Intact Implicit Sequence Learning in Individuals with Autism

Shauna M. Stark¹ and Barry Gordon¹,²
Johns Hopkins University & School of Medicine
Department of Neurology¹
Department of Cognitive Science²

Background

Individuals with autism have demonstrated impaired performance in nearly all cognitive domains, including learning and memory. The sequential reaction time (SRT) task, originally introduced by Nissen & Bulmer (1987), has been used to demonstrate procedural acquisition of a visual sequence, reflecting nondeclarative or implicit learning mechanisms.

Mostofsky et al. (2000) demonstrated that individuals with autism were impaired at learning a 10-trial repeating visual sequence using a variant of the SRT task. They argue that abnormalities of the cerebellum in autism prevent acquisition of procedural knowledge on the SRT task.

Is cerebellar or other brain damage actually preventing the acquisition of procedural learning, or is the learning merely slower and requires more training than normal? With additional training, would individuals with autism be able to acquire a visual sequence, or are the underlying mechanisms simply too impaired?

Table of Participants with Autism

<table>
<thead>
<tr>
<th>ID</th>
<th>Sex</th>
<th>Age</th>
<th>Diagnosis</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>5</td>
<td>Autism</td>
<td>WISC-III</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>6</td>
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<td>WISC-III</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>7</td>
<td>Autism</td>
<td>WISC-III</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>9</td>
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<tr>
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<td>WISC-III</td>
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<tr>
<td>6</td>
<td>M</td>
<td>12</td>
<td>Autism</td>
<td>WISC-III</td>
</tr>
</tbody>
</table>

Participants

4-length Sequence Experiment:
- Autism Group: N = 5; Mean Age: 12.6 years; All males
- Control Group: N = 5; Mean Age: 12.8 years; All males

8-length Sequence Experiment:
- Autism Group: N = 7; Mean Age: 10.9 years; All males
- Control Group: N = 9; Mean Age: 12.3 years; All males

Control group matched for age and gender; no history of seizures or learning disabilities; no siblings diagnosed with autism.

Methods & Design

- 4-length and 8-length sequences: 12 blocks of 48 trials of a repeated sequence
- 2 blocks of random probe trials
- Autism group = 6 runs using the same sequence (each separated by 1 week)
- Control group = 1 run through each sequence
- 8-length sequence exp run first, followed by 4-length sequence
- 8-length sequence = each location used twice
- 4-length sequence = each location used once
- “Touch Star” - 500 ms ITI
- Reaction time recorded by touch screen
- Star remained on screen until correct response

Conclusions

Individuals with autism demonstrated acquisition of a 4-length sequence, which was significant at an individual level after six study-test runs.

Additional training on an 8-length sequence also resulted in acquisition of the repeated sequence, but only at the group level, with no individual demonstrating robust learning.

Procedural learning in individuals with autism is clearly slower and more variable than in normally developing individuals, but possible with more exposure to the sequence and shorter sequence lengths.

Future research will investigate the role of attention and possible contribution of interference in the performance decrement for the 8-length sequences.

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