Exploring Links Between Language and Cognition in Autistic Toddlers: Lexical Processing as a Mediator

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BACKGROUND

Prior research suggests autistic children’s language abilities are tightly linked to nonverbal cognitive abilities (Ellis Weismer & Kover, 2015; Thurm et al., 2015).

The mechanisms which underlie this link remain largely unknown.

Experimental eyegaze methods have been shown in prior research to effectively measure abilities such as online language processing in this population with limited social demands (Ellis Weismer et al., 2016).

Individual differences in eyegaze measures of lexical processing have been shown to predict vocabulary growth in late talking toddlers (Fernald & Marchman, 2012).

Thus, lexical processing measures may provide novel information about the unique relationship between linguistic and cognitive abilities in children with ASD when evaluated alongside established standardized measures.

RESEARCH QUESTION

Does autistic toddlers’ early lexical processing performance mediate the relationship between their cognitive and language abilities?

METHODS

Fifty-two toddlers with autism spectrum disorder (ASD) participated in both standardized assessments as well as an established looking–while–listening eyegaze task to provide an implicit measure of language processing, at two timepoints, age 2 ½ and 3 ½. See Table 1 for participant characteristics.

We used a previously validated looking–while–listening task (Venker et al., 2019) to evaluate lexical processing. Children viewed two images (e.g., a shoe and a ball) and heard an auditory cue labeling one object (e.g., Find the shoe). Lexical Processing was operationalized as mean proportion of looks to target. PLS–5 Raw Scores and Mullen Scales of Early Learning Ratio IQ scores measured language and cognitive abilities, respectively.

We used bootstrap mediation analysis procedures with 1000 permutations to evaluate the significance of the mediation effect (Weisleder & Fernald, 2013; Preacher & Hayes, 2004).

We controlled for maternal education (self-reported years of education) in all models.

ANALYSES & RESULTS

Figure 1. Mediation Model, Expressive Language

![Diagram of Mediation Model, Expressive Language]

Proportion Mediated (significance of indirect effect):
Estimate = 0.304
95% CI: 0.11 - 0.56
p < .001

Figure 2. Mediation Model, Receptive Language

![Diagram of Mediation Model, Receptive Language]

Proportion Mediated (significance of indirect effect):
Estimate = 0.262
95% CI: 0.096 - 0.53
p < .004

CONCLUSIONS

Mediation models revealed that lexical processing significantly mediated the relationship between Time 1 cognitive ability and Time 2 expressive language ability (p < .001; See Figure 1, Figure 3) and Time 2 receptive language ability (p < .004; See Figure 2, Figure 3), when controlling for maternal education.

Findings suggest that higher order cognitive functions play a role in autistic children’s early lexical processing abilities, which in turn may support their broader language development.

Table 1. Participant Characteristics (n = 52)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
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<tbody>
<tr>
<td>Time 1 Age (in months)</td>
<td>30.62</td>
<td>3.34</td>
<td>24</td>
<td>36</td>
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<tr>
<td>Receptive Language</td>
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<td>11.35</td>
<td>50</td>
<td>98</td>
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<tr>
<td>Expressive Language</td>
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<td>10.47</td>
<td>50</td>
<td>100</td>
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<tr>
<td>Lexical Processing</td>
<td>0.58</td>
<td>0.14</td>
<td>0.19</td>
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<td>Nonverbal Ratio IQ</td>
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<td>15.2</td>
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<td>102</td>
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<td>Autism Symptom Severity</td>
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<td>1.66</td>
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<td>10</td>
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<td>Maternal Education (in years)</td>
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<td>2.36</td>
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<td>25</td>
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<tr>
<td>Time 2 Age (in months)</td>
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<td>Expressive Language</td>
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The authors have no financial or non-financial conflicts of interest.

Funding was provided by Funded by R01 DC 012513, NIH R01/DOD17974 USA HD00256.

Symposium on Research in Child Language Disorders
Madison, WI: June 2022

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References available via QR code