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Diversity within complex syntax: Complex syntax tokens of children with Developmental Language Disorder

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Abstract

Constructivist accounts of children's acquisition of complex syntax make a distinction between children's initial complex syntax tokens and later-produced complex syntax tokens. Children's initial complex syntax tokens are concrete expressions or lexically-specific constructions (e.g., *Remember, I like chocolate*). Later-produced complex syntax tokens are built from constructional schemas that contain abstract syntactic categories. The purpose of this study was to explore whether 5-year-old children with developmental language disorder (DLD) produce a lower percentage of later-produced complex syntax tokens as compared to same-age peers with typical language development (TD). Using language sample analysis, we categorized the complex syntax productions of 28 preschool children (DLD n = 14) as early-produced or later-produced complex syntax tokens. Coded complex syntax productions included complement clauses, relative clauses, and subordinate conjunction clauses. We compared the percentage of later-produced complex syntax tokens by language group. Children with DLD produced a lower percentage of later-produced complement clause and subordinate conjunction clause tokens in child–adult conversation than TD children. However, there was no language group difference in children's production of later-produced relative clauses. Further consideration of the balance between early-produced and later-produced complex syntax tokens for children with DLD as compared to same-age TD peers is warranted. The reliance on early-produced tokens for preschool children with DLD as compared to their TD peers may mean that children with DLD are limited in their use of complex syntax.

Keywords: complex syntax; language development; formulaic language; developmental language disorder; relative clauses

1. Introduction

Complex syntax is a well-documented area of weakness for preschool and early school-age children with developmental language disorder (DLD). Complex syntax refers to utterances that include one or more dependent clauses (Barako Arndt & Schuele, 2013). Preschool and early school-age

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children with DLD produce fewer instances of complex syntax and produce more grammatical errors within complex syntax utterances than do same-age peers (Barako Arndt & Schuele, 2012; Owen, 2010; Owen & Leonard, 2006; Schuele & Tolbert, 2001). Because complex syntax encompasses multiple types of dependent clauses, it is possible that preschool children with DLD are challenged differentially across complex syntax types. To explore this issue, we conducted a granular analysis of complement clause, subordinate conjunction clause, and relative clause productions in the language samples of 5-year-old children with and without DLD. To evaluate the hypothesis of Diessel and colleagues (Diessel, 2004; Diessel & Tomasello, 2000, 2001) that child complex syntax productions can be classified as early-produced or later-produced, we evaluated whether 5-year-old children with DLD produce a lower percentage of later-produced tokens as compared to their language typical same-age peers. Early-produced tokens were differentiated from later-produced tokens on the basis of diversity of grammatical features and propositional status.

1.1. Complex syntax development by children with typical language

Diessel (2004) asserted that children's initial complement clause, subordinate conjunction clause, and relative clause tokens contain a single proposition and do not involve true embedding or subordination. These utterances include complement clauses like *I bet it's mine*, subordinate conjunction clauses like *Because I'm tired*, and relative clauses like *It's the one that spins*. Children's first utterances with complex syntax occur before children have acquired abstract representations of complex syntax structures, limiting children's complex syntax to tokens built around either concrete expressions or lexically-specific constructions. Concrete expressions are rote-learned expressions that are stored as a single unit, such as the matrix clause *I bet* in the utterance *I bet it's mine* (Diessel, 2004). Lexically-specific constructions are partially productive schemas, or frames, that are associated with particular meanings or communicative functions. Lexically-specific constructions contain some recurring elements that are fixed and some open slots that can be filled with variable elements, such as the relative clause *Here's a ___ that ____* (Ambridge & Lieven, 2011; Diessel, 2004).

Later-produced complex syntax tokens are not built around concrete expressions or lexically-specific constructions but are built from constructional schemas that contain abstract syntactic categories. Children gain access to complex syntax constructional schemas, in part, by analogizing across lexically-specific constructions on the basis of formal similarities between tokens (Ambridge & Lieven, 2011). Abstract complex syntax knowledge is acquired gradually as children become productive with complex syntax constructional schemas (Diessel, 2004). Productivity can be defined as the likelihood that a constructional schema will be activated for constructing a novel expression rather than a competing constructional schema (Langacker, 2000). However, the production of later-produced complex syntax tokens do not simply replace early-produced tokens (Diessel, 2004). Instead, later-produced complex syntax tokens come to coexist with tokens built around concrete expressions and lexically-specific constructions in children and adults' expressive repertoire of complex syntax tokens.

1.2. Complement clause development

Children's first complement clauses emerge in the second year of life (Bloom et al., 1989; Limber, 1973). Complement clause sentences contain a matrix clause (e.g., *I know*) and a sentential complement clause (e.g., I know *Mary needs my keys*) or a WH-complement clause (e.g., I know *where Mary's keys are*). At 3;0, children frequently produce three verbs with complement clauses: *think*, *know*, and *see*. As children develop, they continue to add to their repertoire of complement clause-taking verbs (Diessel, 2004).

Children's initial complement clauses have fixed semantic and syntactic attributes. Nearly all complement clause verbs produced at the start of the third year of life co-occur in a matrix clause with a first-person or second-person pronoun subject (e.g., the matrix clause *I think* in the utterance *I think it's a ball*). Diessel and Tomasello (2001) referred to these matrix clauses as formulaic matrix clauses. Syntactically, formulaic matrix clauses do not have auxiliaries, modals, adverbs, or prepositional phrases in the main clause verb phrase and sentential complement sentences do not include a complementizer. For example, the formulaic matrix clause *I think* is a simple first-person pronoun-verb combination with no adverbial modifiers and is in the present indicative active. The matrix clause of early-produced complement clause sentences may precede or follow the complement clause (e.g., *It's a crazy bone, I think*). Semantically, formulaic matrix clauses act as attention getters or convey degree of certitude or likelihood, behaving much like a modal as in *I think it's a ball* (Thompson & Mulac, 1991). Formulaic matrix clauses contain no additional propositional content and therefore do not present a second state of affairs (e.g., an event occurring independently of the event described in the complement clause).

By the end of their third year, children begin to produce complement clause sentences that are syntactically and semantically distinct from early-produced complement clause sentences. Syntactically, later-produced complement clause sentences contain matrix clauses that are composed of varied noun phrases in the subject position and grammatical morphemes in the predicate (e.g., inflectional morphology is present on the matrix verb; Bloom et al., 1989; Diessel & Tomasello, 2001). The matrix clause of later-produced complement clause sentences occurs in the utterance-initial position and the optional complementizer *that* may be produced following the matrix clause. These syntactic features signal a change in the semantics of the matrix clause, indicating that the matrix clause presents an independent second state of affairs. These later-produced complement clause sentences exist side by side with early-produced complement clause sentences in children's spontaneous spoken language. See Figure 1 in the Methodology section for a further description.

1.3. Subordinate conjunction clause development

Children begin to produce subordinate conjunction clauses around the age 2;6 (Clark, 1971; Diessel, 2004). Subordinate conjunction clauses are a complex syntax type that joins a dependent clause with a main clause with a subordinate conjunction such as *because*, *when*, or *if* (Schuele, 2009). First productions of subordinate conjunction clauses include the conjunction

because and generally occur in response to *why* questions (Diessel, 2004). Prior to children's third birthday, the subordinate conjunction *so* emerges. The primary function of the conjunction *so* is to provide additional information to children's immediately prior utterances (e.g., *It opened. So [that] the horsie could get out* [Nina 2;9]). At the age of three, *because, so,* and *when* are the most frequent subordinate conjunctions and are produced in more than 80% of children's subordinate conjunction clauses (Diessel, 2004).

Children's initial subordinate conjunction clauses have fixed semantic and syntactic attributes. Children's initial productions of subordinate conjunction clauses are nonembedded utterances that relate to a preceding utterance, linking across speaker turns. For example, if a parent asks *Why did you hit your brother?*, a child might respond *because he laughed at me* (Diessel, 2004; Weiler & Schuele, 2014). Often, early subordinate conjunction clauses occur in specific conversational routines. Nearly all of children's initial subordinate conjunction clauses are single clauses semantically related to an utterance produced somewhere else in the discourse (Diessel, 2004).

In the months after their third birthday, children begin to produce subordinate conjunction clauses that are syntactically and semantically distinct from early-produced subordinate conjunction clauses. They begin to produce *because, so,* and *when* in biclausal tokens, expressing causal relations and temporal relations intrasententially. They also begin to produce additional subordinate conjunctions that express specific temporal relations, such as *before* and *after*, as well as conditional relations, such as *if* (Bloom et al., 1980). Over the first five years of life, more than eighty percent of subordinate conjunction clauses expressing specific temporal or conditional relations are biclausal tokens (Diessel, 2004). See Figure 2 in the Methodology section for a further description.

1.4. Relative clause development

Like complement clauses, children's initial relative clauses emerge in the second year of life (Diessel & Tomasello, 2000). Relative clauses are dependent clauses that modify noun phrases (Quirk et al., 1985). Overwhelmingly, children's initial relative clauses are either isolated noun phrases or presentational relative clauses (Diessel & Tomasello, 2000). Isolated noun phrases are relative clauses which consist only of a noun phrase and a relative clause (e.g., *The meal that you eat* [Adam 4;1]). Presentational relatives contain pronouns as the matrix clause subject and a copula *be* verb as the matrix clause verb (Diessel & Tomasello, 2000, 2005). The early production of isolated noun phrase relatives and presentational relatives may be influenced by their relatively high frequency in the ambient language environment (Roland et al., 2007). However, Diessel hypothesized that isolated noun phrase relatives (e.g., *The toy I like*) and presentational relatives (e.g., *This is the toy I like*) occur early in child language transcripts due to the propositionally reduced nature of those structures.

Children's first relative clauses have fixed semantic and syntactic attributes. The main clause of presentational relatives consists of three components: (1) a deictic pronoun (i.e., *this, that, here, there, it*), (2) the copula *be* in the present tense form, and (3) a predicate nominal, which functions as a slot that can be filled by any noun or pronoun (e.g., *This is the one I*

got). Semantically, early-produced relative clauses function to establish a referent in the focus position whereas the main clause of the sentence remains propositionally empty. Early-produced relative clauses contain only a single proposition with unfamiliar information expressed after the isolated noun phrase or predicate nominal (e.g., *The toy I like; This is the toy I like*).

By age 4;0, children produce relative clauses that are syntactically and semantically distinct from early-produced relative clauses. Syntactically, the matrix clauses of later-produced relative clause tokens may have a variety of noun phrases. The verb phrases in the predicate are no longer exclusively the copular *be* (Diessel & Tomasello, 2000). As with complement clauses, syntactic changes also signal a change in the semantics of the matrix clause. Later-produced relative clause tokens possess a matrix clause that expresses its own independent state of affairs (e.g., *What happened to the thing that I went to* [Adam 4;3]). In later-produced relative clauses, the independent proposition of the matrix clause is modified by the relative clause proposition (Diessel, 2004). Between the age of four and five, children begin to produce object and subject relative clauses that are rare in children's utterances within adult-child conversation, including relative clauses where the head is located in a prepositional phrase (e.g., oblique-object relative clauses such as *Change it to the one you love best* [Adam 4;4]). However, presentational relatives and isolated noun phrase relatives constitute more than half of 5-year-olds' spoken relative clauses (Diessel & Tomasello, 2000). See Figure 3 in the Methodology section for a further description.

1.5. Children with DLD and complex syntax development

A small body of evidence suggests that children with DLD have difficulty producing complex syntax tokens which require abstract knowledge of complex syntax (Novogrodsky & Friedmann, 2006; Owen & Leonard, 2006; Schuele & Dykes, 2005). Frizelle and Fletcher (2014) found that 6-year-old children with DLD were better at imitating presentational relative clauses than biclausal relative clauses. It is plausible that children with DLD are delayed in producing later-produced complement clause, subordinate conjunction clause, and relative clause tokens in their spontaneous spoken language as compared to same-age TD peers.

We proposed that the study of early-produced and later-produced complex syntax tokens in children with DLD was an important next step in understanding complex syntax developmental progression for children with DLD. A granular analysis of preschool children's complex syntax productions may provide evidence that children with DLD remain in a protracted period of complex syntax development where predominately early-produced complex syntax tokens are generated. Such evidence would align with profiles of DLD that posit a protracted period of grammatical process or principle acquisition (Deevy et al., 2017; Grela & Leonard, 1997; Leonard, 1995; Rice et al., 1995; Rice et al., 1998). By revealing that children with DLD produce a lower percentage of later-produced complex syntax tokens, we aimed to provide evidence that 5-year-old children with DLD were more likely to produce complex syntax tokens built around concrete expressions and lexically specific constructions than TD peers.

Our study of children's production of spontaneous spoken language investigated the later-produced complex syntax tokens of 5-year-old children with DLD and same-age TD children. We investigated whether language group status influences the percentage of later-produced complex syntax tokens in children's spontaneous spoken language. One research question was addressed: Is there a between language group difference in children's percentage of later-produced complex syntax tokens?

2. Methodology

2.1. Participants

Twenty-eight monolingual English-speaking early school-age children (13 females, 15 males) completed eligibility and experimental tasks. See Table 1 for parent reported maternal education and race/ethnicity information.

Fourteen participants were children with DLD (female = 5, male = 9). The age of these participants ranged from 4;10 (4 years, 10 months) to 5;11. Inclusion criteria for children with DLD included: (a) could not score -2 standard deviations (SD) below the mean on the Primary Test of Nonverbal Intelligence (PTONI; Ehrler & McGhee, 2008), (b) standard score below 85 on the Structured Photographic Expressive Language Test Preschool–Second Edition (SPELT-P 2; Dawson et al., 2005), (c) score below the chronological age criterion on the Test of Early Grammatical Impairment Screener Probes, Third Person Singular and Past Tense (TEGI; Rice & Wexler, 2001); and (d) per parent report no history of autism or hearing loss.

Table 1
Participant demographic characteristics by diagnostic group

	Group	
Characteristic	DLD (n = 14)	TD (n = 14)
Age in months		
M (SD)	63.71 (5.01)	66.93 (3.12)
Maternal education		
High school or GED	6	3
Bachelor's degree	7	8
Post-baccalaureate	1	3
Race/ Ethnicity		
White/Caucasian	9	7
African American	0	2
Latino/Hispanic	5	5

Fourteen children with typical language development (male = 6, female = 8) were included as a comparison group. The age of participants ranged from 5;0 to 5;10. Inclusion criteria for children with typical language included: (a) could not score -2 SD below the mean on the Primary Test of Nonverbal Intelligence (PTONI; Ehrler & McGhee, 2008), (b) standard score above 87 on the Structured Photographic Expressive Language Test Preschool–Second Edition (SPELT-P 2; Dawson et al., 2005), (c) score at or above the chronological age criterion on the Test of Early Grammatical Impairment Screener Probes, Third Person Singular and Past Tense (TEGI; Rice & Wexler,

2001); (d) no enrollment in speech-language or other special education services; and (e) per parent report no history of autism or hearing loss.

2.2. Language samples

Language samples were collected using the Hadley Interview Protocol for Eliciting Text-Level Discourse (Hadley, 1998). The Hadley Protocol elicits personal narratives and retellings of fictional stories from memory. The Hadley Protocol elicited language samples of at least 200 utterances during a brief session with the first author. In the event that the interview protocol did not elicit an adequate language sample, a play-based language sample collection protocol was administered. The play-based language sample protocol elicited language samples during a brief, 45-minute play session with the first author. In the event that more than 200 utterances were elicited using the protocols, the first 200 utterances were included for analysis. Language samples were collected at the participants' elementary school sites.

Although most participants provided 200-utterance samples during administration of the Hadley Protocol, there were participants that required the supplemental play-based language sample protocol. Five participants in the DLD participant group and three participants in the TD group required the supplemental play-based language sample protocol to reach 200 utterances. When considering differences in percentage of complex syntax produced during the Hadley Protocol and the play-based language sample protocol, we found no evidence of protocol type effects (Mann-Whitney U= 69.00, p = .45).

Language samples were transcribed and coded for grammatical morphology following the conventions for the Systematic Analysis of Language Transcripts (Miller & Chapman, 2008). Utterances were segmented using sentence boundaries, pauses, and intonation changes (Schuele, 2009). For example, when a child paused before finishing a grammatically complete utterance, this utterance was segmented and considered abandoned. Transcription reliability of all samples was examined at the utterance boundary and morpheme level. All collected utterances were transcribed and coded by the first author as well as secondary transcribers. Secondary transcribers (MA students who had extensive child language transcription experience) resolved any transcription differences with the primary transcriber through mutual consensus.

2.3. Study specific coding

We identified utterances that were coded for complement clause, subordinate conjunction clause, and relative clause complex syntax structures. Early-produced complex syntax tokens were operationally defined as complex syntax utterances that possess the syntactic attributes of the initial complement clause, relative clause, or subordinate conjunction clause productions as described in Diessel (2004). Early-produced complement clause tokens use a simple first-person pronoun-unmarked complement clause-taking verb combination in the matrix clause, like the clause *I think*. Coding of early-produced and later-produced complement clauses were determined using the criteria in Figure 1.

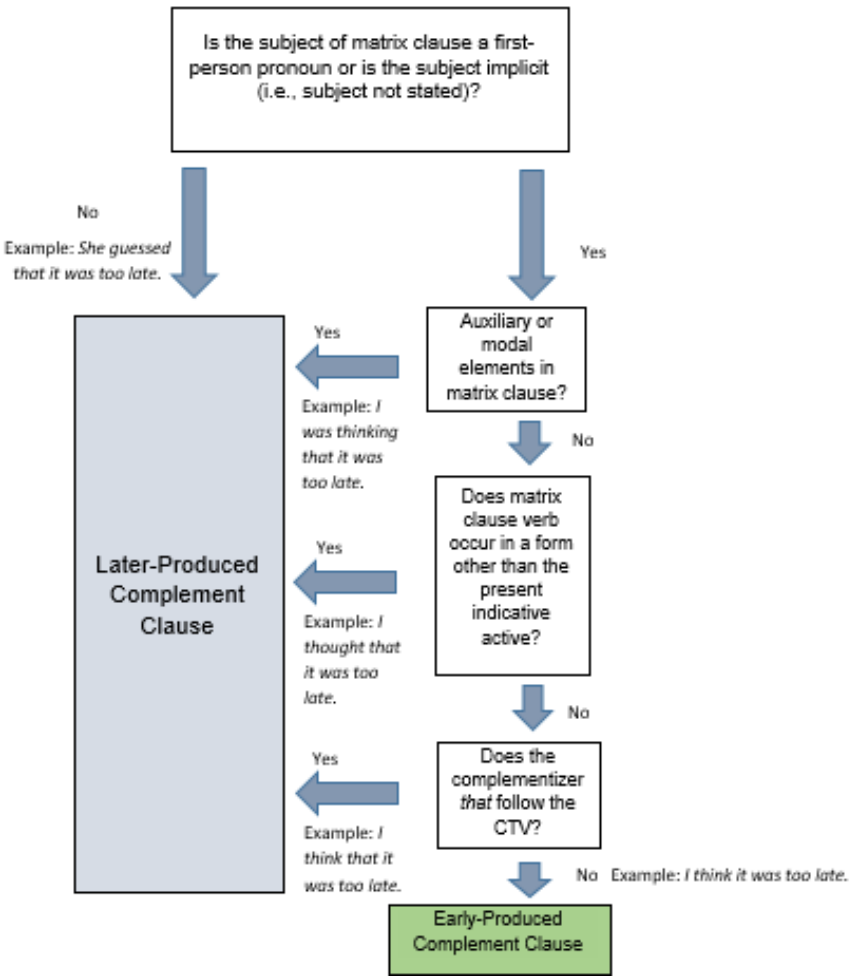

Figure 1. Decision Tree Assigning Later-Produced Complement Clause Status from Diessel & Tomasello (2001) Proposed Criteria

Early-produced subordinate conjunction clause tokens are non-embedded dependent clauses that start with a subordinate conjunction, as seen in the subordinate conjunction clauses *Because I'm tired* and *So [that] the horsie could get out*. We categorized all complex syntax tokens that do not share these attributes as later-produced complex syntax tokens. Coding of early-produced and later-produced subordinate conjunction clauses were determined using the criteria illustrated in Figure 2.

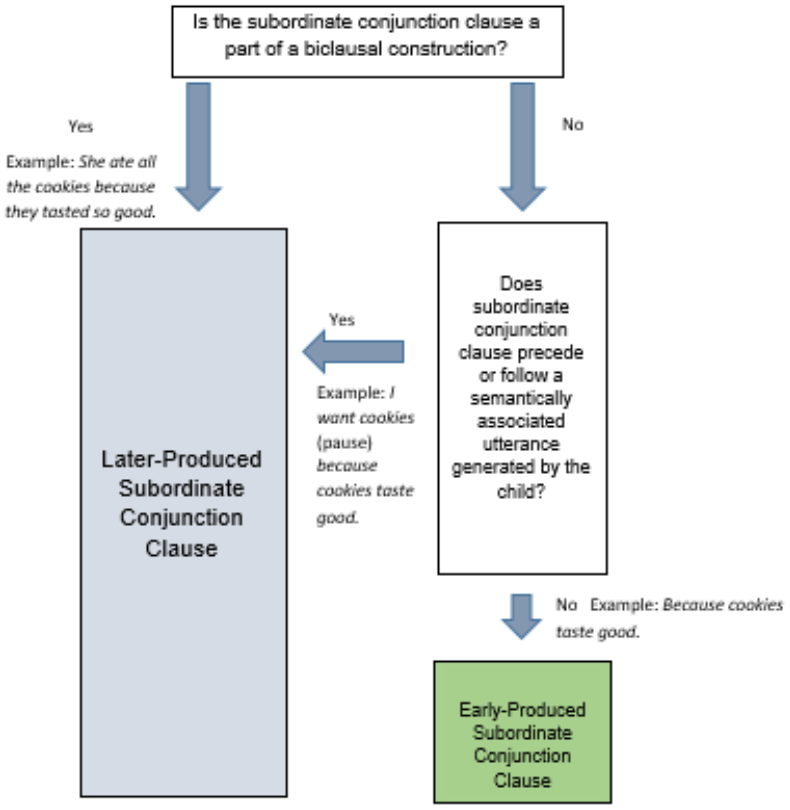

Figure 2. Decision Tree Assigning Later-Produced Subordinate Conjunction Clause Status from Diessel (2004) Proposed Criteria

Early-produced relative clause tokens are presentational relatives that consist of a deictic pronoun, a copula *be* in the present tense form, and a predicate nominal, as seen in the presentational relative *This is the thing that spins*. Nominal relative clauses ([nrc]; e.g., *This is where I put my shoes*; Schuele, 2009) were included in some conditions as outlined in Coding Manual (Appendix A). In addition, if a child produced a relative clause modifying an isolated noun phrase, this instance was also coded as an early-produced relative clause token. Coding of early-produced and later-produced relative clauses were determined using the criteria illustrated in Figure 3.

Six types of complex syntax tokens were included in our study specific analysis: (1) early-produced complement clauses [C-EDV], (2) early-produced subordinate conjunction clauses [S-EDV], (3) early-produced relative clauses [R-EDV], (4) later-produced complement clauses [C-LDV], (5) later-produced subordinate conjunction clauses [S-LDV], and (6) later-produced relative clauses [R-LDV]. Additional coding criteria was provided in the coding manual, located in Appendix A.

2.4. Analysis plan

We conducted a Mann-Whitney U test to compare the percentage of later-produced complex syntax tokens of children with TD and DLD; the Mann-

Whitney U test was selected due to the non-normal distribution of the data. If there was a significant between group difference, we planned three follow-up comparisons of later-produced complement clause, subordinate conjunction clause, and relative clause tokens. Follow-up group comparisons would be conducted with a Bonferroni correction (.05/3). Each variable was derived by dividing the total number of later-produced complex syntax tokens for each complex syntax type by the total number of complex syntax tokens for each complex syntax type and converting that proportion into a percentage. Although we based our analysis plan on the analysis performed by Marinellie (2004), we elected to use a non-parametric statistical analysis to account for the non-normal distribution of the data. Analyses were completed within IBM SPSS Statistics (Versions 23-25).

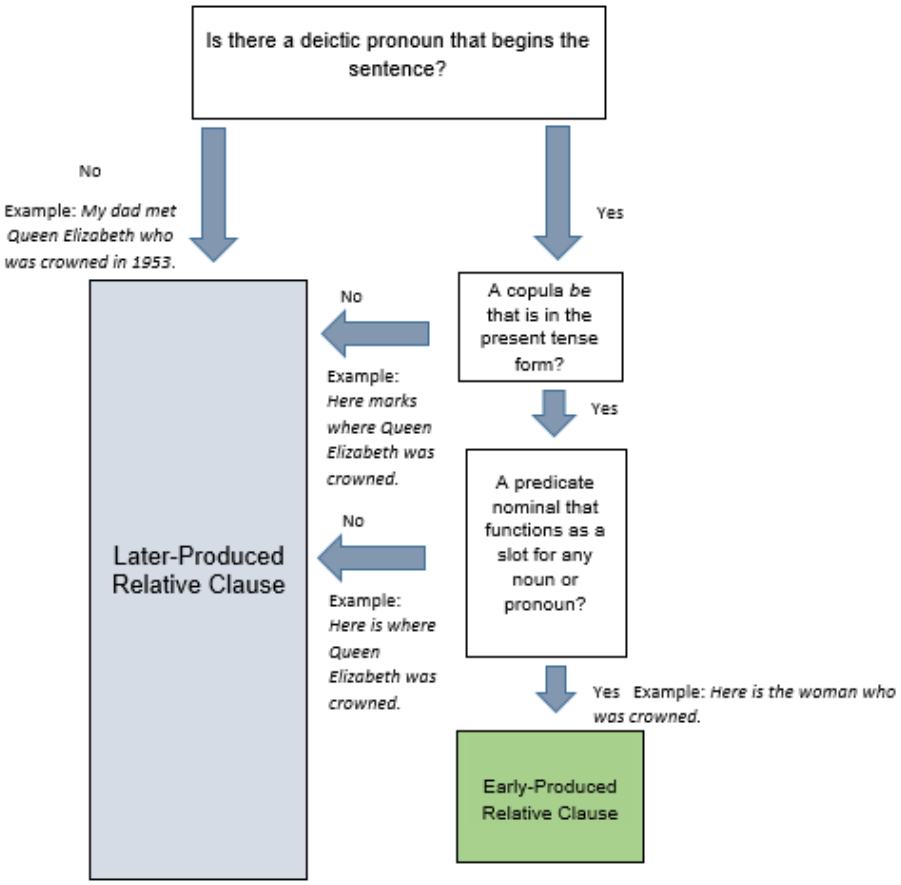

Figure 3. Decision Tree Assigning Later-Produced Relative Clause Status from Diessel & Tomasello (2000) Proposed Criteria

3. Findings

Table 2 provides the median percentage (and percentage range) of later-produced and earlier produced complex syntax tokens by complex syntax type. Because complex syntax token production were not normally distributed based on the Shapiro-Wilk test (ps < 0.05), we report the median data for each condition.

Table 2
Median Percentage and Percentage Range of Later-Produced and Early-Produced Complement Clause, Subordinate Conjunction Clause, and Relative Clause Tokens by Language Group

	TD (n = 14)		DLD (n = 14)	
	Median	Range	Median	Range
% of later-produced complex syntax tokens	64	35-85	43	0-78
% of later-produced complement clause tokens	67	17-100	40	0-82
% of later-produced subordinate conjunction clause tokens	100	0-100	50	0-100
% of later-produced relative clause tokens	58	20-100	49	41-70
% of early-produced complex syntax tokens	36	18-65	57	22-100
% of early-produced complement clause tokens	32.5	0-100	63	31-100
% of early-produced subordinate conjunction clause tokens	0	0-33	48	29-71
% of early-produced relative clause tokens	43	0-69	50	0-100

Note: TD = typically-developing; DLD = developmental language disorder.

When comparing the mean ranking of children with TD (55.50) to children with DLD (29.50), there was a significant between group difference for percentage of later-produced complex syntax tokens (Mann-Whitney U=336.00, p > .001). Thus, the percentage of later-produced complex syntax tokens of the TD group was larger than the percentage of later-produced complex syntax tokens of the DLD group.

Due to the significant between group difference for percentage of later-produced complex syntax tokens, three follow-up Mann-Whitney U tests were performed to investigate potential between group differences within complement clause, subordinate conjunction clause, and relative clause types. When comparing the mean ranking of children with TD (21.18) to children with DLD (7.82), there was a significant between group difference in children's production of later-produced complement clauses (Mann-Whitney U= 4.50, p < .001).

Similarly, when comparing the mean ranking of children with TD (18.54) to children with DLD (10.46), there was a significant between group difference in children's production of later-produced subordinate conjunction clauses

(Mann-Whitney U= 41.50, p = .01). However, there was no significant between group difference in children's production of later-produced relative clauses (Mann-Whitney U= 93.50, p = .83).

The percentage of early-produced complex syntax tokens followed the opposite pattern, whereby children with DLD produced more early-produced complex syntax tokens than children with TD. Indeed, there was a significant overall between group difference (Mann-Whitney U=127.50, p = .008), with significant differences for complement clauses (Mann-Whitney U= 7.50, p = .003) and subordinate conjunction clauses (Mann-Whitney U= 35.50, p = .007) but not for relative clauses (Mann-Whitney U= 69.00, p = .88).

4. Discussion

4.1. General discussion

We investigated the later-produced complex syntax tokens of 5-year-olds with DLD and TD by comparing the percentage of later-produced complex syntax tokens. We then conducted follow-up group comparisons of three complex syntax types: the percentage of later-produced complement clause tokens, the percentage of later-produced subordinate conjunction clause tokens, and the percentage of later-produced relative clause tokens.

Five-year-old children with DLD produced an overall lower percentage of later-produced complex syntax tokens in child–adult conversation than TD children. Our finding provides preliminary support for a qualitative between language group difference in preschool complex syntax production. As compared to TD children, children with DLD produced a higher percentage of complex syntax tokens built around concrete expressions and lexically-specific frames. For example, children with DLD were more likely to produce a higher percentage of utterances like "I think it's mine" than "Sam thought that it was time to go." Thus, our study provides evidence that the spoken language of preschool children with DLD contained a lower percentage of later-produced complex syntax tokens within complex syntax types. Our finding is in contrast with claims that language groups primarily differ in the quantity but not quality of complex syntax productions (Marinellie, 2004). We further explore the between language group difference in complex syntax in the theoretical implications section provided below.

Although children with DLD produced an overall lower percentage of later-produced complex syntax tokens in child–adult conversation than TD children, group differences did not apply for each complex syntax type. There was a significant between group difference in percentage of later-produced complement clauses and subordinate conjunction clauses. However, there was no significant between group differences for relative clauses, providing little evidence for a between group difference in the percentage of later-produced relative clause tokens. We next examine our findings for each complex syntax type.

The language samples of 5-year-old children with DLD contained a lower percentage of later-produced complement clauses than those of TD peers. Our findings supply evidence that children with DLD produce a greater percentage of complement clauses with formulaic matrix clauses than TD peers (i.e., early-produced complement clauses). Such a delay among 5-year-olds aligns with evidence that 4- to-6-year-old children with DLD are less likely than TD

peers to include the optional complementizer *that* in complement clause elicitation tasks (Owen & Leonard, 2006). Production of complement clauses with the optional complementizer *that* may provide evidence that the complement clause is syntactically subordinated to the matrix clause and the matrix clause expresses some propositional content (Diessel, 2004; Morton & Schuele, 2021). It is possible that preschool children with DLD produce formulaic matrix clause features due to a delay relative to TD peers in acquiring matrix clauses that express propositional content (Morton et al., 2025). In our theoretical implications section, we further explore how our findings relate to the developmental trajectory of complement clauses for children with DLD.

Our findings supply evidence that children with DLD produce a greater percentage of monoclausal subordinate conjunction clause utterances than TD peers. Challenges with biclausal subordinate conjunction clauses among 5-year-old children with DLD aligns with evidence that 7-to-10-year-old children with DLD produced fewer biclausal subordinate conjunction clauses than typically developing peers in conversation and spoken narratives (Greenhalgh & Strong, 2001; Marinellie, 2004). A deficit in later-produced subordinate conjunction clauses may indicate that preschool children with DLD have a more restricted means of expressing temporal, causal, or adversative relationships as compared to TD peers (Greenhalgh & Strong, 2001). In our theoretical implications section, we further explore how our finding relates to the developmental trajectory of subordinate conjunction clauses for children with DLD.

The language samples of 5-year-old children with DLD did not contain a lower percentage of later-produced relative clauses than those of TD peers. Our finding does not supply evidence that children with DLD produce a greater percentage of presentational relatives and isolated noun phrase relatives than TD peers. These results contrast with studies of relative clauses produced by children with DLD using elicited imitation and conversation language sample analysis (Frizelle & Fletcher, 2014; Marinellie, 2004). However, it is important to consider that children in both the TD and DLD groups produced a very limited number of relative clause tokens as compared to complement clauses and subordinating conjunction clauses. Additionally, children with and without language impairment do not necessarily demonstrate their full expressive complex syntax ability in conversation (Eisenberg, 2005; Steel et al., 2013). Relative clauses are infrequent in young children's spontaneous language when compared to the production of simple sentences (Diessel, 2004; Steel et al., 2013). Thus, language samples alone may not provide a full picture of children's competency with these structures (Eisenberg, 2005). Alternative elicitation methods, such as sentence imitation, could provide a means of circumventing the limitations of spontaneous language sampling and provide children more opportunities to produce complex syntax structures.

4.2. Theoretical implications

Because we did not include a younger, language-matched TD group in our study, it remains unclear whether the later-produced complex syntax

profile of children with DLD parallels that of TD children, but at a lower performance level. Despite this shortcoming, our findings supply preliminary evidence that preschool children with DLD may undergo a longer period than same-age peers where most complex syntax tokens are built around concrete expressions and lexically-specific frames. When compared to same-age TD children, 5-year-old children with DLD produced a lower percentage of complement clause and subordinate conjunction clause tokens that show evidence of abstract complex syntax knowledge. However, if we are to argue for a between language group difference in abstract complex syntax knowledge, two points must be addressed. First, we discuss why the lower percentage of later-produced complex syntax tokens of the DLD group suggests a delay in producing tokens generated from abstract complex syntax knowledge. Second, we discuss the potential contributing factors for a between language group difference.

According to Diessel (2004), abstract complex syntax knowledge is acquired gradually over the preschool years. A between language group difference suggests that children with DLD are further behind TD peers in the gradual process of becoming productive with complex syntax constructional schemas. However, we do not argue that abstract complex syntax knowledge is absent from 5-year-old children with DLD. Because they produced some later-produced complex syntax tokens, we acknowledge that 5-year-old children with DLD must have a degree of abstract complex syntax knowledge. Instead, the between language group difference suggests that the likelihood that a complex syntax constructional schema will be activated depends on language group.

The finding of a between language group difference raises the question of what possible contributing factors underlie this difference. We next evaluate two potential contributing factors. First, linguistic environmental factors may have contributed to the between language group difference. Diessel asserted that a complex syntax constructional schema is learned through exposure to multiple exemplars of a complex syntax type with various items (e.g., words) in the positions, or slots, of a lexically-specific frame. Home linguistic environments offer opportunities for exposure to these multiple exemplars (Vasilyeva et al., 2006). However, the amount of exposure may vary depending on the nature of the home linguistic environment and the language learning abilities of the child. For example, preschoolers with a history of typical language development receive more maternal complex syntax input than preschoolers with a history of receptive-expressive language delay within the home (Huttenlocher et al., 2010). Therefore, it is possible that children with language impairment may not receive the same degree of exposure to multiple exemplars of complex syntax types, limiting their development of abstract complex syntax knowledge.

Second, differences in vocabulary acquisition may have influenced the between group difference in later-produced subordinate conjunction and complement clause production. Some complex syntax vocabulary words, such as subordinating conjunctions and complement clause verbs, occur more frequently in later-produced tokens than other complex syntax vocabulary words. Unlike utterances containing *because* and *so*, child utterances containing temporal and conditional conjunctions like *while* and *if* occur in

biclausal tokens in more than eighty percent of the subordinate conjunction clauses (Diessel, 2004). Similarly, some complement clause verbs, such as *pretend* and *show*, rarely occur in formulaic matrix clauses (Diessel & Tomasello, 2001). Owen Van Horne and Lin (2011) suggested that early school-age children with DLD produce fewer different complement clause verbs and are less likely to combine low-frequency verbs with a complement clause than their TD peers. It is possible that children with DLD have more difficulty acquiring the complex syntax vocabulary necessary for later-produced subordinate conjunction and complement clauses. Thus, a deficit in vocabulary may contribute to lower percentage of later-produced complex syntax tokens of the DLD group.

4.3. Limitations

It is important to recognize that there are potential limitations to our study that should be considered when interpreting our findings. First, although there was not a statistically significant age difference between our DLD and TD groups ($t(26) = 1.05$, $p = .15$), we note that the mean age of TD participants was numerically larger than that of our DLD participants. Second, we recognize that future group design studies should recruit larger participant samples. Although our collected sample was adequately powered to detect a group difference between our participant groups, we plan to set larger participant recruitment goals moving forward. Finally, more mothers of children in the TD group received a bachelor's degree or advanced degree than mothers of children in the DLD group. We acknowledge that differences in maternal educational level may have played a role in the frequency and variety of complex syntax structures heard by children in the DLD and TD groups. Indeed, Huttenlocher and colleagues (2010) found differences in maternal educational levels and care giver speech that may mediate language growth over children's first four years of life. Future studies of the complex syntax productions of children with and without DLD should attempt to control for maternal educational level.

5. Conclusion

Our results support previous findings that five-year-old children with DLD produce fewer instances of complex syntax and fewer types of complex syntax in their spontaneous spoken language than same-aged peers. However, we also found that children with DLD produce fewer instances of later-emerging complex syntax tokens than same-aged peers, providing preliminary evidence that later-emerging complex syntax is especially challenging for children with DLD. Future observational and experimental studies will further investigate how children with DLD acquire and master later-emerging complex syntax types.

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Appendices

Appendix A: Coding Manual

Database description: The current study involves an analysis of clinician-child language audio recordings.

What utterances were eligible for secondary complex syntax coding?

- Based on Schuele (2009)
  a. Two or more clauses form an utterance with the clauses combined with a coordinate or subordinate conjunction.
  b. Two or more clauses form an utterance with one clause embedded or dependent on the other clause (i.e., main clause and dependent clause).
  c. An utterance that includes only a subordinate conjunction and the dependent clause.
  d. The main clause or independent clause has been elided by the speaker as conversational discourse allows such elision.
  e. An utterance that includes only the relative clause because the NP appears elsewhere in the discourse.

Secondary Complex Syntax Coding

1. **What complex syntax types receive secondary complex syntax coding?**
   a. The following **primary** complex syntax types were included in our study:
      i. full propositional complements [fpc],
      ii. WH-finite complement clauses [wfc],
      iii. WH-nonfinite complement clauses [wnfc],
      iv. subject relative clauses [src],
      v. other relative clauses [rc],
      vi. subordinating conjunction clauses [sc].

   See Table below for description of complex syntax types.

CS Type	Notes	Examples
[sc] subordinate clauses with subordinating conjunctions:	Code if two clauses joined with subordinate conjunction or if subordinate conjunction + clause. Did not include adverbial conjuncts (e.g. however, though, so, thus, therefore; see Quirk et al. 1985).	*I went to the store because I needed a new dress.* *Because he wanted the cookie.*
[fpc] full propositional	Embedded clause may be headed by complementizer *that, if, whether* (Haegeman, 1994). In some utterances	*Mary knew the boys would leave at 4:00.*

clause (sentential complement)	complementizers are obligatory, in others optional.	*The old man wondered whether they were going.*
[wfc] WH finite clause or WH clausal complement	The embedded clause is a verb complement that contains a WH pronoun and a finite verb.	*I wondered where we were going on Saturday.* *I know who Jim was going to the dance with.*
[wnfc] WH non-finite clausal complement	The embedded clause is a verb complement that contains a WH pronoun and a non-finite verb.	*He doesn't know where to go.*
[src] subject relative clause	Subject in relative clause is relativized. Can modify noun in any position of utterance. Relative marker (e.g. who, that, which) is obligatory. Relative marker may be deleted as a developmental error.	*The man drove the car that crashed.*
[rc] relative clause	Object or other non-subject phrase in relative clause is relativized.	*I saw the toy Mary brought to show-n-tell.*

2. What secondary complex syntax codes are provided?

a. The following **secondary** complex syntax types were included in our study:

i. early-produced complement clauses [C-EDV],
ii. early-produced relative clauses [R-EDV],
iii. early-produced subordinate conjunction clauses [S-EDV],
iv. later-produced complement clauses [C-LDV],
v. later-produced relative clauses [R-LDV],
vi. later-produced subordinate conjunction clauses [S-LDV]

See Table below for description of complex syntax types.

Secondary CS Type	Notes	Examples
[C-EDV] Early-produced complement clauses	Code if (a) [fpc], [wfc], or [wnfc] matrix clause contains a first-person pronoun, second-person pronoun, or has an implicit subject, (b) main verb is unmarked on the surface for tense or is accompanied by a	*I think I get one.* *Remember, it's my turn?* *You know who got a pet?*

	model, auxiliary, or adverb, **and** (c) does not have complementizer *that*	
[C-LDV] Later-produced complement clauses	Code if (a) [fpc], [wfc], or [wnfc] matrix clause contains subject that is not a first-person pronoun, second-person pronoun, or has an implicit subject, (b) main verb is not unmarked on the surface for tense and/or has a model, auxiliary, or adverb, **or** (c) has a complementizer *that*	*He bet I would lose.* *She thinks I'm going to move.* *I think that I need a snack.* *I can remember the first pet I had.*
[R-EDV] Early-produced relative clauses	Code if (a) [src] or [rc] utterance is an isolated noun phrase modified by a relative clause Or if (b) i. [src] or [rc] utterance has a main clause that contains a pronoun like *it*, *he*, *there, this, where, here*, etc., ii. main verb is copula like *is, are, was, were*, etc., **and** iii. a predicate nominal is the modified NP [See Coding Exceptions regarding nrc]	*The one that spins.* *Here is the toy I just got.* *He is the kid that moved to my school.* *Big dogs that my mom rescues.*
[R-LDV] Later-produced relative clauses	Code if (a) [src] or [rc] utterance has a main clause that contains a subject that is not a pronoun **or** ii. main verb is not copula. [See Coding Exceptions regarding nrc]	*My dad was the last player that was picked.* *He sees the dog that jumps.*
[S-EDV] Early-produced subordinate conjunction clauses	Code if (a) subordinate conjunction clause appears outside of a biclausal token, meaning the child produced the clause without an adjoined clause.	*A: Why did you leave?* *C: Because I was hungry.* *A: Why did you do that?* *C: So (that) I could win.*
[S-LDV] Later-produced subordinate	Code if (a) subordinate conjunction clause appears in a biclausal token, meaning the child produced two adjoined	*I got a present because it was my birthday.*

conjunction clauses	clauses that are linked by a subordinate conjunction.	*I left after everyone got there.* *To get one because I love pizza.*

Exceptional Coding Situations

Nominal relative clauses. Diessel (2004) does not provide guidance regarding whether [nrc] can occur in early-produced relative clauses. At issue is whether the WH- pronoun is a predicate nominal like those contained in presentational relatives. Because this information cannot guide our decision-making, we do not provide [nrc] additional coding.

UPDATE: 8/12/2020. [nrc] coding is proposed for inclusion using the criteria below:

Secondary CS Type	Notes	Examples
[R-EDV] Early-produced relative clauses	Code if (a) [nrc] utterance has a main clause that contains a pronoun like *it*, *he*, *there, this, where, here*, etc., **and** ii. main verb is copula like *is, are, was, were*, etc.	*This is where the babies get changed?*
[R-LDV] Later-produced relative clauses	Code if (a) [src] or [rc] utterance has a main clause that contains a subject that <u>is not</u> a pronoun **or** ii. main verb <u>is not</u> copula.	*You got whoever got back to here first.*

Subordinate conjunction clauses that are separated by more than Interjections, Fillers, or Filled Pauses. [S-LDV] coding should be assigned to an utterance if it is truly biclausal or if an intervening adult utterance is limited to an interjection, filler, or filled pause. For example:

C: I wanna stand up.

A: (okay)

C: Cause my legs hurt [cs][sc][S-LDV].

In contrast, subordinate conjunction clauses that are separated by more than interjections, fillers, or filled pauses should be coded as [S-EDV]. For example:

C: I wanna stand up.

A: Why?

C: Cause my legs hurt [cs][sc][S-EDV].

Do not code any other types of complex syntax. This instruction extends to [pc], [cc] and any other types of complex syntax that do not apply to our complement clause, relative clause, and subordinate conjunction clause coding scheme.

Notes and clarifications

A note on *say*. We acknowledge that the complement clause verb *say* can be used to embed a complement clause (e.g., *He said (that) it was time to go*) or to convey a direct quotation (e.g., *He said, "It's time to go"*). Although it is plausible that the direct quotation use of *say* does not reflect an instance of embedding, we apply the same complement clause coding criteria. The purpose of C-EDV is not to code all instances of complement clauses that evidence a hierarchical relation between main and complement clauses. Rather, they describe a specific type of complement clause utterance, as described in the **secondary coding table**.

A note on *why*. Diessel (2004) indicates that the most S-EDV tokens are *because* clauses that are responses to *why* questions. Due to this fact, the number of why questions posed to a child may influence the number of S-EDV tokens produced. We take this as an instance of contextual factors that influence the production of production of complex syntax (Fox & Thompson, 1990). Because adult presentation of why questions may artificially influence the production of S-EDV, we encourage that LSA findings be corroborated with elicitation studies of early- and later-produced complex syntax tokens.