Typical and atypical profiles of temporal perception in Autism Spectrum Disorder

Anna Lambrechts, Kielan Yarrow, Sebastian Gaigg
City University London

Introduction

- Autism Spectrum Disorder (ASD) is characterised by difficulties in social interaction and communication, restricted interests and repetitive behaviour
- Recent studies suggest that abnormalities in timing and time perception may contribute to these difficulties
- Relevant evidence, however, is inconclusive, possibly due to the variety of methodologies employed
- Atypical profile of perceptual processing in ASD could affect temporal perception differently across sensory modalities

This study aims to further characterise time perception in ASD by:

- targeting durations relevant for social interaction (ms to sec range)
- examining time perception in the auditory, visual and audiovisual modalities

Materials & Methods

<table>
<thead>
<tr>
<th>TD (n=22)</th>
<th>ASD (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>VIQ</td>
</tr>
<tr>
<td>Mean</td>
<td>45.2</td>
</tr>
<tr>
<td>Max</td>
<td>60</td>
</tr>
</tbody>
</table>

- **Stimuli:** Pure tone (auditory), light grey square (visual) or both simultaneously (audio-visual)
- **Short range:** Standard = 800ms
- **Long range:** Standard = 1200ms
- **Probe durations:** ±5, 10, 25, 50% the standard duration
- **Task:** Duration comparison task, i.e. decide which of two durations lasted longer for each pair

Analysis

- **Inclusion criteria:** Two-parameter (psychometric curve) significantly better than one-parameter (horizontal line) fit in all conditions
- **Analysis:** Data were fitted to a cumulative Gaussian function using the Psignifit toolbox in Matlab.

Point of Subjective Equality (PSE): measure of accuracy

Value supporting 50% of responses “probe longer than standard”

**Weber Ratio (WR):** measure of precision

Slope normalized by the PSE

\[ PSE = f^{-1}(0.5) \]

\[ \text{WR} = \frac{f^{-1}(0.75) - f^{-1}(0.25)}{2} \times \frac{1}{PSE} \]

Results

1. **PSE**

Main effect of range (F(30,1)=27.800, p<.001, \(\eta^2=0.498\)): \(PSE_{\text{range1}} < PSE_{\text{range2}}\)

Marginal interaction modality x range (F(30,2)=3.228, p=.064, \(\eta^2=0.103\))

Post-hoc paired t-tests:
- magnitude of range effect larger in visual than AV modality
- small effect of modality dependent on the range

1. **WR**

Main effect of modality (F(30,2)=28.079, p<.001, \(\eta^2=0.501\)): \(WR_{\text{Aud}} < WR_{\text{Vis}}, WR_{\text{AV}} < WR_{\text{VA}}\)

Main effect of range (F(30,1)=13.481, p<.001, \(\eta^2=0.325\)): \(WR_{\text{range1}} > WR_{\text{range2}}\)

Marginal interaction modality x group (F(30,2)=2.921, p=.062, \(\eta^2=0.094\))

Marginal interaction range x group (F(30,1)=3.324, p=.079, \(\eta^2=0.106\))

Marginal interaction modality x range (F(30,2)=2.975, p=.072, \(\eta^2=0.096\))

Discussion

1. No difference between groups in accuracy
2. Marginally lower precision in ASD group (short range, visual modality)
3. Central tendency of duration representation across the task in both groups (4)
4. Expected lesser precision in the visual modality (8) and for the shorter range in both groups
5. Large subroup of individuals with ASD (12/24) who have great difficulty to perform the task, in particular in the visual modality and for the shorter range of durations, and show shorter reaction times

A large subgroup of individuals with ASD are able to perform temporal judgement on socially-relevant durations typically, but with less precision than TD participants. Another large subgroup however demonstrate great difficulties in timing, especially in the visual modality. These individuals could be lower-functioning and/or impulsive participants. Such subgroups could account for some heterogeneity in the literature, and should be taken in consideration in future research.

References