Motion Prediction Abilities in Autism Spectrum Disorder

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Introduction

- Participants: Individuals with autism spectrum disorder (ASD) often prefer routine and have difficulty in unpredictable situations.
- Emerging theories suggest an underlying prediction impairment in ASD (Van de Cruys et al., 2014; Sinha et al., 2014).
- Motion prediction requires estimating future object position based on experienced sensory information.
- Longer time period of prediction → greater prediction demand → cognitive extrapolation required.
- Motion prediction abilities in typically developing (TD) individuals improve with age as they increasingly rely on the most relevant information present (Benguigui et al., 2004, 2008).

Study Objective:
- To investigate motion prediction abilities in ASD

Methods

Participants:

<table>
<thead>
<tr>
<th>Group</th>
<th>Participants</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD (n=20)</td>
<td>13.76</td>
<td>1.7</td>
<td>10-16</td>
<td></td>
</tr>
<tr>
<td>TD (n=20)</td>
<td>13.61</td>
<td>2.3</td>
<td>9-17</td>
<td></td>
</tr>
<tr>
<td>IQ</td>
<td>105.75</td>
<td>15.0</td>
<td>84-133</td>
<td></td>
</tr>
</tbody>
</table>

Task/Measures:

- “Press space bar when you think the bird arrives at the white line”
- Fixation Moving Object

Occluder

- 4 blocks of 100 trials each
- Eye tracking measured throughout
- Across trials, object speed and occluder length varied
  - Object speed: 10-20 degrees/second
  - Occluder length: 0.5-20 degrees
- Occlusion Time (seconds) = occluder length / object speed

Task/Measures:

- Fixation
- Moving Object

Analysis & Results

Analysis 1. Effects of group and occlusion time on prediction

Two measures of prediction ability calculated for each participant:
- Constant Error = Estimated – Actual Occlusion Time
- Variable Error = Standard deviation of constant error

As occlusion time increased, both groups underestimated the object’s arrival to the target.
The ASD group underestimated more than the TD group at the longest occlusion time.

Analysis 2. Effects of strategy: Are individuals using the most relevant information (time) more than other information (distance)?

Calculate R² for:
- Actual occlusion time on each participant’s estimated occlusion time
- Actual occluded distance on each participant’s estimated occlusion time

Linear regressions to evaluate how time and distance information explain participants’ occlusion time estimates

Data from a representative participant

Time-Distance Tendency = R² for time as information – R² for distance as information

Discussion/Conclusion

- Some evidence for a deficit in motion prediction abilities in ASD when prediction demands are greatest (occlusion times greater than 1 second).
- Individuals with ASD may rely less on the most relevant information when making predictions.
- Children with ASD do not appear to show the expected age-related shift to optimal prediction strategies.

Future directions

- Examine effects of object speed and amount of visible time (before occluded).
- Analyze eye tracking data.
- Examine prediction abilities in ASD over longer durations in other sensory modalities and multisensory conditions.

References


Acknowledgements & Contact

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