Autism with Language Impairment vs. Specific Language Impairment:
Different Declarative and Procedural Memory Profiles
Hanady Bani Hani & Aparna Nading
McGill University School of Communication Sciences and Disorders, Centre for Research on Brain, Language and Music

BACKGROUND

- Some individuals with autism spectrum disorders (ASD) demonstrate the language profile of specific language impairment (SLI) (e.g., Leyfer et al., 2008), leading to an active debate as to whether language impairment has the same underlying cause in both cases.
- Memory systems have been hypothesized to contribute to the language impairment in both ASD (declarative impairment, Bracher et al., 2009; procedural impairment, Ullman, 2004), and SLI (procedural impairment, Ullman & Parpinos, 2005).
- Declarative and procedural memory are hypothesized to play key roles in typical language development. Specifically, declarative memory is implicated in binding conceptual, phonological and semantic representations of words, whereas procedural memory involves learning and storing regularities and rule-based information (Elkis, 1994; Gupta, 2011; Ullman, 2004).
- The status of declarative and procedural memory processing in language-impaired children with ASD and children with SLI is still controversial. Moreover, no study has directly compared the two groups with respect to their performance on declarative and procedural memory tasks as well as vocabulary and phonology.

RESEARCH OBJECTIVE

To clarify whether language-impaired children with ASD (ASD+LI) exhibit similar or different memory and language profiles as those observed in children with SLI.

PARTICIPANTS

- Matched pairwise on dominant language (9 English, 5 French) and NVIQ (Leiter-IV; Reid et al., 2017).
- Had a community diagnosis of either ASD or SLI and were involved in special education services for their condition.
- Scored within the normal range on NVIQ.
- Scored at least ASD below the mean (Kan & Whishaw, 2011; Demodé et al., 2007; Tannock & Zhang, 1999) on the Recalling Sentences subtest of the CELF-4 (Kamil, Wag, & Secord, 2003).

CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>ASD+LI (n=14)</th>
<th>SLI (n=14)</th>
<th>M (SD)</th>
<th>Range</th>
<th>M (SD)</th>
<th>Range</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA/YM</td>
<td>91.24 (1.2)</td>
<td>89 (1.5)</td>
<td>6-9</td>
<td></td>
<td>7.81 (1.39)</td>
<td>5-8</td>
<td>.09</td>
</tr>
<tr>
<td>NVIQ (Leiter-IV)</td>
<td>102.79 (9.7)</td>
<td>91 (1.23)</td>
<td>105.07 (7.8)</td>
<td>92-125</td>
<td>.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CELF-4 Recalling Sentences</td>
<td>3.50 (2.03)</td>
<td>4.86 (2.21)</td>
<td>1-6</td>
<td>1-7</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender Female/Male</td>
<td>3/11</td>
<td>3/4</td>
<td>66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Groups showed similar ability to perform the task as indicated by the number of errors in blocks 4 and 5; \( U = 82, p = .47 \), \( r < .14 \).
- The sequence learning score in the ASD+LI group (\( Mdn = 0.05 \)) was significantly lower than in the SLI group (\( Mdn = 18 \)), \( U = 52.5, p = .04 \), \( r = .04 \), demonstrating a larger difference in response to sequence vs. random blocks in the SLI group than the ASD+LI group.
- Within-group comparisons showed significantly faster responding in block 4 than in the SLI group; \( T < .01, r = .88 \), but not the ASD+LI group; \( T = 30, p = .17 \), \( r = .27 \), indicating that the SLI group learned the sequence while the ASD+LI group did not.
- Similar proportions of children with ASD+LI (5 of 14) and SLI (4 of 14) showed explicit knowledge of the sequence.

MEMORY MEASURES

1. Procedural memory

| Serial Reaction Time task (SRT; Thomas & Nelson, 2001).
| Participants are instructed to press a button on a response box that corresponds to the location of a dog. Unbeknownst to the child, on some blocks of the experiment, the dog follows a repeating four-step-sequence and on others movement is random. Sequence learning is indicated by significantly faster reaction times in block 5 (sequence) in comparison to block 4 (random). This was measured by a sequence learning score (mean of block 4 – mean of block 5) (mean of block 4 + mean of block 5).

Participants received a score out of 12 correct test items in each modality.

2. Intra-modality recognition task (Bashir & Bari, 1999). The participant sees six novel objects, one by one. Then the participant is presented with those objects as well as six not-seen-before novel objects and is required to identify those seen before.

Participants received a score out of 12 correct test items in each modality.

MEMORY MEASURES

1. Procedural memory

| Serial Reaction Time task (SRT; Thomas & Nelson, 2001).
| Participants are instructed to press a button on a response box that corresponds to the location of a dog. Unbeknownst to the child, on some blocks of the experiment, the dog follows a repeating four-step-sequence and on others movement is random. Sequence learning is indicated by significantly faster reaction times in block 5 (sequence) in comparison to block 4 (random). This was measured by a sequence learning score (mean of block 4 – mean of block 5) (mean of block 4 + mean of block 5).

Participants received a score out of 12 correct test items in each modality.

2. Intra-modality recognition task (Bashir & Bari, 1999). The participant sees six novel objects, one by one. Then the participant is presented with those objects as well as six not-seen-before novel objects and is required to identify those seen before.

Participants received a score out of 12 correct test items in each modality.

MEMORY MEASURES

1. Procedural memory

| Serial Reaction Time task (SRT; Thomas & Nelson, 2001).
| Participants are instructed to press a button on a response box that corresponds to the location of a dog. Unbeknownst to the child, on some blocks of the experiment, the dog follows a repeating four-step-sequence and on others movement is random. Sequence learning is indicated by significantly faster reaction times in block 5 (sequence) in comparison to block 4 (random). This was measured by a sequence learning score (mean of block 4 – mean of block 5) (mean of block 4 + mean of block 5).

Participants received a score out of 12 correct test items in each modality.

2. Intra-modality recognition task (Bashir & Bari, 1999). The participant sees six novel objects, one by one. Then the participant is presented with those objects as well as six not-seen-before novel objects and is required to identify those seen before.

Participants received a score out of 12 correct test items in each modality.

MEMORY MEASURES

1. Procedural memory

| Serial Reaction Time task (SRT; Thomas & Nelson, 2001).
| Participants are instructed to press a button on a response box that corresponds to the location of a dog. Unbeknownst to the child, on some blocks of the experiment, the dog follows a repeating four-step-sequence and on others movement is random. Sequence learning is indicated by significantly faster reaction times in block 5 (sequence) in comparison to block 4 (random). This was measured by a sequence learning score (mean of block 4 – mean of block 5) (mean of block 4 + mean of block 5).

Participants received a score out of 12 correct test items in each modality.

2. Intra-modality recognition task (Bashir & Bari, 1999). The participant sees six novel objects, one by one. Then the participant is presented with those objects as well as six not-seen-before novel objects and is required to identify those seen before.

Participants received a score out of 12 correct test items in each modality.