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Research Article

Comparing Morphosyntactic Profiles of Children With Developmental Language Disorder or Language Disorder Associated With Autism Spectrum Disorder

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Purpose: Previous cross-population comparisons suggest a considerable overlap in the morphosyntactic profiles of children with developmental language disorder (DLD) and children who experience language disorder associated with autism spectrum disorder (LD-ASD). The goal of this study was to further examine and compare the morphosyntactic profiles of the two populations using both standardized, norm-referenced assessments and language sample analysis.
Method: We used the Structured Photographic Expressive Language Test–Third Edition (Dawson et al., 2003) and the Index of Productive Syntax (in *Applied Psycholinguistics, 11*(1), 1990 by Scarborough) to compare the morphosyntactic profiles of 21 children with DLD (5;6–8;1 [years;months]) and 15 children with LD-ASD (4;4–9;8).
Results: Overall, both groups' morphosyntactic profiles were not significantly different based on the 26 structures assessed by the Structured Photographic Expressive Language Test–Third Edition. Chi-square analyses identified two structures on which the DLD group outperformed the LD-ASD group (i.e., participle and the conjunction "and"). Likewise, the groups' morphosyntactic profiles were not significantly different based on the 56 items assessed by the Index of Productive Syntax. Analyses identified only one structure on which the DLD group outperformed the LD-ASD group (i.e., S8: Infinitive) and four structures on which the LD-ASD group outperformed the DLD group (i.e., Q9: Why/when/which, etc.; Q6: *Wh*-question with auxiliary, modal, or copula; Q4: *Wh*-question with verb; and Q2: Routine question).
Conclusions: Study results suggest that the morphosyntactic profiles of children with DLD and children with LD-ASD are not significantly different. Results also suggest potential weaknesses on forms that have not been the focus of previous studies. It is important for clinicians to assess each of these forms using both standardized assessments and language sample analysis to gain a full understanding of the language profiles of children with DLD or LD-ASD.

Developmental language disorder (DLD) is a prevalent condition that affects at least 7% of children (Bishop et al., 2017; Norbury et al., 2016; Paul, 2007; Tomblin et al., 1997). Children with DLD exhibit weaknesses in expressive language despite the absence of sensory deficits, neurological disorders, or intellectual disability (Leonard, 2014); that is, DLD is not a result of, for example, hearing loss or Down syndrome. Much of the research on children with DLD, including research reviewed here, has focused on a subgroup of children identified as having specific language impairment (SLI). Children with SLI meet the criteria for DLD. They are considered a subgroup, however, because they have nonverbal IQ scores in the average range (i.e., greater than a standard score of 85). Bishop et al. (2017) suggested broadening terminology and diagnostic criteria to include children with language disorders who have nonverbal IQ scores between 70 and 85 because the cutoff did not seem to distinguish subtypes of children with language disorders. In the current study, we use the term *DLD* to describe our group of participants, which includes participants with nonverbal IQ scores of 70 and above; however, we will also refer to the subgroup of children with SLI who have been the focus of previous investigations.

While DLD manifests in many aspects of language performance, such as limited expressive vocabulary and poor use of social language, grammatical difficulties are

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often one of the core deficits for these children, especially in their early elementary years (Bedore & Leonard, 1998; Kohnert et al., 2009; Leonard, 2014; Rice et al., 2004; Rice & Wexler, 1996). Children with DLD tend to omit inflectional morphemes marking tense (e.g., regular past tense *–ed*) or agreement (e.g., third-person singular *–s*) as well as auxiliary and copula *BE* forms (Cleave & Rice, 1997; Leonard, 1998). As they enter adolescence and possibly into adulthood, some children with DLD continue to demonstrate weaknesses with the correct usage of the auxiliary and copula *BE* and the auxiliary *DO* (Rice et al., 2009). Moreover, evidence suggests that children with language impairment associated with other disorders demonstrate similar weaknesses in grammatical language. For example, Eadie et al. (2002) examined 11 grammatical morphemes in conversational language production of children with DLD (M_{age} = 5.3 years) and Down syndrome (M_{age} = 7.2 years). The researchers compared performance between the two groups and their typically developing peers (M_{age} = 3.3 years) matched on mean length of utterance (MLU; Brown, 1973). They found that both children with DLD and children with Down syndrome performed significantly lower on composite measures of tense inflections (e.g., third-person singular *–s*) and nontense morphemes (e.g., articles) than their peers with typical development.

However, other studies have found that children with other developmental disorders do not demonstrate significant differences on grammatical inflections. Haebig et al. (2016) used the Test of Early Grammatical Impairment (Rice & Wexler, 2001) to compare finiteness marking (e.g., third-person singular *–s* and past tense *–ed*) in children with DLD (M_{age} = 4.9 years), fragile X syndrome (M_{age} = 11.9 years), and typical development (M_{age} = 3.3 years). They found that children with DLD performed significantly lower than the other two groups that were matched on MLU. Thus, it is clear that there are not uniform weaknesses in the development of grammatical language forms across developmental diorders often associated with language impairment. One group of children, for whom relatively little is known regarding their grammatical language profile, is children with autism spectrum disorder (ASD).

Children with ASD have considerable heterogeneity in language abilities in terms of their proficiency across various language domains (Ellawadi & Weismer, 2015; Tager-Flusberg et al., 2005). Some children with ASD may be minimally verbal with restricted vocabularies; some may only show deficits in using language for social purposes in the face of otherwise age-appropriate language development. Among the heterogeneous language profiles of children with ASD, there is a subgroup of children who exhibit specific weaknesses in the production of morphosyntactic language forms similar to those of children with DLD (Condouris et al., 2003; Rice et al., 2004). Kjelgaard and Tager-Flusberg (2001) identified this group of children with a language disorder associated with ASD (LD-ASD) in a large-scale investigation of 89 verbal children with ASD between 4 and 14 years of age. The researchers administered a battery of standardized assessments to compare performance across different language domains and found that the children with LD-ASD scored significantly poorer on tasks that targeted morphosyntax and that their language profile was similar to the profile of children with DLD.

Earlier research by Bartolucci et al. (1980) and Howlin (1984) indicated that children with LD-ASD have difficulties using articles, the auxiliary and copula *BE*, and inflectional morphemes, including the third-person singular *–s*, the past tense *–ed*, and the progressive *–ing*, in spontaneous speech. Roberts et al. (2004) used experimental tasks to elicit tense marking in obligatory contexts, as in "the girl runs" and "the boy jumped." They found that children with LD-ASD demonstrated high rates of omission of tense marking, which is argued to be a reliable clinical marker of DLD (Rice & Wexler, 1996). Even though previous cross-population comparisons suggest a considerable overlap in the morphosyntactic profiles of children with DLD and children with LD-ASD, researchers have only identified a relatively small number of shared weaknesses, including the third-person singular *–s*, the past tense *–ed*, and the auxiliary and copula *BE* (Rice et al., 2009; Roberts et al., 2004; Tager-Flusberg et al., 2003). The ability for children with LD-ASD to produce many other morphosyntactic structures is largely unknown, and how their overall morphosyntactic language profile overlaps with that of children with DLD remains unclear.

There are a number of studies comparing different clinical groups with a specific focus on identifying overlapping language profiles, such as Finestack et al. (2013) and Haebig et al. (2016). To our best knowledge, there is no study that has directly compared the morphosyntactic profile of children with LD-ASD to that of children with DLD, following Kjelgaard and Tager-Flusberg's (2001) finding that the two language profiles showed a structural language deficit. A recent survey of speech-language pathologists (Finestack & Satterlund, 2018) indicated that 25% of elementary school clinicians reported working on grammatical goals with children with ASD, compared to 35% working on grammatical goals with children with DLD. These data suggest that the assessment and intervention of grammatical goals is pertinent for many clinicians. However, relatively little is known regarding the grammatical profile of this group and how the profile compares to that of children who are known to have significant weaknesses in grammatical language. Thus, the current study aimed to further identify the potential grammatical weaknesses of children with LD-ASD and compare those to children of the same age with DLD.

Assessing Morphosyntax

Researchers and clinicians use standardized assessments and language sample analysis to conduct a comprehensive evaluation of morphosyntax in structured and naturalistic contexts, respectively. Standardized, norm-referenced assessments are useful for indexing proficiency by

comparing performance with peers. For example, the Clinical Evaluation of Language Fundamentals–Fourth Edition (CELF-4; Wiig et al., 2013) and the Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 1999a) are commonly used in clinical practice to assess morphosyntax and other aspects of language (Finestack & Satterlund, 2018). The Structured Photographic Expressive Language Test–Third Edition (SPELT-3; Dawson et al., 2003) is another standardized, norm-referenced assessment that specifically assesses grammatical language. The SPELT-3 uses colored photographs of common objects and scenarios paired with short verbal questions to elicit a prespecified set of 35 morphosyntactic structures (see pp. 25–31 of the SPELT-3 manual for descriptions). In 15–20 min of test time, the SPELT-3 can efficiently identify weaknesses in specific morphosyntactic structures that may not occur in spontaneous language samples. Additionally, Dawson et al. (2003) demonstrated that the test has high levels of sensitivity and specificity identifying language disorders in children aged 4–9 years.

Language sample analysis may compliment standardized assessments by providing information regarding a child's ability to use language in more natural contexts. MLU (Brown, 1973) and the Index of Productive Syntax (IPSyn; Scarborough, 1990) are the two most common measures of language sample analysis focused on grammatical complexity (Schulman & Capone, 2010). MLU is a good indicator of morphosyntactic development and useful for charting change in productive language; however, it does not identify specific grammatical deficits. In contrast to MLU, the IPSyn assesses a child's spontaneous use of 56 specific morphosyntactic structures by examining occurrences of the structures in a 50- to 100-utterance sample. If a sample has less than 100 utterances, Scarborough (1990) provided a conversion table for the estimated IPSyn scores.

Items assessed on the IPSyn are based on the grammatical categories and developmental schemes of Brown's (1973) grammatical morphemes and Miller's (1981) Assigning Structural Stage Procedure. Essentially, a language sample is reviewed for instances of the following four subscales of morphosyntactic development: (a) elaboration of noun phrases (NP), such as articles, demonstratives, pronouns, and quantifiers; (b) elaboration of verb phrases (VP), such as auxiliary verbs, copulas, past tense marking, and subject–verb agreement marking; (c) production of negative sentences and questions (questions and negations [Q/N]), such as simple negation before a verb or a noun, yes/no questions, and *wh*-questions; and (d) use of sentence structures (SS) with varying complexity, ranging from the use of any two-word combinations to embedded clauses. Items within each subscale are developmentally ordered based on previous literature focused on language development and assessment (e.g., Brown, 1973; Crystal et al., 1976; Lee, 1974; Miller, 1981) as well as based on Scarborough's (1990) analyses of language samples of typically developing children. For example, items included in the NP subscale range from N1: Any noun (e.g., proper, mass, or count nouns) to N11: Lexical bound morpheme (e.g., "tall<u>est</u>," "a fix<u>er</u>," "<u>un</u>happy").

In the current study, we aimed to document detailed morphosyntactic profiles for children with DLD and children with LD-ASD. To best achieve this goal, we selected the SPELT-3 as our standardized assessment and the IPSyn as our measure for language sample analysis. Both are commonly used clinical measures that include a wide range of morphosyntactic forms. Comparing the numbers of grammatical structures targeted by the SPELT-3 with several other commercially available language assessments, such as the CELF-4 and the CASL, the SPELT-3 includes more morphosyntactic structures than the other tests (e.g., 35 in the SPELT-3 vs. 17 in the CELF-4 and 21 in the CASL). The SPELT-3 examines not only the third-person singular *–s* and the copula *BE* forms, which have been previously identified as difficult for children with DLD and children with LD-ASD to master, but also other morphosyntactic structures that are less commonly examined by researchers (e.g., future modal "will" and passive voice). Similarly, the IPSyn provides a detailed look at a child's morphosyntactic repertoire, with examination of a total of 56 specific items. There is substantial overlap between the morphosyntactic structures assessed by the SPELT-3 and the IPSyn. According to the SPELT-3 manual, the test "covers 14 of the 17 verb categories and 9 of the 11 categories in the area of questions and negations" from the IPSyn protocol (p. 46). The authors of the SPELT-3 used this as evidence to show the adequacy of content validity of the test and to support convergent validity between the two measures. Given this considerable overlap, we were interested in the extent to which the similarity of the morphosyntactic profiles of children with DLD and children with LD-ASD may be illustrated by the SPELT-3 and the IPSyn.

Research Questions

The goal of the current study was to further examine and compare the morphosyntactic profiles of children with DLD and children with LD-ASD using a standardized language assessment (SPELT-3) and a spontaneous language sample analysis (IPSyn). Specifically, our research questions were as follows:

1. Based on the SPELT-3, a standardized, norm-referenced assessment, what grammatical forms are evident and not evident in the morphosyntactic profiles of children with DLD and children with LD-ASD, and are there significant differences in their profiles?
2. Based on the IPSyn, a language sample analysis, what grammatical forms are evident and not evident in the morphosyntactic profiles of children with DLD and children with LD-ASD, and are there significant differences in their profiles?
3. What is the consistency of the morphosyntactic structures identified as evident and not evident by the SPELT-3 and the IPSyn for children with DLD and children with LD-ASD?

Method

Participants and Procedure

This study included 36 participants between the ages of 4 and 9 years, of which 21 were children with DLD and 15 were children with LD-ASD. The DLD group is composed of 14 boys and seven girls who received special education services for speech-language impairment or reading impairment. The LD-ASD group is composed of 13 boys and two girls who had a documented medical diagnosis of ASD, including Asperger syndrome, pervasive developmental disorder not otherwise specified, or an educational qualification status of ASD. For participants in the LD-ASD group, we completed the Childhood Autism Rating Scale–Second Edition (Schopler et al., 2010) to assess behaviors that are characteristic of ASD, such as repetitive behaviors, rituals and routines, and the presence of hyper- or hyposensitivity. Scores on each scale were interpreted relative to a clinical sample of individuals diagnosed with ASD to categorize a child's severity of ASD symptomology as minimal, moderate, or severe. Three children in the current sample scored in the minimal symptoms category, nine children scored in the mild-to-moderate symptoms category, and three children scored in the severe symptoms category. We recruited participants through local school districts and clinics in the metropolitan Minneapolis–St. Paul area. Participants in the current study include participants who were in two other studies focused on the acquisition of novel grammatical forms (i.e., Bangert et al., 2019; Finestack, 2018). Both studies were approved by the University of Minnesota Institutional Review Board for Human Subjects. Parents signed consent forms prior to participating in any study sessions.

Participants met the following inclusionary criteria: should be a monolingual English speaker; should pass a pure-tone hearing screening at 25 dB HL at 1000, 2000, and 4000 Hz in both ears; should have nonverbal intelligence standard scores of 70 or greater on the brief form of the Leiter International Performance Scale–Revised (Leiter-R; Roid & Miller, 1997); and should obtain a standard score equal to or below 95 on the SPELT-3 that indicates weaknesses in grammatical language. We set the criterion for a standard score cutoff of 95 based on findings from two studies conducted by Perona et al. (2005) and Spaulding et al. (2006). Findings from these studies indicated that the SPELT-3 achieved 90% sensitivity and 95%–100% specificity in identifying language impairment in 4- to 5-year-old children with a cutoff standard score of 95. Although this age range overlaps with only the youngest children included in this study, we applied this cutoff to the entire sample.

We included one participant whose Leiter-R score was 67 in the current study. Although her Leiter-R score was slightly below criteria, her performance on the receptive and expressive language assessments was comparable to other participants' scores. All participants were verbally fluent and able to produce three-word utterances using basic sentence structures such as subject–verb–object and subject–copula–compliment. Participants also completed the Test for Auditory Comprehension of Language–Third Edition (TACL-3; Carrow-Woolfolk, 1999b) to characterize their comprehension of aurally presented vocabulary, grammatical forms, and elaborated phrases. All participants obtained a standard score between 55 and 128.

Table 1 provides a detailed summary of the demographic and linguistic characteristics of the two participant groups. The DLD group was statistically older than the LD-ASD group, with a mean difference of 10 months; however, the distribution of the standard scores of the Leiter-R, TACL-3, and SPELT-3 did not differ significantly between groups (all ps > .24). The distribution of SPELT-3 scores was similar in both groups, with 52% of the participants with DLD versus 67% of the participants with LD-ASD scoring within 2 *SD*s (standard scores

Table 1. Characteristics of participant groups.

Variable	DLD (n = 21)	LD-ASD (n = 15)	p[a] (d)
Age (years;months)			
M	7;1	6;3	.03*
SD	0.75	1.48	(.71)
Min–max	5;6–8;1	4;4–9;8	
Leiter-R[b] standard score			
M	90.43	98.07	.24
SD	18.02	20.16	(.40)
Min–max	67–124	71–133	
SPELT-3[c] standard score			
M	73.71	75.53	.73
SD	16.46	13.75	(.12)
Min–max	44–95	47–93	
MLU			
M	4.52	4.06	.27
SD	0.83	1.60	(.36)
Min–max	3.37–6.25	2.14–7.39	
TACL-3[d] standard score			
M	82.76	89.07	.30
SD	16.69	19.22	(.35)
Min–max	55–121	55–128	
Sex			
Male:Female	14:7	13:2	.17 (.47)
Race			
White:Other	5:16	15:0	< .01*[e] (2.04)

Note. DLD = developmental language disorder; LD-ASD = language disorder associated with autism spectrum disorder; MLU = mean length of utterance in morphemes.

[a]Group comparisons using *t* tests for age, Leiter-R, SPELT-3, and TACL-3 or chi-square analyses for sex and race. [b]Leiter-R = Leiter International Performance Scale–Revised (Roid & Miller, 1997) mean standard score = 100, *SD* = 15. [c]SPELT-3 = Structured Photographic Expressive Language Test–Third Edition (Dawson et al., 2003) mean standard score = 100, *SD* = 15. [d]TACL-3 = Test for Auditory Comprehension of Language–Third Edition (Carrow-Woolfolk, 1999b) mean standard score = 100, *SD* = 15. [e]Modified p value calculated by adding .5 to each cell value.

*p < .05.

between 70 and 95) and 48% versus 33% scoring below 2 *SD*s (standard scores below 70). Figure 1 summarizes the performance of each participant on the SPELT-3, Leiter-R, and TACL-3, ordered from youngest to oldest. The only notable trend revealed in Figure 1 was that the younger participants in the DLD group tended to have higher Leiter-R and TACL-3 scores.

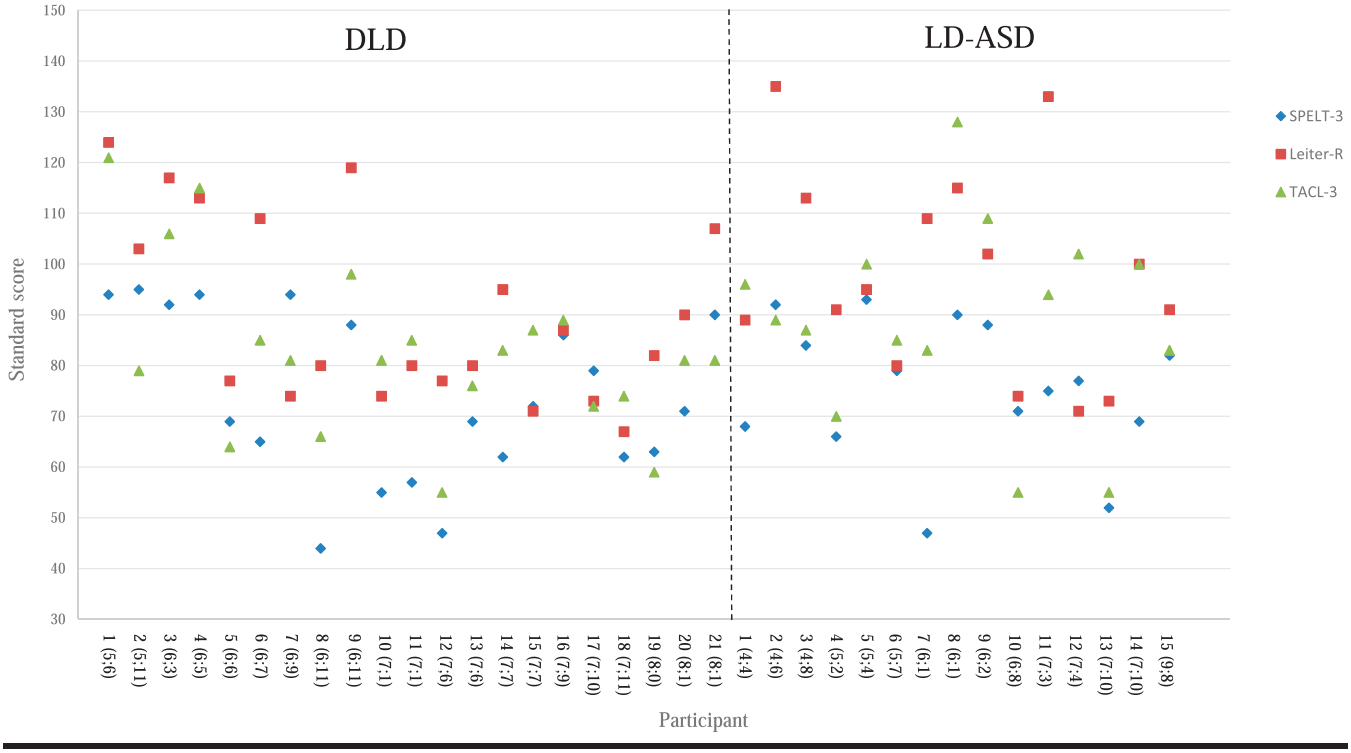
In addition to the standardized assessments, participants completed a conversational language sample with a research assistant. Using a specified script (Abbeduto et al., 1995), the assistant conversed with the child about familiar topics and activities of interest, such as school, family, sports, pets, and video games, for approximately 20 min. The conversation started with a question based on a topic familiar to the child (i.e., "Your mom told me that you enjoyed X. I would like to hear more about what you like about X."). To maximize spontaneous language output, the assistant asked open-ended questions, followed the child's lead, and allowed sufficient wait time before asking a follow-up question or switching to a new topic. The assistant recorded each interaction using a digital audio recorder. All assessments were administered by trained graduate-level student research assistants in a quiet space free of distraction at the child's home, school, or clinic. Participants completed the assessments over two 60-min sessions scheduled on different days within a 2-week period.

Transcription and Scoring

Two trained undergraduate research assistants listened to language sample recordings and transcribed them using the Systematic Analysis of Language Transcripts (Miller & Chapman, 2000) transcription conventions. Utterances were segmented as communication units (C-units; Loban, 1976), which consist of an independent clause (subject + predicate) and any subordinating clauses. After one transcriptionist completed a first transcription pass, the other transcriptionist double-checked it by identifying errors and discrepancies between the first pass and the audio recording. The first transcriptionist then reviewed these corrections and differences and made final judgments on whether to accept or decline the changes. The length of all transcripts was between 103 and 366 intelligible utterances. There was no significant difference in MLU in morphemes between the DLD (M = 4.52, SD = 0.83) and LD-ASD (M = 4.06, SD = 1.60) groups, $t(34) = 1.12$, $p = .27$.

A team of four trained undergraduate students in speech-language pathology completed the IPSyn scoring.

Figure 1. Relationships between age (years;months), language ability, and cognitive ability. DLD = developmental language disorder; LD-ASD = language disorder associated with autism spectrum disorder; SPELT-3 = Structured Photographic Expressive Language Test–Third Edition (Dawson et al., 2003); Leiter-R = Leiter International Performance Scale–Revised (Roid & Miller, 1997); TACL-3 = Test for Auditory Comprehension of Language–Third Edition (Carrow-Woolfolk, 1999b).



They first screened each transcript to identify the first 100 successive, complete, and intelligible utterances that were not imitations of adult utterances, self-repetitions, verbatim songs, or nursery rhymes. From the selected utterances, the coders awarded points to the occurrence of 56 morphosyntactic structures organized under four subscales (i.e., NP, VP, Q/N, and SS). Participants earned 2 points if they produced two different exemplars of a target structure, 1 point for producing one exemplar, and 0 points if they did not produce an exemplar. Each transcript was coded and scored independently by two coders, whose interrater reliability was 96% for NP, 91% for VP, 91% for Q/N, 92% for SS, and 92% overall. Using the identified exemplars from each coder, the coders developed a consensus IPSyn scoring for each transcript.

The coders examined 11 items under the NP subscale, 16 items under the VP subscale, 10 items under the Q/N subscale, and 19 items under the SS subscale. This resulted in a total of 56 grammatical items on the IPSyn protocol. For this study, the coders did not search for examples that could be counted toward the last item in each subscale (i.e., other NP, other VP, other Q/N, and other SS) to reduce potential scoring inconsistency between coders. As a result, the total number of IPSyn items examined in the current study is 56 instead of 60.

Dependent Measures

SPELT-3

To characterize participants' performance on the SPELT-3, we first conducted an item analysis of the morphosyntactic structures assessed by the SPELT-3. The SPELT-3 manual indicates that across the 53 items, 35 morphosyntactic structures are assessed (pp. 25–31). Some structures are assessed by one test item, whereas others are assessed by multiple items. For example, the manual categorizes Items 1–4 as prepositional phrase because they assess a child's ability to produce prepositions, as in "under the table" and "behind the chair." Items 20–22 are categorized as past tense copula *BE* because they target the use of "was" and "were" in a sentence.

We further grouped the 35 morphosyntactic structures into 26 unique structures to match them with the grammatical forms assessed by the IPSyn. First, we merged progressive verb (Item 8), auxiliary plus present progressive verb (Items 13 and 15), and third-person plural present progressive verb tense (Items 17–19) into one collective progressive *–ing* category. Second, we combined Items 10 and 12 because both assess future modal "will." We also combined Items 11 and 16 because both assess past tense *–ed*, and we combined Items 14 and 23 because both assess the past tense of an irregular verb (i.e., "ate" and "went"). Third, we combined *wh*-question (Items 45 and 46) and negative *wh*-question (Item 47) to create a general *wh*-question category. We did not categorize Item 47 as a negative form because the main syntactic structure of the target response is an interrogative sentence. Finally, we assigned negative infinitive phrase (Item 49) to the negative structure along with Items 38 and 39 because they all assess the use of negation with a modal auxiliary (i.e., "don't" "doesn't," and "can't"). Table 2 outlines the resulting 26 morphosyntactic structures and their corresponding test items on the SPELT-3. Additionally, Appendix A provides example sentences using each structure.

After grouping was completed, we examined participant responses to each morphosyntactic structure and characterized their performance as falling into one of three categories: All Correct, Partially Correct, and None Correct. That is, if a participant answered all items targeting the same structure correctly, we characterized his or her performance as All Correct for that structure. If some items were answered correctly, we characterized the performance as Partially Correct. If none of the items were answered correctly, we characterized the performance as None Correct. Taking Items 5–7, which assess the plural *–s*, as an example, the research assistant characterized the participant's responses as All Correct if all three items were answered correctly, as Partially Correct if one or two items were answered correctly, or as None Correct if all three items were missed. If a structure was only targeted by one item, the assistant characterized the participant's response as either All Correct or None Correct.

To create our dependent variable, we tallied the number of participants across performance categories for each structure for the two groups. Then, we identified the structures for which more than half of the participants in each group (i.e., ≥ 11 in the DLD group and ≥ 8 in the LD-ASD group) scored All Correct as "Evident" in their morphosyntactic profiles. Likewise, we identified the structures for which more than half of the participants in each group scored None Correct as "Not Evident" in their profiles. If neither criteria were met, we labeled the structure as "Scarce Evidence."

IPSyn

Parallel to the proficiency scheme used to develop the SPELT-3 measures, we characterized participant performance as falling into one of three categories based on identified exemplars: Full Credit, Partial Credit, and No Credit. That is, participant performance received Full Credit for earning 2 points, Partial Credit for earning 1 point, and No Credit for earning 0 points for that structure. Then, we tallied the number of participants in each category for each structure. We used the same criteria to identify structures as Evident (i.e., more than half of the participants scoring Full Credit), Not Evident (i.e., more than half of the participants scoring No Credit), or Scarce Evidence (i.e., neither criteria are met) for each group. Appendix B provides example sentences using each IPSyn item.

Statistical Analyses

To address Research Question 1 regarding significant differences in group performance based on the SPELT-3, we conducted a 2×2 (conditions: DLD vs. LD-ASD; performance categories: All Correct vs. None Correct) or

Table 2. Morphosyntactic structures assessed by the Structured Photographic Expressive Language Test–Third Edition (SPELT-3; Dawson et al., 2003) and their corresponding Index of Productive Syntax (IPSyn; Scarborough, 1990) item.

Form	Test item on SPELT-3	Corresponding IPSyn item
Prepositional phrase	1,2,3,4	V3: Prepositional phrase
Plural *–s*	5,6,7	N7: Plural
Progressive *–ing*	8,13,15,17,18,19	V7: Progressive *–ing*
Third-person singular *–s*	9	V10: Third-person singular *–s*
Future modal "will"	10,12	V9: Evident/past modal[a]
Past tense *–ed*	11,16	V12: Past *–ed*
Irregular past tense	14,23	V17: Other VP[a]
Past tense copula *BE*	20,21,22	V16: Past copula
Infinitive	24,25	S8: Infinitive
Infinitive (two subjects)	26	S17: Infinitive (two subjects)
Conjunction "and"	27	S12: Conjoined clause[a]
Conjunction "because"	28	S10: Adverbial conjunction[a]
Possessive *'s*	29,30	N3: Modifier[a]
Possessive pronoun	31,32,33,34	N3: Modifier[a]
Wh-clause	35	S13: *Wh*-clause
Participle	36,37	S18: Gerund
Negative	38,39,49	Q5N: N + not + V
Passive voice	40	S20: Other SS[a]
Reflexive pronoun	41	N2: Pronoun[a]
Y/N interrogative	42,43,44	Q8: Y/N question
Wh-question	45,46,47	Q9: Why/when/which, etc.
Direct/indirect object	48	S14: Bitransitive predicate
Copula *BE*	50	V4: Copula (present/past)
Propositional clause	51	S11: Propositional complement
Relative clause	52	S16: Relative clause
Embedded clause	53	S19: Fronted clause

Note. VP = verb phrase; N = noun; V = verb; SS = sentence structure; Y/N = yes/no.

[a]The SPELT-3 structure is not well matched to the IPSyn item (e.g., reflexive pronoun on the SPELT-3 was best matched with N2: Pronoun on the IPSyn, which also assesses personal pronouns such as "he" or "she").

2 × 3 (adding Partially Correct to the performance category) chi-square analysis for each structure to determine difference in performance between groups. If a cell value was 0, we added .5 to each cell to calculate a modified *p* value. We also evaluated effect sizes using Cohen's *w,* with 0.1, 0.3, and 0.5 representing small, medium, and large effect sizes, respectively (Ellis, 2010). To address Research Question 2 regarding significant differences in group performance based on the IPSyn, we conducted a 2 × 3 (conditions: DLD vs. LD-ASD; performance categories: Full Credit vs. Partial Credit vs. No Credit) chi-square analysis for each structure and followed the same methods to calculate *p* values and Cohen's *w*.

To address Research Question 3, which aimed to compare participants' performance on the SPELT-3 and the IPSyn, it was necessary to match the structures assessed. Some of the matchings were straightforward with one-to-one correspondence. For example, prepositional phrase (Items 1–4 on the SPELT-3) was matched with V3: Prepositional phrase on the IPSyn protocol, and plural *–s* (Items 5–7 on the SPELT-3) was matched with N7: Plural on the IPSyn protocol. Some matchings were less direct because IPSyn items tend to target broader grammatical categories. For example, reflexive pronoun (Item 41 on the SPELT-3) was not well matched with N2: Pronoun, which also includes personal pronouns such as "he" or "she." Similarly, the conjunction "and" was not well matched with S12: Conjoined clause, which awards points to other conjoined sentences using "but" or "so." We excluded these structures from comparison because their best matched IPSyn items give credit to other grammatical targets; hence, the comparison may not be accurate or meaningful. Finally, we matched the SPELT-3 structures irregular past tense and passive voice to V17: Other VP and S20: Other SS, respectively. Because these structures were not scored in the IPSyn analysis, they were also excluded from comparison to avoid potential intercoder inconsistency. Table 2 provides a complete list of the structures assessed on the SPELT-3 and their corresponding IPSyn items. There are a total of 18 comparable structures and eight indirect matches, indicated by a superscript "a" in the last column of Table 2.

After matching was complete, we cross-examined the structures identified by the SPELT-3 with those identified by the IPSyn for each group. The results for each identified structure could be Consistent (when both measures identified the structure as Evident, Not Evident, or Scarce Evidence), Contradictory (when one measure identified the structure as Evident and the other identified the structure as Not Evident), or Neutral (when one measure identified

Table 3. Number (%) of participants in each performance category across 26 Structured Photographic Expressive Language Test–Third Edition structures.

Structure	DLD (*n* = 21)			LD-ASD (*n* = 15)			Overall (*N* = 36)		
	All (%)	Partial (%)	None (%)	All (%)	Partial (%)	None (%)	All (%)	Partial (%)	None (%)
Propositional clause◇	**3 (14)**	**n/a**	**18 (86)**	**1 (7)**	**n/a**	**14 (93)**	4 (11)	n/a	32 (89)
Passive voice◇	**3 (14)**	**n/a**	**18 (86)**	**3 (20)**	**n/a**	**12 (80)**	6 (17)	n/a	30 (83)
Relative clause◇	**4 (19)**	**n/a**	**17 (81)**	**4 (27)**	**n/a**	**11 (73)**	8 (22)	n/a	28 (78)
Reflexive pronoun◇	**5 (24)**	**n/a**	**16 (76)**	**3 (20)**	**n/a**	**12 (80)**	8 (22)	n/a	28 (78)
Wh-clause◇	**5 (24)**	**n/a**	**16 (76)**	**4 (27)**	**n/a**	**11 (73)**	9 (25)	n/a	27 (75)
Infinitive (two subjects)◇	**8 (38)**	**n/a**	**13 (62)**	**3 (20)**	**n/a**	**12 (80)**	11 (31)	n/a	25 (69)
Copula *BE*◇	11 (52)	n/a	10 (48)	**4 (27)**	**n/a**	**11 (73)**	15 (42)	n/a	21 (58)
Embedded clause◇	11 (52)	n/a	10 (48)	**7 (47)**	**n/a**	**8 (53)**	18 (50)	n/a	18 (50)
Wh-question	1 (05)	13 (62)	7 (33)	**0 (0)**	**5 (33)**	**10 (67)**	1 (3)	18 (50)	17 (47)
Past tense copula *BE*	2 (10)	9 (42)	10 (48)	2 (13)	7 (47)	6 (40)	4 (12)	16 (44)	16 (44)
Third-person singular *–s*◇	13 (62)	n/a	8 (38)	**7 (47)**	**n/a**	**8 (53)**	20 (56)	n/a	16 (44)
Irregular past tense	0 (0)	11 (52)	10 (48)	0 (0)	10 (67)	5 (33)	0 (0)	21 (58)	15 (42)
Infinitive	5 (24)	10 (48)	6 (29)	**3 (20)**	**4 (27)**	**8 (53)**	8 (22)	14 (39)	14 (39)
Direct/indirect object◇	13 (62)	n/a	8 (38)	9 (60)	n/a	6 (40)	22 (61)	n/a	14 (39)
Participle*	11 (52)	8 (38)	2 (10)	**2 (13)**	**4 (27)**	**9 (60)**	13 (36)	12 (33)	11 (31)
Y/N interrogative	5 (24)	12 (57)	4 (19)	2 (13)	7 (47)	6 (40)	7 (19)	19 (53)	10 (28)
Conjunction "because"◇	17 (81)	n/a	4 (19)	9 (60)	n/a	6 (40)	26 (72)	n/a	10 (28)
Conjunction "and"*◇	18 (86)	n/a	3 (14)	8 (53)	n/a	7 (47)	26 (72)	n/a	10 (28)
Future modal "will"	12 (57)	6 (29)	3 (14)	8 (53)	2 (13)	5 (34)	20 (56)	8 (22)	8 (22)
Possessive *'s*	17 (81)	3 (14)	1 (5)	10 (67)	1 (7)	4 (27)	27 (75)	4 (11)	5 (14)
Negative	3 (14)	17 (81)	1 (5)	4 (27)	8 (53)	3 (20)	7 (19)	25 (70)	4 (11)
Past tense *–ed*	12 (57)	8 (38)	1 (5)	3 (20)	9 (60)	3 (20)	15 (42)	17 (47)	4 (11)
Progressive *–ing*	5 (24)	15 (71)	1 (5)	2 (13)	13 (87)	0 (0)	7 (19)	28 (77)	1 (3)
Prepositional phrase	7 (33)	13 (62)	1 (5)	4 (27)	11 (73)	0 (0)	11 (31)	24 (66)	1 (3)
Plural *–s*	4 (19)	17 (81)	0 (0)	8 (53)	7 (47)	0 (0)	12 (33)	24 (66)	0 (0)
Possessive pronoun	12 (57)	9 (42)	0 (0)	4 (27)	11 (73)	0 (0)	16 (44)	20 (56)	0 (0)

Note. Bold data indicate grammatical structures that are Not Evident, identified by > 50% participants scoring None Correct. Underlined data indicate grammatical structures that are Evident, identified by > 50% participants scoring All Correct. Due to rounding, total percentages range from 99 to 101. DLD = developmental language disorder; LD-ASD = language disorder associated with autism spectrum disorder; Y/N = yes/no.
*Significant differences in group performance. ◇Structures that are assessed by only one item.

the structure as Evident or Not Evident and the other identified the structure as Scarce Evidence).

Results

Research Question 1

The first research question aimed to develop detailed morphosyntactic profiles of children with DLD and children with LD-ASD and to compare their profiles based on the SPELT-3. We identified grammatical forms in which more than half of the group's participants scored All Correct as Evident and those in which more than half of the group's participants scored None Correct as Not Evident. Table 3 summarizes the number and percentage of participants in each performance category. The structure with the highest count of None Correct is at the top (i.e., propositional clause) and the structure with the lowest count of None Correct is at the bottom (i.e., possessive pronoun) of the table.

The first six structures in Table 3 were identified as Not Evident in both groups' morphosyntactic profiles, including propositional clause, passive voice, relative clause, reflexive pronoun, *wh*-clause, and infinitive (two subjects). There were six additional structures marked as Not Evident for only the LD-ASD group, including copula *BE*, embedded clause, *wh*-question, third-person singular *–s*, infinitive, and participle.

Five morphosyntactic structures were identified as Evident in both groups' morphosyntactic profiles, including the possessive *'s*, future modal "will," the conjunction "and," the conjunction "because," and direct/indirect object. There were six additional forms marked as Evident for only the DLD group, including copula *BE*, embedded clause, third-person singular *–s*, participle, past tense *–ed*, and possessive pronoun. There was one additional form marked as Evident for only the LD-ASD group: plural *–s*.

Based on the chi-square analyses, the DLD group outperformed the LD-ASD group on two morphosyntactic structures: participle, $\chi^2(2, N = 36) = 11.33$, $p = .003$ ($w = 0.56$), and the conjunction "and," $\chi^2(1, N = 36) = 4.57$, $p = .032$ ($w = 0.35$). Medium effect sizes emerged for four analyses that yielded p values greater than .05, including plural *–s*, $\chi^2(2, N = 36) = 4.41$, $p = .110$ ($w = 0.33$); past tense *–ed*, $\chi^2(2, N = 36) = 5.61$, $p = .060$ ($w = 0.39$); possessive *'s*, $\chi^2(2, N = 36) = 3.72$, $p = .156$ ($w = 0.32$); and negative, $\chi^2(2, N = 36) = 3.48$, $p = .176$ ($w = 0.31$). Of these structures, the DLD group had a higher percentage of participants scoring All Correct on possessive *'s* and

past tense *–ed*, whereas the LD-ASD group had a higher percentage of participants scoring All Correct on plural *–s* and negative.

Research Question 2

The second research question aimed to develop detailed morphosyntactic profiles of children with DLD and children with LD-ASD and to compare their profiles based on the IPSyn. Similar to methods used for Research Question 1, we identified grammatical forms in which more than half of the group's participants scored Full Credit as Evident and those in which more than half of the group's participants scored No Credit as Not Evident. Table 4 summarizes the number and percentage of participants in each performance category. The item with the highest count of No Credit is at the top (i.e., V15: Copula, modal, or auxiliary for emphasis or ellipsis in uncontractible context) and the item with the lowest count of No Credit is at the bottom (i.e., S1: 2 words) of the table.

The first 10 items in Table 4 were identified as Not Evident in both groups' morphosyntactic profiles (i.e., those from V15: Copula, modal, or auxiliary for emphasis or ellipsis in uncontractible context to S14: Bitransitive predicate). Four additional items were identified as Not Evident for only the DLD group, including Q8: Yes/no question with inverted auxiliary, modal, or copula; Q6: *Wh*-question with inverted modal, copula, or auxiliary; Q4: Initial *wh*-pronoun followed by a verb; and Q2: Routine question.

Both groups had 34 items identified as Evident in their profiles, including S15: 3-VP sentences, V9: Present or past modal, and the other 32 items from Q1: Intonation question, in the middle of Table 4, to S1: 2 words, at the bottom of the table. There were four additional items marked as Evident for only the DLD group, including V16: Past copula, S12: Conjoined clause, S13: *Wh*-clause, and V12: Past tense *–ed*. There were four additional items marked as Evident for only the LD-ASD group, including Q4: *Wh*-question with verb, Q2: Routine question, S11: Propositional complement, and V10: Third-person singular *–s*.

Based on the chi-square analyses, the DLD group outperformed the LD-ASD group on only one item: S8: Infinitive, $\chi^2(2, N = 36) = 6.31$, $p = .042$ ($w = 0.40$). The LD-ASD group outperformed the DLD group on four items, including Q9: Why/when/which, etc., $\chi^2(2, N = 36) = 6.67$, $p = .036$ ($w = 0.43$); Q6: *Wh*-question with auxiliary, modal, or copula, $\chi^2(2, N = 36) = 6.52$, $p = .038$ ($w = 0.42$); Q4: *Wh*-question with verb, $\chi^2(2, N = 36) = 11.74$, $p = .003$ ($w = 0.57$); and Q2: Routine question, $\chi^2(2, N = 36) = 6.5$, $p = .039$ ($w = 0.42$). Medium effect sizes emerged for nine analyses that yielded p values greater than .05, including Q10: Tag question, $\chi^2(2, N = 36) = 4.70$, $p = .095$ ($w = 0.34$); Q8: Y/N question, $\chi^2(2, N = 36) = 4.79$, $p = .091$ ($w = 0.36$); S15: 3-VP sentences, $\chi^2(2, N = 36) = 5.55$, $p = .062$ ($w = 0.37$); S12: Conjoined clause, $\chi^2(2, N = 36) = 5.70$, $p = .058$ ($w = 0.39$); S13: *Wh*-clause, $\chi^2(2, N = 36) = 3.74$, $p = .154$ ($w = 0.32$); V12: Past tense *–ed*, $\chi^2(2, N = 36) = 3.31$, $p = .191$ ($w = 0.30$); Q1: Intonation question, $\chi^2(2, N = 36) = 3.52$, $p = .172$ ($w = 0.30$); S7: Conjoined phrase, $\chi^2(2, N = 36) = 5.34$, $p = .060$ ($w = 0.38$); and S10: Adverbial conjunction, $\chi^2(2, N = 36) = 3.79$, $p = .150$ ($w = 0.31$). Of these items, the DLD group had a higher percentage of participants receiving Full Credit on the following five items: S12: Conjoined clause, S13: *Wh*-clause, V12: Past tense *–ed*, S7: Conjoined phrase, and S10: Adverbial conjunction, whereas the LD-ASD group had a higher percentage of participants receiving Full Credit on the other four items: Q10: Tag question, Q8: Y/N question, S15: 3-VP sentences, and Q1: Intonation question.

Research Question 3

The last research question aimed to compare participants' performance across the two measures. Table 5 summarizes the consistency of the 18 comparable structures for each group. The SPELT-3 identified six structures as Evident for the DLD group, of which two were Consistent with the IPSyn (V4: Copula and V12: Past tense *–ed*), three were Contradictory to the IPSyn (S14: Bitransitive predicate, S19: Fronted clause, and S18: Gerund), and one was Neutral (V10: Third-person singular *–s*). Of the four structures identified by the SPELT-3 as Not Evident for the DLD group, one was Consistent with the IPSyn (S17: Infinitive [two subjects]), one was Contradictory to the IPSyn (S13: *Wh*-clause), and two were Neutral (S11: Propositional complement and S16: Relative clause). The specific number and percentage of participants in each performance category can be found in Table 3 (SPELT-3 results) and Table 4 (IPSyn results). Note that the SPELT-3 and the IPSyn identified more structures as Evident or Not Evident for the DLD group, but we only compared those that were assessed by both measures.

For the LD-ASD group, the SPELT-3 identified two structures as Evident, of which one was Consistent with the IPSyn (N7: Plural) and the other was Contradictory (S14: Bitransitive predicate). Of the nine structures identified by the SPELT-3 as Not Evident for the LD-ASD group, three were Consistent with the IPSyn (S17: Infinitive [two subjects], S19: Fronted clause, and Q9: Why/when/which, etc.), four were Contradictory (S11: Propositional complement, V4: Copula, V10: Third-person singular *–s*, and S8: Infinitive), and two were Neutral (S16: Relative clause and S13: *Wh*-clause). The SPELT-3 and the IPSyn identified more structures as Evident or Not Evident for the LD-ASD group, but we only compared those that were assessed by both measures.

Discussion

The current study provides a rigorous description of grammatical forms that are Evident or Not Evident in the morphosyntactic profiles of children with DLD and children with LD-ASD and a comparison of the two profiles. Overall, analyses revealed that the two profiles are not greatly different. Using the SPELT-3, a standardized assessment,

Table 4. Number (%) of participants in each performance category across 56 Index of Productive Syntax (Scarborough, 1990) items.

Item	DLD (*n* = 21)			LD-ASD (*n* = 15)			Overall (*N* = 36)		
	Full (%)	Partial (%)	No (%)	Full (%)	Partial (%)	No (%)	Full (%)	Partial (%)	No (%)
V15: Ellipsis	**0 (0)**	**2 (10)**	**19 (90)**	**1 (7)**	**1 (7)**	**13 (87)**	1 (3)	3 (8)	32 (89)
S9: Let/make/help, etc.	**0 (0)**	**2 (10)**	**19 (90)**	**1 (7)**	**1 (7)**	**13 (87)**	1 (3)	3 (8)	32 (89)
Q10: Tag question	**0 (0)**	**1 (5)**	**20 (95)**	**0 (0)**	**5 (33)**	**10 (67)**	0 (0)	6 (17)	30 (83)
Q9: Why/when/which, etc.*	**1 (5)**	**1 (5)**	**19 (90)**	**2 (13)**	**5 (33)**	**8 (53)**	3 (8)	6 (17)	27 (75)
N11: Lexical bound morpheme	**2 (10)**	**3 (14)**	**16 (76)**	**3 (20)**	**2 (13)**	**10 (67)**	5 (14)	5 (14)	26 (72)
S19: Fronted clause	**2 (10)**	**7 (33)**	**12 (57)**	**0 (0)**	**3 (20)**	**12 (80)**	2 (6)	10 (28)	24 (66)
S18: Gerund	**0 (0)**	**8 (38)**	**13 (62)**	**2 (13)**	**4 (27)**	**9 (60)**	2 (6)	12 (33)	22 (61)
V11: Past modal	**7 (33)**	**2 (10)**	**12 (57)**	**3 (20)**	**3 (20)**	**9 (60)**	10 (28)	5 (14)	21 (58)
S17: Infinitive (two subjects)	**2 (10)**	**7 (33)**	**12 (57)**	**2 (13)**	**5 (33)**	**8 (53)**	4 (11)	12 (33)	20 (56)
S14: Bitransitive predicate	**2 (10)**	**8 (38)**	**11 (52)**	**1 (7)**	**5 (33)**	**9 (60)**	3 (8)	13 (36)	20 (56)
Q8: Y/N question	**3 (14)**	**5 (24)**	**13 (62)**	7 (47)	3 (20)	5 (33)	10 (28)	8 (22)	18 (50)
Q6: *Wh*-question with AMC*	**3 (14)**	**5 (24)**	**13 (62)**	6 (40)	6 (40)	3 (20)	9 (25)	11 (31)	16 (44)
V13: Past auxiliary	10 (48)	4 (19)	7 (33)	3 (20)	5 (33)	7 (47)	13 (36)	9 (25)	14 (39)
Q4: *Wh*-question with verb*	**2 (10)**	**7 (33)**	**12 (57)**	9 (60)	4 (27)	2 (13)	11 (31)	11 (31)	14 (39)
Q2: Routine question*	**7 (33)**	**3 (14)**	**11 (52)**	11 (73)	2 (13)	2 (13)	18 (50)	5 (14)	13 (36)
V16: Past copula	13 (62)	3 (14)	5 (24)	6 (40)	2 (13)	7 (47)	19 (53)	5 (14)	12 (33)
S15: 3-VP sentences	11 (52)	6 (29)	4 (19)	8 (53)	0 (0)	7 (47)	19 (53)	6 (17)	11 (31)
S11: Propositional compt	8 (38)	6 (29)	7 (33)	9 (60)	3 (20)	3 (20)	17 (47)	9 (25)	10 (28)
S16: Relative clause	10 (48)	6 (29)	5 (24)	5 (33)	5 (33)	5 (33)	15 (41)	11 (31)	10 (28)
S12: Conjoined clause	16 (76)	3 (14)	2 (10)	6 (40)	3 (20)	6 (40)	22 (61)	6 (17)	8 (22)
V10: Third-person singular *–s*	10 (48)	6 (29)	5 (24)	11 (73)	2 (13)	2 (13)	21 (58)	8 (22)	7 (19)
V9: Evident/past modal	17 (81)	0 (0)	4 (19)	11 (73)	1 (7)	3 (20)	28 (78)	1 (3)	7 (19)
S13: *Wh*-clause	15 (71)	4 (19)	2 (10)	6 (40)	5 (33)	4 (27)	21 (58)	9 (25)	6 (17)
V12: Past tense *–ed*	16 (76)	3 (14)	2 (10)	7 (47)	5 (33)	3 (20)	23 (64)	8 (22)	5 (14)
Q1: Intonation question	12 (57)	5 (24)	4 (19)	13 (87)	2 (13)	0 (0)	25 (70)	7 (19)	4 (11)
Q7N: Negation of AMC	15 (71)	4 (19)	2 (10)	11 (73)	2 (13)	2 (13)	26 (72)	6 (17)	4 (11)
S7: Conjoined phrase	20 (95)	1 (5)	0 (0)	10 (67)	1 (7)	4 (27)	30 (83)	2 (6)	4 (11)
N8: 2-word NP + V	18 (85)	1 (5)	2 (10)	13 (87)	1 (7)	1 (7)	31 (86)	2 (6)	3 8)
N10: NP adverb	14 (76)	5 (24)	2 (10)	12 (80)	2 (13)	1 (7)	26 (72)	7 (19)	3 (8)
V7: Progressive *–ing*	19 (90)	1 (5)	1 (5)	11 (73)	2 (13)	2 (13)	30 (83)	3 (8)	3 (8)
S8: Infinitive*	20 (95)	1 (5)	0 (0)	9 (60)	3 (20)	3 (20)	29 (81)	4 (11)	3 (8)
S10: Adverbial conjunction	18 (85)	3 (14)	0 (0)	10 (67)	2 (13)	3 (20)	28 (78)	5 (14)	3 (8)
V6: Evident auxiliary	18 (85)	2 (10)	1 (5)	12 (80)	2 (13)	1 (7)	30 (83)	4 (11)	2 (6)
V5: Catenative	19 (90)	0 (0)	2 (10)	14 (93)	1 (7)	0 (0)	33 (91)	1 (3)	2 (6)
V14: Medial adverb	14 (76)	6 (29)	1 (5)	12 (80)	2 (13)	1 (7)	26 (72)	8 (22)	2 (6)
Q5N: N + not + V	16 (76)	5 (24)	0 (0)	11 (73)	2 (13)	2 (13)	27 (75)	7 (19)	2 (6)
V4: Copula (present/past)	21 (100)	0 (0)	0 (0)	14 (93)	0 (0)	1 (7)	35 (97)	0 (0)	1 (3)
S6: Any 2 verbs	21 (100)	0 (0)	0 (0)	14 (93)	0 (0)	1 (7)	35 (97)	0 (0)	1 (3)
S4: S + V + O	20 (95)	0 (0)	1 (5)	15 (100)	0 (0)	0 (0)	35 (97)	0 (0)	1 (3)
S5: Any conjunction	21 (100)	0 (0)	0 (0)	13 (87)	1 (7)	1 (7)	34 (94)	1 (3)	1 (3)
N9: 3-word NP	19 (90)	2 (10)	0 (0)	13 (87)	2 (13)	0 (0)	32 (89)	4 (11)	0 (0)
N6: V + 2-word NP	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
N5: Article + N	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
N4: 2-word NP	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
N1: Noun	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
N2: Pronoun	20 (95)	1 (5)	0 (0)	15 (100)	0 (0)	0 (0)	35 (97)	1 (3)	0 (0)
N3: Modifier	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
N7: Plural	21 (100)	0 (0)	0 (0)	13 (87)	2 (13)	0 (0)	34 (94)	2 (6)	0 (0)
V1: Verb	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
V8: Adverb	20 (95)	1 (5)	0 (0)	14 (93)	1 (7)	0 (0)	34 (94)	2 (6)	0 (0)
V3: Prepositional phrase	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
V2: Particle/preposition	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
Q3N: Simple negation	19 (90)	2 (10)	0 (0)	13 (87)	2 (13)	0 (0)	32 (89)	4 (11)	0 (0)
S2: S + V	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
S3: V + O	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)
S1: 2 words	21 (100)	0 (0)	0 (0)	15 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)

Note. Bold data indicate grammatical structures that are Not Evident, identified by > 50% participants scoring No Credit. Underlined data indicate grammatical structures that are Evident, identified by > 50% participants scoring Full Credit. Due to rounding, total percentages range from 99 to 101. DLD = developmental language disorder; LD-ASD = language disorder associated with autism spectrum disorder; Y/N = yes/no; AMC = auxiliary, modal, or copula; VP = verb phrase; Propositional compt = propositional complement; NP = noun phrase; V = verb; N = noun; S = subject; O = object.

*Significant differences in group performance.

Table 5. Consistency between Structured Photographic Expressive Language Test–Third Edition (SPELT-3; Dawson et al., 2003) and Index of Productive Syntax (IPSyn; Scarborough, 1990) across 18 morphosyntactic structures.

Form (IPSyn no.)	SPELT-3	IPSyn	Consistency
Prepositional phrase (V3)			
DLD	Scarce Evidence	Evident	Neutral
LD-ASD	Scarce Evidence	Evident	Neutral
Plural *–s* (N7)			
DLD	Scarce Evidence	Evident	Neutral
LD-ASD	Evident	Evident	Consistent
Progressive *–ing* (V7)			
DLD	Scarce Evidence	Evident	Neutral
LD-ASD	Scarce Evidence	Evident	Neutral
Third-person singular *–s*◇ (V10)			
DLD	Evident	Scarce Evidence	Neutral
LD-ASD	Not Evident	Evident	Contradictory
Past tense *–ed* (V12)			
DLD	Evident	Evident	Consistent
LD-ASD	Scarce Evidence	Scarce Evidence	Consistent
Past tense copula *BE* (V16)			
DLD	Scarce Evidence	Evident	Neutral
LD-ASD	Scarce Evidence	Scarce Evidence	Consistent
Infinitive (S8)			
DLD	Scarce Evidence	Evident	Neutral
LD-ASD	Not Evident	Evident	Contradictory
Infinitive (two subjects)◇ (S17)			
DLD	Not Evident	Not Evident	Consistent
LD-ASD	Not Evident	Not Evident	Consistent
Wh-clause◇ (S13)			
DLD	Not Evident	Evident	Contradictory
LD-ASD	Not Evident	Scarce Evidence	Neutral
Participle (S18)			
DLD	Evident	Not Evident	Contradictory
LD-ASD	Not Evident	Not Evident	Consistent
Negative (Q5N)			
DLD	Scarce Evidence	Evident	Neutral
LD-ASD	Scarce Evidence	Evident	Neutral
Y/N interrogative (Q8)			
DLD	Scarce Evidence	Not Evident	Neutral
LD-ASD	Scarce Evidence	Scarce Evidence	Consistent
Wh-question (Q9)			
DLD	Scarce Evidence	Not Evident	Neutral
LD-ASD	Not Evident	Not Evident	Consistent
Direct/indirect object◇ (S14)			
DLD	Evident	Not Evident	Contradictory
LD-ASD	Evident	Not Evident	Contradictory
Copula *BE*◇ (V4)			
DLD	Evident	Evident	Consistent
LD-ASD	Not Evident	Evident	Contradictory
Propositional clause◇ (S11)			
DLD	Not Evident	Scarce Evidence	Neutral
LD-ASD	Not Evident	Evident	Contradictory
Relative clause◇ (S16)			
DLD	Not Evident	Scarce Evidence	Neutral
LD-ASD	Not Evident	Scarce Evidence	Neutral
Embedded clause◇ (S19)			
DLD	Evident	Not Evident	Contradictory
LD-ASD	Not Evident	Not Evident	Consistent

Note. DLD = developmental language disorder; LD-ASD = language disorder associated with autism spectrum disorder; Y/N = yes/no.

◇Structures that are assessed by only one item on the SPELT-3.

and the IPSyn, a language sample analysis, we assessed these groups' performance on 26 SPELT-3 structures and 56 IPSyn items. There were few significant differences in the groups' morphosyntactic profiles based on the SPELT-3 as the chi-square analyses identified two structures for which the DLD group outperformed the LD-ASD group (i.e., participle and the conjunction "and"). Likewise, for the most part, the groups' morphosyntactic profiles were not

significantly different based on the IPSyn, which identified only one structure on which the DLD group outperformed the LD-ASD group (i.e., S8: Infinitive) and four structures on which the LD-ASD group outperformed the DLD group (i.e., Q9: Why/when/which, etc.; Q6: *Wh*-question with auxiliary, modal, or copula; Q4: *Wh*-question with verb; and Q2: Routine question). These results provide empirical evidence supporting previous findings that suggest a considerable overlap of morphosyntactic profiles between children with DLD and children with LD-ASD (Kjelgaard & Tager-Flusberg, 2001; Park et al., 2012; Rice et al., 2009; Rice & Wexler, 1996; Roberts et al., 2004; Tager-Flusberg et al., 2003).

The current study also indicates potential grammatical weaknesses shared by both children with DLD and children with LD-ASD that are different from those found in previous studies (e.g., Cleave & Rice, 1997; Leonard, 1998; Rice & Wexler, 1996; Roberts et al., 2004). Specifically, the SPELT-3 identified six structures as Not Evident, with more than half of each group's participants scoring None Correct: propositional clause, passive voice, relative clause, *wh*-clause, infinitive (two subjects), and reflexive pronoun. This result is unsurprising as the first five structures target more advanced and complex syntactic production, and reflexive pronoun may be considered a later developing morphologic structure. In a study by Chien and Wexler (1990), the researchers used a yes/no judgment task to examine pronoun interpretation of 2- to 6-year-old children with typical development. They found that only children 5 years and older were able to correctly distinguish between personal and reflexive pronouns across various conditions, with percentages at the 50% chance level. It is also important to note that all six of the Not Evident structures were assessed by only one item on the SPELT-3. This might have caused overidentification compared to a structure that was difficult, but assessed by multiple items (e.g., *wh*-question by three items). That is, the six structures were more susceptible to the Not Evident category because participants only had one opportunity to produce the form in the assessment.

Based on the IPSyn, there were 10 items identified as Not Evident for both groups (i.e., the first 10 items at the top of Table 4). The distribution of these items in the four subscales reveals one in NP, two in VP, two in Q/N, and five in SS. A broad examination of this trend of performance suggests that this is similar to what we would expect for typical language development. That is, noun phrases are the easiest (hence, being mastered first), followed by verb phrases, followed by using negations and questions, and finally followed by complex sentence structures.

It is important to note that the absence of these forms may not necessarily indicate developmental weaknesses due to the formats of the assessments. The SPELT-3 identifies weaknesses by eliciting a prespecified set of target responses and judging their accuracy. However, 12 of the 26 SPELT-3 structures are assessed by merely one test item. This may not be sufficient to determine whether the child can or cannot produce the target structure. The IPSyn analyzes a language sample without creating specific opportunities for the child to produce each of the 56 items in 100 spontaneous utterances. Therefore, a structure that is absent in the sample does not necessarily mean that it is a grammatical weakness for the child.

Although difficulty in the acquisition of tense and agreement forms, including past tense *–ed* and third-person singular *–s*, is considered a hallmark feature of children with DLD and of a subgroup of children with ASD (Cleave & Rice, 1997; Leonard, 1998; Rice & Wexler, 1996; Roberts et al., 2004), we only found third-person singular *–s* to be Not Evident on the SPELT-3 profile of children with LD-ASD. This is likely due to our participants being older (M_{age} = 7;1 [years;months] for DLD and 6;3 for LD-ASD) than those in the previous studies (e.g., M_{age} = 4;8 in Cleave & Rice, 1997, and 5;0 in Rice & Wexler, 1996). Another possible explanation is that third-person singular *–s* was only assessed by one test item on the SPELT-3, resulting in overidentification of this form as a potential weakness. Nonetheless, the results suggest that children with DLD or LD-ASD may acquire these grammatical forms after preschool years. Therefore, the morphosyntactic structures we identified in this study may help clinicians identify next-level treatment targets for school-aged children with language disorders.

The chi-square analyses indicated significant group differences based on two SPELT-3 structures, participle and the conjunction "and," on which the DLD group outperformed the LD-ASD group. This finding aligns with the overall tendency for children with DLD to perform better than children with LD-ASD on the SPELT-3 (11 structures identified as Evident for DLD vs. six for LD-ASD and six structures identified as Not Evident for DLD vs. 12 for LD-ASD). This may be explained by how standardized assessment adversely affects children with ASD due to the requirement of a high level of attentional and behavioral compliance (Tager-Flusberg, 2004). In contrast, children with DLD have less difficulty following directions and may have more experience with standardized language testing of structural forms using the cloze format.

For the IPSyn, the chi-square analyses indicated significant differences based on one item (i.e., S8: Infinitive), on which the DLD group outperformed the LD-ASD group, and four items (i.e., Q9: Why/when/which, etc.; Q6: *Wh*-question with auxiliary, modal, or copula; Q4: *Wh*-question with verb; and Q2: Routine question), on which the LD-ASD group outperformed the DLD group. It appears that children with DLD do not ask questions as frequently as children with LD-ASD in their spontaneous language production. While we are unaware of this finding being reported in the literature, it may be an area worth further investigation. If the results can be replicated in future studies, some of these structures may be indicators of grammatical strengths or weaknesses unique to the DLD or the LD-ASD population.

Consistency Between SPELT-3 and IPSyn Profiles

We compared structures that were identified as Evident or Not Evident across SPELT-3 and IPSyn measures

and found inconsistent results. For the structures that we could make direct comparison for the DLD group, three were Consistent, four were Contradictory, and 11 were Neutral. With examination of the Contradictory structures, direct/indirect object (S14: Bitransitive predicate), embedded clause (S19: Fronted clause), and participle (S18: Gerund) were identified as Evident by the SPELT-3 but as Not Evident by the IPSyn. This is likely due to the lack of opportunity for participants to use these complex structures in their spontaneous speech. They might choose to use simpler structures to express their communicative intent. As a result, they received No Credit for these structures in the IPSyn but were indeed capable of producing them when assessed by the SPELT-3. This finding suggests that more advanced, later developing structures may be easier to elicit and assess using standardized assessment than language sample analysis (Fitton et al., 2017). However, the *wh*-clause (S13: *Wh*-clause), which may also be considered an advanced sentence structure, presents counterevidence against such hypothesis. The SPELT-3 identified this structure as Not Evident, but the IPSyn identified it as Evident for children with DLD.

For the structures that we could make direct comparison for the LD-ASD group, eight were Consistent, five were Contradictory, and five were Neutral. Of the Contradictory structures, propositional clause (S11: Propositional complement), copula *BE* (V4: Copula), third-person singular *–s* (V10: Third-person singular *–s*), and infinitive (S8: Infinitive) were identified as Not Evident by the SPELT-3 but as Evident by the IPSyn. As discussed earlier, one possible explanation is that propositional clause, copula *BE*, and third-person singular *–s* were one-item structures (infinitive was assessed by two items) on the SPELT-3. Another possible explanation is the nature of standardized assessment being highly decontextualized. Test administrators follow a rigid procedure and are restricted to certain verbal prompts that they are allowed to provide. Consequently, it is more challenging to elicit the target responses from children with ASD. Perspective-taking, known to be difficult for children with ASD due to their impaired theory of mind (Baron-Cohen, 1988; Capps et al., 2000; Tager-Flusberg, 1995; Tager-Flusberg & Sullivan, 1995), is also a factor that may adversely affect their performance. In standardized language assessment, children are usually asked to pretend to be someone and speak for that person in a presented scenario (e.g., Items 33–35, 39, 42–46, 48, and 51 on the SPELT-3). Without sufficient background information, it adds an extra layer of difficulty for children to understand why they should answer for that person. Additionally, they often have to pretend to be another person in the next picture and scenario (e.g., a boy in Item 33, an older girl in Item 34, and then a father in Item 35 on the SPELT-3). This finding suggests that more natural contexts may promote the production of these structures for children with LD-ASD. However, direct/indirect object (S14: Bitransitive predicate) is an exception, with the SPELT-3 identifying the structure as Evident and the IPSyn identifying it as Not Evident.

Overall, when evaluating each group's language performance across the two measures, the SPELT-3 appeared to have a more positive effect on eliciting complex grammatical structures than the IPSyn for children with DLD. The SPELT-3 identified three structures as Evident that were identified as Not Evident by the IPSyn (i.e., S14: Bitransitive predicate, S19: Fronted clause, and S18: Gerund). In contrast, the IPSyn appeared to provide more positive support than the SPELT-3 for children with LD-ASD. Even though the SPELT-3 identified four structures as Not Evident, more than half of the participants with LD-ASD received Full Credit for each of these IPSyn items (i.e., S11: Propositional complement, V4: Copula, V10: Third-person singular *–s*, and S8: Infinitive). Thus, it is clear that standardized assessment and language sample analysis have advantages and disadvantages in evaluating different morphosyntactic structures and different clinical populations. The two types of measures complement each other and provide a less biased morphosyntactic profile when used together (Fitton et al., 2017; Tager-Flusberg et al., 2009).

Study Limitations and Future Directions

Although the current study provides a detailed description of morphosyntactic profiles of children with DLD and children with LD-ASD, one limitation to these findings stems from our wide inclusion of children between 4 and 9 years of age. When divided into three smaller age groups (i.e., 4–5 years, 6–7 years, and 8–9 years), the majority of participants fall into the "6–7 years" group (16/21 for DLD and 8/15 for LD-ASD; see Figure 1). Because we used the "more than 50% of participants" cutoff to identify morphosyntactic structures as Evident or Not Evident, results from the current study are most appropriate to be generalized to 6- to 7-year-old children with DLD or LD-ASD. Although the DLD group was significantly older than the LD-ASD group by 10 months, there was no significant difference in their SPELT-3 scores. Additionally, Figure 1 suggests that, for both groups, there was not a close relationship between age and SPELT-3 scores. However, given our small sample size and the uneven numbers of participants in each group, future studies should more closely examine and compare the developmental patterns of morphosyntactic forms of children with DLD and of those with LD-ASD.

Another study limitation arises from our inclusionary criteria for participants with LD-ASD. They were all clinic referred and previously diagnosed with an ASD, including Asperger syndrome or pervasive developmental disorder not otherwise specified. We did not administer the Autism Diagnostic Observation Schedule–Second Edition (Lord et al., 2012) or the Autism Diagnostic Interview–Revised (Rutter et al., 2003) to confirm diagnosis. Nevertheless, we used the Childhood Autism Rating Scale–Second Edition to assess the severity of ASD symptomology. Given that the majority was in the mild–moderate symptoms category (9/15) and we used the "more than 50% of participants" cutoff to identify morphosyntactic structures as Evident or

Not Evident, results from the current study are most appropriate when applied to children with similar severity of ASD symptomology. Future studies should examine the impact of autism symptom severity on the acquisition of morphosyntactic forms.

There are also a few methodological limitations. First, the proficiency scheme used to compare performance between the two measures is not entirely parallel. We adapted the three IPSyn tiers (i.e., Full, Partial, and No Credit) to evaluate each SPELT-3 structure with three performance categories (i.e., All, Partially, and None Correct). However, 12 of the 26 SPELT-3 structures were assessed by only one test item, resulting in scoring either All Correct or None Correct for the structures. Thus, those identified as Evident or Not Evident by the SPELT-3 might be "false positive" based on only one trial. We marked these one-item structures with a diamond (◊) in Tables 3 and 5. Given the purpose of the current study, we selected this measure because of its clinical relevance and wide coverage of morphosyntactic structures. The structures identified as Not Evident in this study may serve as preliminary data for potential grammatical weaknesses. Future studies focusing on this topic should further examine the structures we identified, especially those assessed by only one test item by the SPELT-3. Our study results also demonstrate the importance of using multiple assessments and probes to identify grammatical forms to target in intervention.

Second, the IPSyn judges the proficiency of an item based on the child's free will to use it within a 50- to 100-utterance sample. As a result, more advanced structures may not appear in a conversation interview (Hadley, 1998; Heilmann et al., 2010; Miller & Chapman, 1981). This is important when interpreting the items identified as Not Evident in the current study because they are not necessarily grammatical weaknesses. Children with DLD or LD-ASD may be able to produce the Not Evident forms when specifically elicited or in another language context. Although it is not feasible to target every single item on the IPSyn protocol, researchers and clinicians may refer to Loeb et al. (1996), Lund and Duchan (1993), and Miller (1981) for strategies to probe various morphosyntactic structures, including verb forms, questions, and complex sentences.

Finally, we set the 50% cutoff as an easy reference to categorize whether more than half of the participants pass or fail a particular structure. While the criterion is arbitrary, clinicians and researchers can refer to Tables 3 and 4 for specific percentages of participants who scored All Correct/Full Credit versus None Correct/No Credit for each structure. Future studies may identify grammatical strengths and weaknesses for the two populations by referencing our data if 80%, or perhaps 40%, is deemed more sensitive.

Conclusions

The main contribution of the current study is that it provides a detailed description and comparison of morphosyntactic profiles of children with DLD and children with LD-ASD, including grammatical structures that are less commonly examined in the literature based on two types of assessments. Our findings provide more comprehensive empirical evidence to previous literature that suggests a considerable overlap of morphosyntactic profiles between the two groups (Kjelgaard & Tager-Flusberg, 2001; Park et al., 2012; Rice et al., 2009; Rice & Wexler, 1996; Roberts et al., 2004; Tager-Flusberg et al., 2003). Additionally, we identified potential grammatical weaknesses shared by school-aged children with DLD or LD-ASD who have received relatively little attention in past studies. When working with these populations, clinicians may use the same measures, such as the SPELT-3 and IPSyn to assess morphosyntactic structures, which may then be targeted in intervention. Future studies will need to evaluate if similar intervention approaches are appropriate for both children with DLD and children with LD-ASD. Our analyses also indicate structures on which one group outperformed the other. Future studies should further investigate these specific grammatical forms that may be strengths or weaknesses unique to children with DLD or children with LD-ASD. Finally, when comparing performance across testing contexts, we found inconsistencies with some structures being identified as Evident by one measure but as Not Evident by the other. These results suggest that standardized assessment and language sample analysis complement each other and that both should be used together as the gold standard to assess grammatical language.

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References

Abbeduto, L., Benson, G., Short, K., & Dolish, J. (1995). Effects of sampling context on the expressive language of children and adolescents with mental retardation. *Mental Retardation, 33*(5), 279–288.

Bangert, K. J., Halverson, D., & Finestack, L. H. (2019). Evaluation of an explicit intervention to teach grammatical forms to children with low-symptom severity autism spectrum disorder. *American Journal of Speech-Language Pathology, 28*(2), 650–663. https://doi.org/10.1044/2018_AJSLP-18-0016

Baron-Cohen, S. (1988). Without a theory of mind one cannot participate in a conversation. *Cognition, 29*(1), 83–84. https://doi.org/10.1016/0010-0277(88)90011-X

Bartolucci, G., Pierce, S. J., & Streiner, D. (1980). Cross-sectional studies of grammatical morphemes in autistic and mentally retarded children. *Journal of Autism and Developmental Disorders, 10*(1), 39–50. https://doi.org/10.1007/BF02408431

Bedore, L. M., & Leonard, L. B. (1998). Specific language impairment and grammatical morphology: A discriminant function analysis. *Journal of Speech, Language, and Hearing Research, 41*(5), 1185–1192. https://doi.org/10.1044/jslhr.4105.1185

Bishop, D. V., Snowling, M. J., Thompson, P. A., Greenhalgh, T., & the CATALISE-2 consortium. (2017). Phase 2 of CATALISE: A multinational and multidisciplinary Delphi consensus study

of problems with language development: Terminology. *The Journal of Child Psychology and Psychiatry, 58*(10), 1068–1080. https://doi.org/10.1111/jcpp.12721

Brown, R. (1973). *A first language: The early stages*. Harvard University Press. https://doi.org/10.4159/harvard.9780674732469

Capps, L., Losh, M., & Thurber, C. (Eds.). (2000). "The frog ate the bug and made his mouth sad": Narrative competence in children with autism. *Journal of Abnormal Child Psychology, 28*(2), 193–204. https://doi.org/10.1023/A:1005126915631

Carrow-Woolfolk, E. (1999a). *Comprehensive Assessment of Spoken Language (CASL)*. Western Psychological Services.

Carrow-Woolfolk, E. (1999b). *Test for Auditory Comprehension of Language–Third Edition (TACL-3)*. Pro-Ed.

Chien, Y.-L., & Wexler, K. (1990). Children's knowledge of locality conditions in binding as evidence for the modularity of syntax and pragmatics. *Language Acquisition, 1*(3), 225–295. https://doi.org/10.1207/s15327817la0103_2

Cleave, P. L., & Rice, M. L. (1997). An examination of the morpheme BE in children with specific language impairment: The role of contractibility and grammatical form class. *Journal of Speech, Language, and Hearing Research, 40*(3), 480–492. https://doi.org/10.1044/jslhr.4003.480

Condouris, K., Meyer, E., & Tager-Flusberg, H. (2003). The relationship between standardized measures of language and measures of spontaneous speech in children with autism. *American Journal of Speech-Language Pathology, 12*(3), 349–358. https://doi.org/10.1044/1058-0360(2003/080)

Crystal, D., Fletcher, P., & Garman, M. (1976). *The grammatical analysis of language disability*. Edward Arnold.

Dawson, J. I., Stout, C. E., & Eyer, J. A. (2003). *Structured Photographic Expressive Language Test–Third Edition (SPELT-3)*. Janelle Publications.

Eadie, P. A., Fey, M. E., Douglas, J. M., & Parsons, C. L. (2002). Profiles of grammatical morphology and sentence imitation in children with specific language impairment and Down syndrome. *Journal of Speech, Language, and Hearing Research, 45*(4), 720–732. https://doi.org/10.1044/1092-4388(2002/058)

Ellawadi, A. B., & Weismer, S. E. (2015). Using spoken language benchmarks to characterize the expressive language skills of young children with autism spectrum disorders. *American Journal of Speech-Language Pathology, 24*(4), 696–707. https://doi.org/10.1044/2015_AJSLP-14-0190

Ellis, P. D. (2010). *The essential guide to effect sizes: Statistical power, meta-analysis, and the interpretation of research results*. Cambridge University Press. https://doi.org/10.1017/CBO9780511761676

Finestack, L. H. (2018). Evaluation of an explicit intervention to teach novel grammatical forms to children with developmental language disorder. *Journal of Speech, Language, and Hearing Research, 61*(8), 2062–2075. https://doi.org/10.1044/2018_JSLHR-L-17-0339

Finestack, L. H., & Satterlund, K. E. (2018). Current practice of child grammar intervention: A survey of speech-language pathologists. *American Journal of Speech-Language Pathology, 27*(4), 1329–1351. https://doi.org/10.1044/2018_AJSLP-17-0168

Finestack, L. H., Sterling, A. M., & Abbeduto, L. (2013). Discriminating Down syndrome and fragile X syndrome based on language ability. *Journal of Child Language, 40*(1), 244–265. https://doi.org/10.1017/S0305000912000207

Fitton, L., Wofferd, M. C., Bustamante, K. N., De Novi, N. M., Nunez, B. M., & Wood, C. (2017). Comparing methods for assessing the English grammatical development of Spanish-speaking English learners. *Perspectives of the ASHA Special Interest Groups, 2*(SIG 16), 45–60. https://doi.org/10.1044/persp2.SIG16.45

Hadley, P. A. (1998). Language sampling protocols for eliciting text-level discourse. *Language, Speech, and Hearing Services in Schools, 29*(3), 132–147. https://doi.org/10.1044/0161-1461.2903.132

Haebig, E., Sterling, A., & Hoover, J. (2016). Examining the language phenotype in children with typical development, specific language impairment, and fragile X syndrome. *Journal of Speech, Language, and Hearing Research, 59*(5), 1046–1058. https://doi.org/10.1044/2016_JSLHR-L-15-0185

Heilmann, J., Nockerts, A., & Miller, J. F. (2010). Language sampling: Does the length of the transcript matter. *Language, Speech, and Hearing Services in Schools, 41*(4), 393–404. https://doi.org/10.1044/0161-1461(2009/09-0023)

Howlin, P. (1984). The acquisition of grammatical morphemes in autistic children: A critique and replication of the findings of Bartolucci, Pierce, and Streiner, 1980. *Journal of Autism and Developmental Disorders, 14*(2), 127–136. https://doi.org/10.1007/BF02409656

Kjelgaard, M. M., & Tager-Flusberg, H. (2001). An investigation of language impairment in autism: Implications for genetic subgroups. *Language and Cognitive Processes, 16*(2–3), 287–308. https://doi.org/10.1080/01690960042000058

Kohnert, K., Windsor, J., & Ebert, K. D. (2009). Primary or "specific" language impairment and children learning a second language. *Brain and Language, 109*(2–3), 101–111. https://doi.org/10.1016/j.bandl.2008.01.009

Lee, L. L. (1974). *Developmental Sentence Scoring (DSS)*. Northwestern University Press.

Leonard, L. B. (1998). *Children with specific language impairment*. MIT Press.

Leonard, L. B. (2014). *Children with specific language impairment* (2nd ed.). MIT Press. https://doi.org/10.7551/mitpress/9152.001.0001

Loban, W. (1976). *Language Development: Kindergarten through Grade Twelve. NCTE Committee on Research Report No. 18.* National Council of Teachers of English.

Loeb, D. F., Pye, C., Redmond, S., & Richardson, L. Z. (1996). Eliciting verbs from children with specific language impairment. *American Journal of Speech-Language Pathology, 5*(4), 17–30. https://doi.org/10.1044/1058-0360.0504.17

Lord, C., Rutter, M., DiLavore, P. C., Risi, S., Gotham, K., & Bishop, S. L. (2012). *Autism Diagnostic Observation Schedule–Second Edition (ADOS-2)*. Western Psychological Services.

Lund, N., & Duchan, J. (1993). *Assessing children's language in naturalistic contexts* (3rd ed.). Prentice Hall.

Miller, J. F. (1981). *Assessing language production in children*. Allyn & Bacon.

Miller, J. F., & Chapman, R. S. (1981). The relation between age and mean length of utterance in morphemes. *Journal of Speech and Hearing Research, 24*(2), 154–161. https://doi.org/10.1044/jshr.2402.154

Miller, J. F., & Chapman, R. S. (2000). *Systematic Analysis of Language Transcripts* (SALT) [Computer software]. SALT Software.

Norbury, C. F., Gooch, D., Wray, C., Baird, G., Charman, T., Simonoff, E., Vamvakas, G., & Pickles, A. (2016). The impact of nonverbal ability on prevalence and clinical presentation of language disorder: Evidence from a population study. *The Journal of Child Psychology and Psychiatry, 57*(11), 1247–1257. https://doi.org/10.1111/jcpp.12573

Park, C. J., Yelland, G. W., Taffe, J. R., & Gray, K. M. (2012). Morphological and syntactic skills in language samples of

pre-school aged children with autism: Atypical development. *International Journal of Speech-Language Pathology, 14*(2), 95–108. https://doi.org/10.3109/17549507.2011.645555

Paul, R. (2007). *Language disorders from infancy through adolescence: Assessment & intervention* (3rd ed.). Mosby.

Perona, K., Plante, E., & Vance, R. (2005). Diagnostic accuracy of the Structured Photographic Expressive Language Test: Third Edition (SPELT-3). *Language, Speech, and Hearing Services in Schools, 36*(2), 103–115. https://doi.org/10.1044/0161-1461(2005/010)

Rice, M. L. (2003). A unified model of specific and general language delay: Grammatical tense as a clinical marker of unexpected variation. In Y. Levy & J. Schaeffer (Eds.), *Language competence across populations: Toward a definition of specific language impairment* (pp. 63–95). Erlbaum.

Rice, M. L., Hoffman, L., & Wexler, K. (2009). Judgments of omitted BE and DO in questions as extended finiteness clinical markers of specific language impairment (SLI) to 15 years: A study of growth and asymptote. *Journal of Speech, Language, and Hearing Research, 52*(6), 1417–1433. https://doi.org/10.1044/1092-4388(2009/08-0171)

Rice, M. L., Tomblin, J. B., Hoffman, L., Richman, W. A., & Marquis, J. (2004). Grammatical tense deficits in children with SLI and nonspecific language impairment: Relationships with nonverbal IQ over time. *Journal of Speech, Language, and Hearing Research, 47*(4), 816–834. https://doi.org/10.1044/1092-4388(2004/061)

Rice, M. L., & Wexler, K. (1996). Toward tense as a clinical marker of specific language impairment in English-speaking children. *Journal of Speech and Hearing Research, 39*(6), 1239–1257. https://doi.org/10.1044/jshr.3906.1239

Rice, M. L., & Wexler, K. (2001). *Test of Early Grammatical Impairment*. The Psychological Corporation.

Roberts, J. A., Rice, M. L., & Tager-Flusberg, H. (2004). Tense marking in children with autism. *Applied Psycholinguistics, 25*(3), 429–448. https://doi.org/10.1017/S0142716404001201

Roid, G. H., & Miller, L. J. (1997). *Leiter International Performance Scale–Revised (Leiter-R)*. Western Psychological Services.

Rutter, M., Le Couteur, A., & Lord, C. (2003). *Autism Diagnostic Interview–Revised (ADI-R)*. Western Psychological Services.

Scarborough, H. S. (1990). Index of Productive Syntax. *Applied Psycholinguistics, 11*(1), 1–22. https://doi.org/10.1017/S0142716400008262

Schopler, E., Van Bourgondien, M. E., Wellman, G. J., & Love, S. R. (2010). *Childhood Autism Rating Scale–Second Edition (CARS-2)*. Western Psychological Services.

Schulman, B. B., & Capone, N. C. (2010). *Language development: Foundations, processes, and clinical applications*. Jones & Bartlett.

Spaulding, T. J., Plante, E., & Farinella, K. A. (2006). Eligibility criteria for language impairment: Is the low end of normal always appropriate. *Language, Speech, and Hearing Services in Schools, 37*(1), 61–72. https://doi.org/10.1044/0161-1461(2006/007)

Tager-Flusberg, H. (1995). "Once upon a ribbit": Stories narrated by autistic children. *British Journal of Developmental Psychology, 13*(10), 45–59. https://doi.org/10.1111/j.2044-835X.1995.tb00663.x

Tager-Flusberg, H. (2004). Strategies for conducting research on language in autism. *Journal of Autism and Developmental Disorders, 34*(1), 75–80. https://doi.org/10.1023/B:JADD.0000018077.64617.5a

Tager-Flusberg, H., Levy, Y., & Schaeffer, J. (2003). Language impairment in children with complex neurodevelopmental disorders: The case of autism. In Y. T. Levy & J. Schaeffer (Eds.), *Language competence across populations: Toward a definition of specific language impairment* (pp. 297–321). Erlbaum.

Tager-Flusberg, H., Paul, R., & Lord, C. (2005). Language and communication in autism. In F. R. Volkmar, R. Paul, A. Klin, & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders: Diagnosis, development, neurobiology, and behavior* (pp. 335–364). Wiley. https://doi.org/10.1002/9780470939345.ch12

Tager-Flusberg, H., Rogers, S., Cooper, J., Landa, R., Lord, C., Paul, R., Rice, M., Stoel-Gammon, C., Wetherby, A., & Yoder, P. (2009). Defining spoken language benchmarks and selecting measures of expressive language development for young children with autism spectrum disorders. *Journal of Speech, Language, and Hearing Research, 52*(3), 643–652. https://doi.org/10.1044/1092-4388(2009/08-0136)

Tager-Flusberg, H., & Sullivan, K. (1995). Attributing mental states to story characters: A comparison on narratives produced by autistic and mentally retarded individuals. *Applied Psycholinguistics, 16*(3), 241–256. https://doi.org/10.1017/S0142716400007281

Tomblin, J. B., Records, N. L., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of Speech, Language, and Hearing Research, 40*(6), 1245–1260. https://doi.org/10.1044/jslhr.4006.1245

Wiig, E. H., Secord, W. A., & Semel, E. (2013). *Clinical Evaluation of Language Fundamentals–Fifth Edition (CELF-5)*. Pearson.

Appendix A

SPELT-3 Structures and Examples

Structure	Example
Propositional clause	They think it's cold out.
Passive voice	The baby is picked up.
Relative clause	The boy who wears a bow tie looks smart.
Reflexive pronoun	She hugs herself.
Wh-clause	Tell me where you were yesterday.
Infinitive (two subjects)	I want you to leave.
Copula *BE*	She is sad.
Embedded clause	After I came home, I washed my hands.
Wh-question	What's your name?
Past tense copula *BE*	She was hungry.
Third-person singular *–s*	He jumps.
Irregular past tense	They drank milk.
Infinitive	They want to play video games.
Direct/indirect object	Give your money to the poor.
Participle	I hear a baby crying.
Y/N interrogative	Are you going to the party?
Conjunction "because"	They are tired because they stayed up late last night.
Conjunction "and"	Mom is cooking and Dad is watching TV.
Future modal "will"	He will jump.
Possessive *'s*	Mike's skateboard is cool.
Negative	I don't like it.
Past tense *–ed*	He jumped.
Progressive *–ing*	He is jumping.
Prepositional phrase	The ball is on the table.
Plural *–s*	There are three apples.
Possessive pronoun	Her dress is pretty.

Note. Y/N = yes/no.

Appendix B

IPSyn Items (in the same order as Table 4 from most to least difficult) and Examples

Item	Example
V15: Ellipsis	Yes it can. Here it is.
S9: Let/make/help, etc.	Let's do this. Help it stand up.
Q10: Tag question	It goes here, right?
Q9: Why/when/which, etc.	Why? Which one?
N11: Lexical bound morpheme	tallest, a fixer
S19: Fronted clause	The one I like best is the baby doll.
S18: Gerund	Singing is fun.
V11: Past modal	It might fall.
S17: Infinitive (two subjects)	I need you to help.
S14: Bitransitive predicate	I give her tea. I give tea to her.
Q8: Y/N question	Are you tired?
Q6: *Wh*-question with AMC	Where is it?
V13: Past auxiliary	He was talking.
Q4: *Wh*-question with verb	Who made it?
Q2: Routine question	What dis?
V16: Past copula	They were tired.
S15: 3-VP sentences	They are tired and they want to go.
S11: Propositional complement	I know you broke it.
S16: Relative clause	Find the one that fits in here.
S12: Conjoined clause	I'll start it and then you finish.
V10: Third-person singular *–s*	This goes here.
V9: Evident/past modal	I can/could do it.
S13: *Wh*-clause	Here's where it went.
V12: Past tense *–ed*	cried
Q1: Intonation question	Mine? Want some?
Q7N: Negation of AMC	doesn't work, not ready
S7: Conjoined phrase	red or blue, you and me
N8: 2-word NP + V	This one goes in.
N10: NP adverb	too hard, really cute
V7: Progressive *–ing*	sleeping
S8: Infinitive	I like to swim.
S10: Adverbial conjunction	after, unless, until, as soon as
V6: Evident auxiliary	She is coming.
V5: Catenative	hafta, gotta
V14: Medial adverb	I just need two.
Q5N: N + not + V	You can't have it.
V4: Copula (present/past)	He's fine.
S6: Any 2 verbs	I like play this.
S4: S + V + O	I like this.
S5: Any conjunction	and me, or a caboose
N9: 3-word NP	my new car
N6: V + 2-word NP	see two cats
N5: Article + N	a baby
N4: 2-word NP	my doll
N1: Noun	dog
N2: Pronoun	I, here
N3: Modifier	his, that boy
N7: Plural	cats
V1: Verb	eat
V8: Adverb	now, hardly
V3: Prepositional phrase	at school
V2: Particle/preposition	up, under
Q3N: Simple negation	no talk, not yours
S2: S + V	Monkey fall.
S3: V + O	Help me.
S1: 2 words	Lookit Mom.

Note. Y/N = yes/no; AMC = auxiliary, modal, or copula; VP = verb phrase; NP = noun phrase; V = verb; N = noun; S = subject; O = object.