbody>
</table>

Table 1: Visit 1 and Visit 2 Participants

Procedures
The infant, seated on the parent’s lap, was positioned 1 meter from a 46 in. monitor at eye level with the center of the screen. A 9 x 9 cm peripheral spinning stimulus, counterbalanced to the left and right, was then presented for 28 cm from the center stimulus. 2.5 seconds after appearance of the peripheral stimulus, a reward stimulus was presented. Infants performed the gap-overlap task two times, once per visit. In Visit 1, the task was administered at the end of the approximately 90-minute visit. For Visit 2, the task was administered upon arrival.

Trials
Three different trial types were used in the presentation of the peripheral targets: Baseline, Overlap, and Gap. The timescale shown is in milliseconds.

- Baseline: The peripheral target appeared immediately after the central stimulus disappeared.
- Overlap: The peripheral target was presented simultaneously with the central stimulus.
- Gap: The peripheral target appeared after the screen was blank for 200 ms.

Stimuli
Two different sets of stimuli were used. Facial features were blurred on both the clown and the sun.

Table 2: Visual Stimuli in Visual Attention Task

<table>
<thead>
<tr>
<th></th>
<th>Set 1</th>
<th>Set 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Stimulus</td>
<td>Sun</td>
<td>Clown</td>
</tr>
<tr>
<td>Peripheral Stimulus</td>
<td>Green Balloon</td>
<td>Red Balloon</td>
</tr>
<tr>
<td>Reward Stimulus</td>
<td>Cartoon Animal w/ Noise</td>
<td>Cartoon Animal w/ Noise</td>
</tr>
</tbody>
</table>

Coding
A reliable coder tracked the saccadic reactions of each infant offline. Each trial was determined to be valid or invalid, depending on the gaze behavior of the infant. For valid trials, the amount of time between the appearance of the peripheral stimulus and when the infant began a saccadic reaction was measured.

Results
We extracted the mean gap-baseline differences and performed a univariate analysis on them. While we did not see significance in Visit 1, Visit 2 showed a significance of p < 0.027.

Discussion
- Twelve-month-olds at high risk and at low risk for developing ASD both exhibited a main effect of condition between the gap, overlap, and baseline trials of a visual attention task.
- Among twelve-month-olds, those without a sibling with Autism Spectrum Disorder exhibited a significantly more rapid saccadic reaction during the gap trials of the visual attention task than those with a sibling diagnosed with ASD.
- This significant facilitation effect was not detected among the six-month-old cohort in preliminary findings (Venema, 2009), suggesting that the ability to anticipate visual stimuli may develop between six and twelve months.
- Future research should focus on performance in the gap-overlap task at 18 and 24 months of age to determine whether or not this difference in facilitation between high-risk and low-risk infants remains stable through development.

References

Funding was provided by the National Institutes of Health, NIH P01HD052562.
For questions, contact Sara Gruner at saragruner@yahoo.com

Table 2: Visual Stimuli in Visual Attention Task

Figure 1: Visit 1 Mean Reaction Times

Figure 2: Visit 2 Mean Reaction Times

Figure 3: Visit 1 Gap – Baseline Mean Reaction Time Difference

Figure 4: Visit 2 Gap – Baseline Mean Reaction Time Difference

Table 1: Visual Stimuli in Visual Attention Task

Figures 1-4: Reaction Time (s)