

UNIVERSITY COLLEGE LONDON

Division of Psychology and Language Sciences

# When I'm 25, I will...

THE EFFECTS OF DEVELOPMENTAL LANGUAGE  
DISORDER ON CHILDREN'S FUTURE NARRATIVES

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## **Abstract**

Previous research suggests language contributes to the development of future-thinking skills. To explore whether children with limited linguistic competence struggle to engage in future-oriented behaviours, the current study examined five indices of syntactic complexity in a large sample of children's future-oriented narratives collected during the Surrey Communication and Language in Education Study (SCALES). Children with developmental language disorder (DLD) wrote shorter stories with fewer words per t-unit compared to typically developing peers. Children with limited language skills also had a harder time using subordination to express the motivations underlying their desires for the future. These results suggest the reduced use of complex grammar in the narratives of children with DLD impacts their ability to plan towards future objectives. An exploratory analysis of temporal perspective provides preliminary support for the idea that children with DLD experience declarative memory deficits that affect their ability to use semantic and episodic knowledge in the generation of future-oriented narratives.

**Keywords:** developmental language disorder, future-thinking skills, syntactic complexity

*For speech is so much more than words and sentences.*

John Steinbeck, *Travels with Charley*

## 1. Introduction

The ability to think about the future has contributed significantly to the evolution of human culture and civilisation (Tulving, 2001). The anticipation of future events is not only an essential component of human cognition, but a distinguishing feature of the species: primates are unable to project themselves into the future (Atance and O’Neill, 2001).

The finding that primates are solely present-oriented suggests language might be a necessary (and likely non-sufficient) pre-requisite for the emergence of episodic future thinking. Further support for this hypothesis comes from a study exploring the cognitive factors affecting the development of episodic future thinking in children aged 6-11 (Ferretti et al., 2018). Using a task with minimal narrative demands, the authors found children’s future-thinking skills correlated with measures of phonological short-term and verbal working memory, suggesting imagining oneself in the future requires verbal skills.

If language contributes to the development of future-thinking skills, children with limited linguistic competence may find it harder to engage in future-oriented behaviours compared to typical developing peers and might consequently be less able to modify their present actions to bring about future goals. To explore this possibility further, the present study examines syntactic complexity and temporal perspective in a large sample of children’s future narratives to investigate whether children with developmental language disorder (DLD) and their typically developing peers think about the future in similar ways.

Developmental language disorder (DLD), previously known as specific language impairment (SLI), is a neuro-developmental disorder associated with reduced vocabulary, limited sentence structure and impairments in discourse (DSM-5; American Psychiatric Association, 2013). These language difficulties not only interfere with academic achievement, but also disrupt the development of other cognitive domains. Nilsson and Jensen de López (2016), for instance, performed a meta-analysis of 17 studies with 745 children aged 4-12 to explore the

relationship between language and theory of mind (ToM). Their results show that children with DLD had substantially lower ToM performance compared to age-matched typically developing peers, suggesting the effects of developmental language disorder expand to other areas of cognition beyond language (e.g., theory of mind).

Building onto the idea that impairment in one domain (e.g., language) extends into another (e.g., the ability to attribute mental states), the present secondary analysis explores the relationship between language and future-thinking skills in a large sample of children taking part in the Surrey Communication and Language in Education Study (SCALES). Section 1 introduces the SCALES project and describes the future narratives collected when the children were in Year 8. The second section reviews previous scholarship on syntactic complexity and relates it to the methodologies of the current analysis. Statistical results are reported in Section 3 (indices of syntactic complexity) and Section 4 (temporal perspective). The fifth section discusses the effects of reduced complexity on children’s ability to plan towards future objectives and explores the idea that children with DLD experience declarative memory deficits. The essay concludes with study limitations and an overview of areas for future research. The pre-registration for this study can be found on the Open Science Framework ([osf.io/pdnjx](https://osf.io/pdnjx)).

## **1.1 The SCALES project**

SCALES is the first longitudinal UK population study of language development and disorder at school entry (Norbury et al., 2016, 2017). The project consisted of three main phases: (i) a population screen of language at school entry (7,267 children), (ii) an in-depth assessment of 590 children from age 5 to 8 years old and (iii) an additional follow-up of 499 children between the age of 8 and 13 years.

### *1.1.1 Assessing language skills*

In Year 1, the SCALES team selected a stratified sample of 590 children (aged 5-6) for in-depth assessment of language, social and cognitive skills. Following Tomblin et al. (1996),

<b>Understanding</b>	<b>Speaking</b>
Receptive One-Word Picture Vocabulary Test (ROWPVT)	Expressive One-Word Picture Vocabulary Test (EOWPVT)
Test for Reception of Grammar (TROG short form)	School-Age Sentence Imitation Test-English 32 (SASIT-E32)
<i>Assessment of Comprehension and Expression (ACE)</i>	
Narrative Comprehension	Narrative Retelling Subtest

Table 1: Language assessments administered in Year 1

the authors evaluated children’s language skills using three tests focusing on language understanding and three examining the ability to articulate thoughts correctly. The six assessments are summarised in Table 1. Combining the two components of the One-Word Picture Vocabulary Test, the authors derived five language composite scores and classified children scoring below  $-1.5SD$  on at least two of these five measures as language impaired. Using this cut-off criteria, the prevalence rate of developmental language disorder at school entry was estimated to be around 7.58% (Norbury et al., 2016).

### 1.1.2 Exploring future-thinking

The third phase of SCALES focused on children’s social, emotional and mental health outcomes between the age of 8 and 13 years (Goh et al., 2021; Suksasilp et al., 2021). In Year 8, the SCALES team assessed a total of 244 children. Part of the cohort ( $N = 196$ ) was tested in school before the 26<sup>th</sup> of March 2020 (beginning of the covid-19 lockdown), while the remaining children ( $N = 48$ ) completed the assessment online during lockdown. Table 2 summarises the children’s vocabulary scores by language group and gender. Interested in the way pre-teens would approach a future-oriented narrative, the SCALES team asked Year 8 children (aged 12-13) to write a short story about the lives they would be leading at 25 years of age using the following writing prompt:

For this task you are going to imagine that you are 25 years old. Write about the life you are leading including things like your interests, your home life and your work

at the age of 25. You have up to 15 minutes to write as much or as little as you wish. Please try to write in full sentences and paragraphs like you are writing a story. You can spend a bit of time planning before you write if you wish. I will tell you when to stop writing if you reach the end of the time.

Pandemic restrictions, however, meant the SCALES team was unable to gather future narratives from each participant. In this study, we considered all available narrative samples ( $N = 212$ ) and excluded the 32 children (15 with DLD) who did not provide a narrative from the analysis. The final sample contained 108 boys (27 diagnosed with DLD) and 104 girls (18 with DLD). Because we were interested in variation across the full spectrum of language ability, no statistical outliers were excluded.

## 2. Syntactic complexity

Previous research on syntactic complexity in the expressive language of children with DLD has focused exclusively on spontaneous language samples (e.g., Delage and Frauenfelder, 2020; Tuller et al., 2011). While this approach can be used to study specific aspects of speech production (e.g., failed attempts), it is limited by the lower proportion of complex structures found in spoken language (e.g., Biber, 1988; Roland et al., 2007). The analysis of written language, on the other hand, provides access to a wide-range of complex grammatical constructions not easily encountered in speech (Hsiao et al., 2022). The aim of our analysis focusing on future-oriented narratives is therefore two-fold: (i) complement previous work on

		<b>DLD</b>		<b>TD</b>	
		Male	Female	Male	Female
Amount		37 (15%)	23 (9%)	89 (36%)	95 (39%)
Age		12;8	12;6	12;7	12;7
<b>Vocabulary</b>	Receptive	112.1 (21.2)	113.0 (17.3)	136.4 (15.7)	136.2 (13.8)
	Expressive	105.5 (21.3)	109.9 (17.1)	130.0 (13.8)	128.0 (13.4)

Table 2: Research sample and raw vocabulary scores in Year 8

syntactic complexity in children with DLD and (ii) consider the effects of reduced complexity on children's ability to engage in future-oriented behaviours.

## 2.1 The effects of reduced complexity

To illustrate how children's reduced use of complex constructions may restrict their ability to express elaborate thoughts, we have taken a future narrative from our corpus and manually removed all subordinate phrases:

(A1) I want to be sharing a flat with my best friend as roommates. In my flat I want the colour scheme to be grey and pink with a comfortable sofa. I would like a TV in my room and some kind of dim light source. I would like to be an actress. I'd especially like to do comedy. I would also like to be a lawyer or a midwife. I wouldn't mind what job I have. I'd like to do swimming. I would also like to do private singing lessons. Another interest that I like is baking and cooking especially cakes Yum. I'd like to get a rescue dog.

This (artificial) example shows how the systematic avoidance of dependent clauses would limit a child's ability to express complex thoughts. In fact, while coordination can be used to list the things one would like to do (e.g., I would also like to be a lawyer or a midwife), it fails to provide the structure needed to explain the reasons behind these choices. In other words, removing complex constructions significantly restricts the child's ability to describe why she would like to be a lawyer or take private singing lessons. Compare the version in (A1) with the original narrative:

(A2) **When I am 25** I want to be sharing a flat with my best friend as roommates. In my flat I want the colour scheme to be grey and pink with a comfortable sofa. I would like a TV in my room and some kind of dim light source **because I get scared of what's in the dark. When I am 25** I would like to be an actress **because I like drama**. I'd especially like to do comedy **because it's funny. If I don't become an actress** I would also like to be a lawyer **because I'm very good**

**at debating** or a midwife **because that's helping the community**. **If I'm not any of those** I wouldn't mind what job I have **as long as I am happy**. **When I am 25** I'd like to do swimming **because it's fun and very good for you**. I would also like to do private singing lessons **because I enjoy singing although I'm not very good at it**. Another interest that I like is baking and cooking especially cakes Yum. **When I am 25** I'd like to get a rescue dog **because after what some of them have been through they deserve a nice warm bed and endless food and play**.

The reinstatement of embedded clauses (highlighted in bold) transforms the narrative: subordination not only helps the child express why she would like to work in certain fields, but also shows she is engaging in future-oriented behaviours such as thinking about the qualities she would bring to specific jobs (e.g., being very good at debating) and the impact of her actions (e.g., helping the community). While we have no proof (or reason) to believe that any of the children in our corpus are systematically incapable or unwilling to produce subordinates clauses, we hope this extreme example helps contextualise the quantitative results discussed in the following sections.

## 2.2 Avoiding complex utterances

In real-life samples, discerning the capacity to be complex from the avoidance of complexity is extremely challenging. Previous research on this topic suggests children and adolescents with DLD are able to produce complex sentences, but might not consistently do so in spontaneous utterances (i.e., when they are free to choose their own words). As part of a larger study exploring the relationship between working memory and complex syntax, Delage and Frauenfelder (2020) analysed the complexity of spontaneous language samples and found that children with DLD produced significantly fewer complex utterances (i.e., sentences with at least one embedded clause) than age-matched controls. A similar study by Tuller et al. (2011) showed that French-speaking adolescents with DLD avoided using complex structures and relied on compensatory strategies to minimise the chances of uttering a target-deviant sentence that would attract attention to their language impairment.

Arguing in favour of reducing the social stigma associated with ungrammatical utterances, Tuller and colleagues (2011) counterintuitively praise the infrequent use of subordination and hazard the claim that complexity avoidance in older adolescents might actually be a therapeutic goal. While reducing the chances of producing target-deviant utterances might be seen as a positive outcome, explicitly training children and adolescents with DLD in the use of grammatical alternatives to complex constructions (e.g., direct discourse, juxtaposition, etc) might have a negative impact on their ability to engage in future-oriented behaviours. Measuring grammatical sophistication using different indices of syntactic complexity (Ortega, 2015), the present secondary analysis contributes to previous scholarship by considering (i) whether children with DLD also show reduced complexity in their written samples and (ii) whether the avoidance of complexity negatively affects their ability to plan towards future objectives.

### **2.3 Methods and data analysis**

Previous research has used different approaches to assess syntactic complexity (for a review, see Szmrecsányi, 2004). Beaman (1984), for instance, established the syntactic complexity of spoken and written samples by comparing the percentage of subordinate structures across discourse types (see also Givón, 1991). Thanks to recent developments in the field of natural language processing (NLP), researchers have gradually abandoned manual coding in favour of automated methods (e.g., Kitaev and Klein, 2018; Levy and Andrew, 2006). The L2 Syntactic Complexity Analyser (L2SCA), for instance, is a tool designed to automate the analysis of written language samples produced by advanced learners of English (Ai & Lu, 2013, 2015; Lu, 2010, 2011).

Using a web-based interface to the L2SCA ([aihaiyang.com/software/l2sca](http://aihaiyang.com/software/l2sca)), we analysed the syntactic complexity of children's future narratives using a range of measures covering length of production units, number of coordination phrases, amount of subordination, degree of phrasal sophistication and overall sentence complexity. The five measures reported in this study are (i) word count, (ii) mean length of t-unit, (iii) amount of dependent clauses, (iv)

amount of complex t-units and (v) amount of coordinate phrases. Following Hunt (1965), the term ‘t-unit’ refers to a dominant clause and all the dependent clauses attached to it. In the following example, sentence (1a) contains a single t-unit, while (1b) and (1c) have two each:

- (1) a. [I went home after watching the game]
- b. [I watched the game] and [I went home]
- c. [I watched the game while eating fries] and [I went home after I saw your cousin]

The amount of complex t-units, however, depends on text length: longer narratives are more likely to display a higher number of complex clauses compared to shorter ones. To minimise this dependence on text length, the number of complex t-units was divided by the total number of t-units. Considering dependent clauses and coordinate phrases in absolute terms is equally problematic: a written text might display a higher amount of specific structures by virtue of its length rather than its complexity. To control for this length-sensitivity, the analysis considered the number of dependent clauses divided by the total number of clauses and the number of coordinate phrases divided by the total number of verb phrases rather than the absolute amounts. This simple transformation significantly reduces length-sensitivity and allows us to consider the occurrence of a complex structure with respect to its total frequency (see also Delage and Frauenfelder, 2020).

### 3. Results

The decision to include all available observations left us with a positively skewed dataset. Shapiro-Wilk tests confirmed that none of the complexity variables reported in this study followed a normal distribution (all  $ps < 0.001$ ). After failing to reduce skewness with logarithmic transformations, we opted for a non-parametric test of the null hypothesis and conducted five Mann-Whitney U tests comparing (i) word count, (ii) mean length of t-unit, (iii) number of dependent clauses divided by the total number of clauses, (iv) number of complex t-units divided by the total number of t-units and (v) number of coordinate phrases divided by the total number of verb phrases in the DLD versus TD group. Using the Bonferroni correction

for multiple comparisons, the significance threshold was adjusted to 0.01.

### 3.1 Length

The typically developing children in our sample wrote longer stories (i.e., more words) than children with DLD (TD  $M = 111.2$ ,  $sd = 54.5$ ; DLD  $M = 76.4$ ,  $sd = 45.7$ ). The mean difference between the two (34.8 words) was statistically significant ( $U = 2339.5$ ,  $p < 0.001$ ). The distribution of text length in the two groups is plotted in Figure 1.

#### 3.1.1 Gender differences

An exploratory analysis found that girls wrote longer stories than boys (girls  $M = 117.4$ ,  $sd = 57.2$ ; boys  $M = 90.6$ ,  $sd = 48.6$ ;  $U = 7116.5$ ,  $p < 0.001$ ). This difference was significant in the typically developing group (girls  $M = 125.0$ ,  $sd = 56.8$ ; boys  $M = 96.5$ ,  $sd = 48.1$ ;  $U = 4486.5$ ,  $p = 0.001$ ) but not in the group of children with DLD (girls  $M = 81.4$ ,  $sd = 45.0$ ; boys  $M = 73.1$ ,  $sd = 46.7$ ;  $U = 272.5$ ,  $p = 0.50$ ). The results are plotted in Figure 2.

### 3.2 Mean length of t-unit

The typically developing children in our sample wrote longer t-units ( $M = 12.1$ ,  $sd = 3.4$ ) compared to children with DLD ( $M = 9.7$ ,  $sd = 2.7$ ). The mean difference between the two

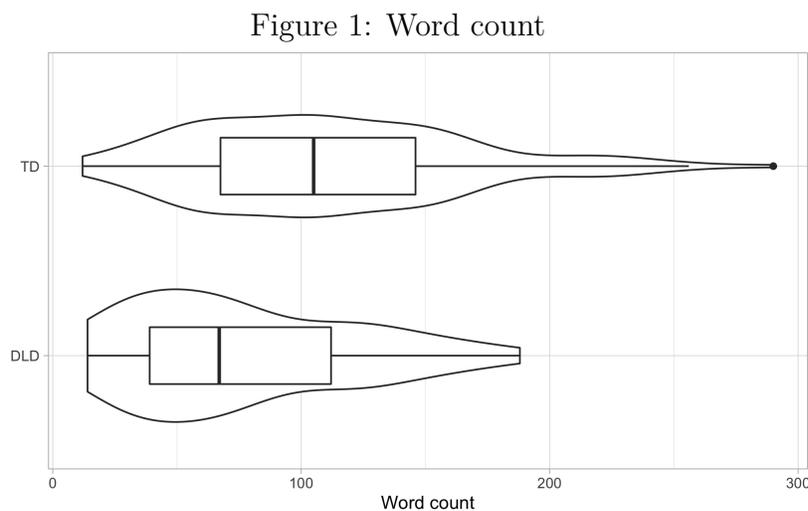
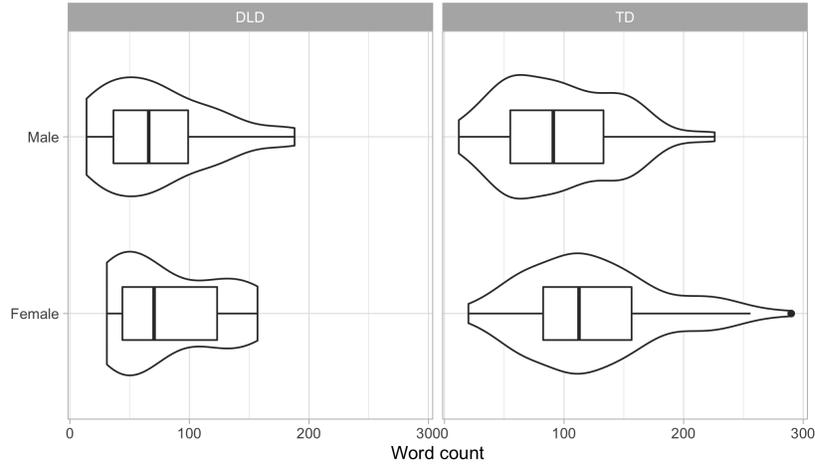


Figure 2: Word count by gender and language group



(2.4 words) was statistically significant ( $U = 5370, p < 0.001$ ). The results are plotted in Figure 3.

### 3.3 Dependent clauses

The typically developing children in our sample produced a higher ratio of dependent clauses ( $M = 0.29, sd = 0.16$ ) than children with DLD ( $M = 0.23, sd = 0.18$ ). The mean difference between the two (0.06) was below the conventional level of 0.05, but not below our Bonferroni-adjusted threshold ( $U = 3022.5, p = 0.04$ ). The results are plotted in Figure 4.

Figure 3: Mean length of t-unit

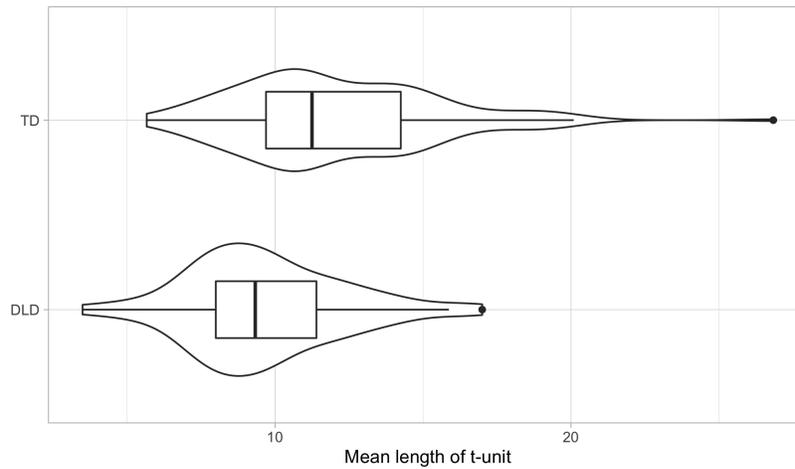
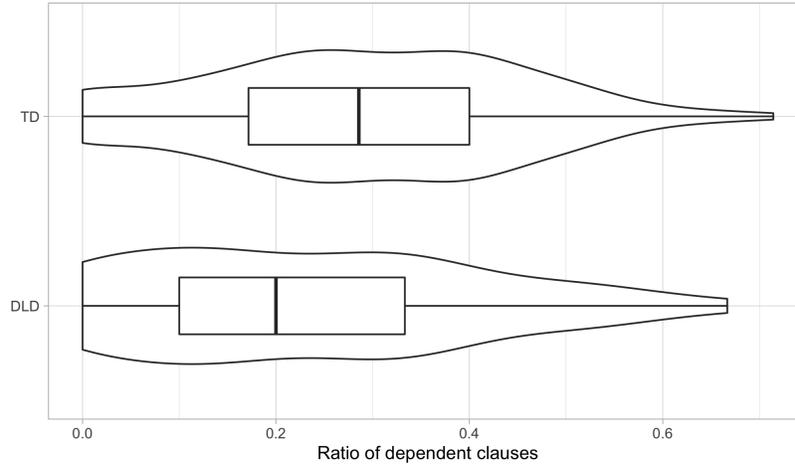


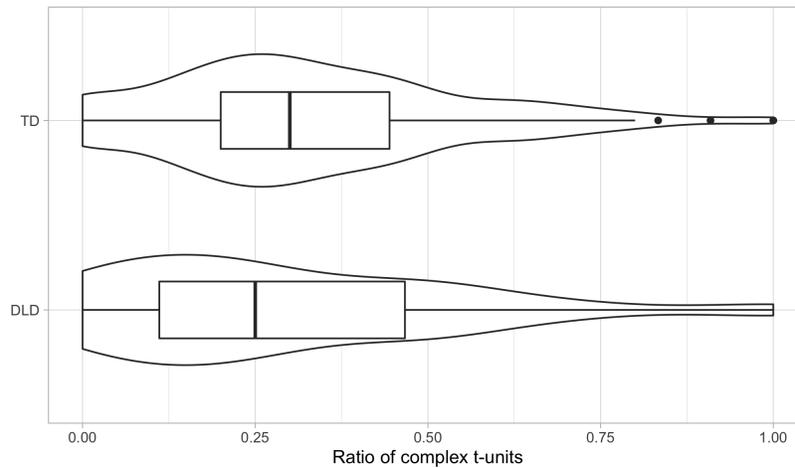
Figure 4: Ratio of dependent clauses to total number of clauses



### 3.4 Complex t-units

Children with DLD and typically developing peers produced a similar ratio of complex t-units (DLD  $M = 0.29$ ,  $sd = 0.26$ ; TD  $M = 0.33$ ,  $sd = 0.22$ ;  $U = 3194$ ,  $p = 0.12$ ). The results are plotted in Figure 5.

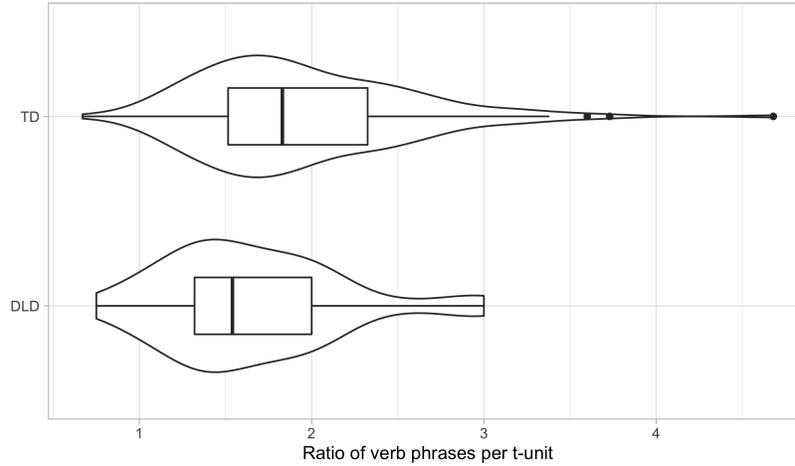
Figure 5: Ratio of complex t-units to total number of t-units



#### 3.4.1 Verb phrases per t-unit

An exploratory analysis looking at the amount of verb phrases per t-unit found a lower ratio of verb phrase per t-unit in the stories of children with DLD ( $M = 1.66$ ,  $sd = 0.52$ )

Figure 6: Ratio of verb phrases per t-unit

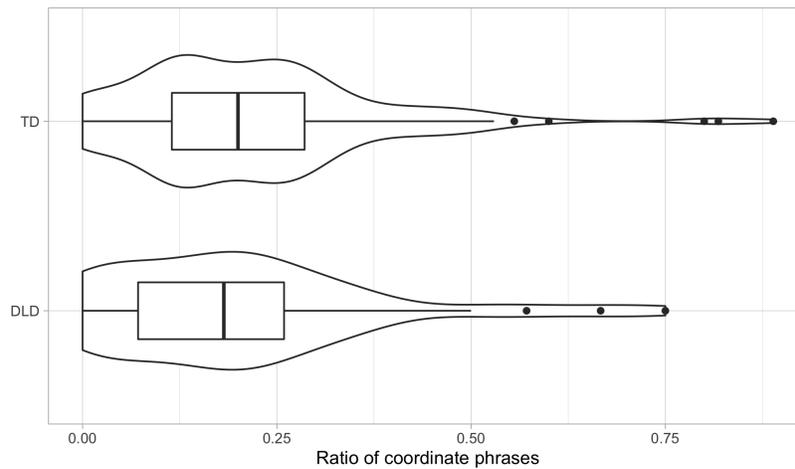


compared to those written by typically developing peers ( $M = 1.94$ ,  $sd = 0.61$ ). The mean difference between the two (0.28) was below the conventional level of 0.05 as well as our Bonferroni-adjusted threshold ( $U = 4839.5$ ,  $p = 0.003$ ). The results are plotted in Figure 6.

### 3.5 Coordinate phrases

Our analysis shows that children with DLD and typically developing peers produced a similar ratio of coordinate phrases (DLD  $M = 0.20$ ,  $sd = 0.17$ ; TD  $M = 0.22$ ,  $sd = 0.16$ ;  $U = 3439.5$ ,  $p = 0.38$ ). The results are plotted in Figure 7.

Figure 7: Ratio of coordinate phrases to total number of verb phrases



#### 4. Temporal perspective

In our pre-registration, we set out to explore whether children with DLD and typically developing peers think about the future in similar ways. In doing so, we assumed there would be a one-to-one correspondence between a story's temporal perspective and its predominant verb tense. Consider the following example:

(B) I am 25 years old and I am in Borneo saving orangutans and turtles. Borneo has been my favourite place ever since I went there on holiday when I was five years old. I've always wanted to help save wildlife and here is a place where they are being stolen and sold. I live in a small house by the beach with one of my friends from work. In my spare time I go on the beach and read or volunteer to help pick litter off the shores and find out where it came from. I also collect shells and I like to come up with ideas on how to decorate our house. The person who I share my house with is a friend from work, she also loves wildlife. Sometimes I take tourists who come to Borneo on tours. I have lived on the island for three years now and have enjoyed it a lot. Everyone is very friendly and the people who I work with are very nice. The house we own is more like a ground floor flat but we have a view of the sea and a small garden.

This child has assumed a present perspective: she has projected herself into the future and writes pretending to be her 25-year-old self (e.g., I live in a small house by the beach). Compared the example in (B) with the following narrative:

(C) In 13 years I think I will be in university finishing up my degree in animation and design. I think I will be working at a small art business. I think I will be living in a flat with 1 or 2 dogs. I will be working and getting ready for my final in hopefully Escape Studios. I think I will not have a partner but will be wanting one. I think I will be looking for where I want to work as a full time animator pursuing my dreams.

This child, unlike the one in (B), writes about her life using future tense (e.g., I will be in university). In other words, instead of pretending to be 25, she writes as her 12-year-old self and imagines what she will be doing in 13 years time from her current perspective (e.g., I think I will...). While these examples support a one-to-one correspondence between temporal perspective and verb tense, the following narrative suggests our coding scheme might be inadequate:

(D) When I am 25 I want to be a dolphin trainer in the Zoomarine. I want to do this because I have a passion for dolphins and I have always loved them. I swam with dolphins in Portugal in October 2019. When I am 25 I want to live in a villa in Portugal with a kind and caring man who accepts me for who I am.

This child, just like the one in (C), describes what she wants to do at 25 years of age from her current perspective (e.g., I want to be a dolphin trainer). Nonetheless, even though the child's thinking is clearly future-oriented, our tense-based coding scheme would suggest this narrative follows a present perspective akin to the one in (B). While a thorough analysis of the phenomenon is beyond the scope of this essay, the example in (D) suggests assuming a one-to-one correspondence between temporal perspective and verb tense is an oversimplification that fails to capture important aspects of the data. Table 3 provides examples of the main narrative patterns in our sample and summarises their distribution per temporal category.

Mindful of the limitations of the coding scheme outlined in our pre-registration, we focused on the narratives that showed a one-to-one correspondence between temporal perspective and verb tense (65% of our total sample). This restricted dataset contains 24 narratives written in future tense (10 by children with DLD) and 114 written in present tense (20 by children with DLD). The typically developing children in our research sample wrote remarkably less future-oriented stories (13% of all TD stories) than children with DLD (33% of all DLD stories). An exploratory chi-square test of independence showed typically developing children are more likely to write about the future using present tense than children with DLD ( $X^2(1) = 5.4, p = 0.02$ ).

Table 3: Narrative patterns per temporal category

Perspective	Examples	Amount
Past	I was 25 years old and I work[ed] with my Dad. I had a dog called Syd and a child called Hannah. They got on really well. [...]	3 (1%)
	Joshua Franks was 25 years old. He was a historian, a fairly successful historian. He's [had] written 3 books and sold over 20,000 copies. He lived in a village called Coldharbour in Surrey, England. [...]	
Present	I'm 25 years old. My name is John. I'm in the British army. I just came back from fighting as a light infantry. I enjoy my work as I respect my queen and my country. I have always enjoyed the army life and what we do. [...]	114 (54%)
	Dear Diary, today was an average day. The morning started as it normally did [does] with me waking up to the sound of my dogs barking. I think my new neighbours might already be annoyed by Lilo and Snoopy. [...]	
Future	When I'm 25, I would like to work as a civil engineer or architect designing and building eco-friendly carbon-neutral buildings. [...]	87 (41%)
	I will [live] on a flat near a good uni and I will be studying to be a trauma surgeon. I might go on holiday and might explore the world, but first I will do my uni. [...]	
Mixed	[inconsistent tense or insufficient information]	8 (4%)

## 5. Discussion

The finding that children with DLD wrote shorter stories compared to their typically developing peers is unsurprising: carrying out a task that requires the use of written language is significantly harder for children with limited linguistic competence (Boscolo, 2009). This increased difficulty not only affects the amount of words produced during the writing period, but might also have a negative impact on the child's willingness to engage with the task. The decision to present children with a new writing prompt, instead of considering a graded piece of schoolwork, exacerbate this trend: aware that their performance would have no effect on their marks, 36% of children with DLD (16 children) and 10% of typically developing peers (17 children) wrote 50 or less words. Although we are unable to discern whether this low-engagement reflects avoidance of complexity or little interest in the task, the observation made us aware of the fact that the lack of extrinsic motivation might have discourage children from writing to the best of their abilities.

Furthermore, although measuring the total number of words (i.e., length) is a time-honoured proxy for syntactic complexity (Szmrecsányi, 2004), our analysis suggests mean length of t-unit might provide a better way to assess the narratives' syntactic complexity. In fact, even though overall length has the obvious advantage of providing a rough assessment of children's expressive vocabulary, this measurement fails to capture the fact that a 100-word narrative with plenty of subordinate clauses is more complex than a 200-word one made up of simple sentences. Mean length of t-unit, on the other hand, offers a concrete estimate of syntactic complexity as well as valuable insights into children's ability to qualify their thoughts. Consider the following example:

- (2) a. I will have a dog. It will be white. It will be fluffy. It will come from another country.
- b. In the future I will have a beautiful white fluffy dog from a foreign country with lots of snow.

Although both sentence have 19 words, their structures are remarkably different. Example

(2a) contains four simple t-units with a mean length of 4.75 words. Sentence (2b), on the other hand, contains a single t-unit and yet provides significantly more information than its counterpart in (2a). These examples illustrate a simple point: the length of a t-unit (e.g., the quantity of adjectives and adverbial phrases) influences the amount of information it carries. The finding that children with DLD wrote significantly shorter t-units suggests they compensate for their struggles with expressive vocabulary (see §1.1.2) by reducing the amount of optional information in their written sentences. While this compensatory strategy undoubtedly eases cognitive demands, it also limits the children's ability to adequately describe their thoughts and share complex ideas with the reader.

### 5.1 Planning future goals

The finding that both groups produced a similar ratio of dependent clauses shows children with DLD can generally produce dependent clauses. The narratives in our sample, however, suggest children with DLD might have a harder time using subordination to express the motivations underlying their desires for the future. Consider the following narrative written by a child with DLD:

(E) **When I am 25 years old** I want to work with animals and take care of them. I would want to live in a mansion and have lots of money. I would want to drive a car and have all my friends with me. I would live with my sister.

This child introduces her narrative with a dependent clause (highlighted in bold), but fails to produce clauses of cause and reason to justify her choices (e.g., 'because that used to be my grandma's job'). In other words, she lists the things she would like to do but offers no explanations to help the reader understand why she wants to take care of animals, why she would live with her sister, etc. Compare example (E) with the following narrative written by a typically developing girl with similar goals:

(F) **When I am 25 years old** I want to be working with animals or children. This is because I want to make sure that children grow up being

happy and lead the best life they can. **When I am not working** I would like to volunteer for animal shelters or other projects like that. I want to own my own house and maybe live with a friend. **If I could** I would live by the sea as I have always gone on holiday by the sea so I would want to stay by there and see the views. I would also like to continue doing sports as I have enjoyed sports from a young age. But I would only like to do it as a hobby. As well as sports I want to keep my sewing skills up and maybe make things for friends and family.

This child, who wants to work with animals or children, clearly explains the motivations behind her choices by including three clauses of reason (highlighted in blue) alongside other types of subordinate clauses (highlighted in bold). Her rich use of subordination, absent in narrative (E), helps her thoroughly describe why she wants to live by the sea and discuss why she wants to continue doing sports.

This consistent reference to her motives, which contrasts sharply with the story in example (E), highlights an important point that has been previously overlooked: while both children with DLD and their typically developing peers can use complex syntax (e.g., the dependent clause in example E), the two groups likely differ in the kind of complexity they produce. For instance, out of all the narratives written by children with DLD (45 total), only one contained two or more clauses of reason:

(G) When I'm 25 I see myself as a hairdresser who lives in a 2 bedroom house. I see myself as a hairdresser because I love to style my friends hair and I have a bunch of fun. Another reason [I see myself as a hairdresser] is because I'm being taught different styles as well. Also [the reason] I see myself in a two bedroom house is because I feel like I might have found someone who loves and cares for me. I would love to live somewhere in America because it is a fun place to live and it would be a place to explore and get used to before anything further. I would like to work somewhere not so huge or small since the perfect size would be fine for me.

This observation suggests considering dependent clauses as a single category might obscure some important differences between the kinds of subordination found in children's narratives. If this were the case, our analysis might have been too coarse to detect a significant difference between the two groups. To address this issue, future research exploring the impact of language skills on future-oriented behaviours could consider only those subordinate clauses that show children are engaging in elaborate thought-processes (e.g., clauses of cause and reason). This fine-grained analysis would help researchers explore whether strong language skills help typically developing children make use of the complex linguistic structures needed to engage in future-oriented behaviours (e.g., explaining why a certain career would be a good fit).

Quite interestingly, syntax might also give children a mechanism to plan the 'how' and 'why' of future goals. For instance, the following typically developing children not only talked about their future job, but also described the steps they would have taken to get there:

(H1) I am an engineer and achieved this by going to UTPortsmouth.

(H2) [At 25 years old] I would have only just finished my training [to become a doctor].

(H3) Before [becoming a lawyer] I would like to finish sixth form and go to university to study about law.

While children with DLD occasionally mention attending university, they often fail to explicitly link their career objectives with higher education. Consider the following example written by a boy with DLD:

(I) When I am 25 years old I would be finishing uni and get a degree. And I would be playing football on the weekends. I would get a part time job while searching for a place in a veterinary. I would either live where I am now or move to Portugal. I would have a big garden. And have lots of animals and take good care of them like my aunt does in Portugal. If I earned lots of money I would give some money to my family and spend lots of time with them. If I get even further in my football career I would start my own veterinary as I love to help animals and I would look after abandoned or mistreated animals.

While this child mentions he will attend university, he fails to draw an explicit connection between his degree and his dream career in veterinary sciences. In other words, his narrative ignores the fact that opening a veterinary studio hinges on the attainment of a degree in this subject. Quite amusingly, the two are actually divided by a matter of the utmost importance for many 12-year-old boys: playing football on the weekends. Overall, the narrative contrasts sharply with the excerpts in (H1)-(H3): these typically developing children explain why they wish to attend university (e.g., to study about law) and explicitly relate higher education to their future careers (e.g., I achieved [becoming an engineering] by going to UTPortsmouth).

## 5.2 Exploring future-oriented narratives

The results of our exploratory analysis suggest typically developing children are more likely to write about the future using present tense than children with DLD. Stories written in the ‘diary diary’ format, a subset of the present-tense narratives in our sample, offer useful insights as to why typically developing children might be more likely to assume a present perspective. Consider the following example:

(J) Dear diary, today I have flown 36 planes and on one of them I took across the Queen of England. My trainee Dave is learning very fast and I think that he will be ready to fly as a captain very soon. **My girlfriend Natalie and I are going out tonight to a very expensive restaurant because it is her birthday very soon.** I am very excited for it. At work I am trying to go for a promotion so I can finally fly in a private jet. I know that I will need a lot of extra training but I think it will be a great decision and I am eager to start the course. I've got to go for the meal now so I think I will talk to you tomorrow about the party.

Instead of talking about his general lifestyle, the boy in (J) chose to describe a specific episode of his (imaginary) adult life using the ‘dear diary’ format. In other words, the child projected himself in the future and recalled an episode that has yet to occur (i.e., taking his girlfriend to a very expensive restaurant). These ‘episodic’ narratives straightforwardly show how future-oriented thinking builds onto past memories. The boy in example (J),

for instance, retrieves from his past knowledge what other people usually organise for the birthdays of their significant others (e.g., what his dad does on his mum’s birthday) and adapts it to a new context (i.e., what he would do at 25 for his girlfriend’s birthday).

The acquisition and flexible use of this context-free knowledge about the world (*semantic memory*), as well as the context-specific information unique to an individual (*episodic memory*), are supported by the declarative memory system (Tulving, 1972). Quite interestingly, several neuroimaging studies have shown that the acquisition of episodic information uses the same brain systems that also subserve the mental lexicon (e.g., Bartha-Doering et al., 2018; Breitenstein et al., 2005; Davis & Gaskell, 2009). This finding suggests children with DLD, who experience significant struggles with vocabulary, might also have declarative memory deficits that affect their ability to access semantic memories and re-adapt them to a new context. A recent study by Lee et al. (2020) found that young adults with DLD showed atypical age-related changes in the white matter microstructure of the fornix. This bundle of nerve fibers, which represents the major output of the hippocampus (Thomas et al., 2011), plays an important role in the formation and consolidation of declarative memory (Mabbott et al., 2009; Sepulcre et al., 2008), suggesting the retrieval of past knowledge in individuals with DLD might be impaired (Lee et al., 2020).

### 5.3 Study limitations

The ratio of complex t-units, a time-honoured proxy for syntactic complexity, is unsuitable when comparing highly dissimilar narratives like the ones in our research sample. Compare the following examples:

(K) When I’m 25 I see myself working as a counsellor therapist because I’ve always wanted to help people and help them with what they are going through. If I wasn’t going to do that I could see myself as a forensic scientist because I’ve always wanted to work in crime scenes and take photos of evidence. The last job I would see myself as is at the top of the tower at an airport because that can give you a good salary to get a good home. I hope that when I turn 25 I have found someone

to spend the rest of my life with and to start a family with. If I have already found someone I hope I have twin girls as children because I have always wanted to raise twins. Because most of my family will be around 50/60/70 I see myself looking after them a lot because I'm a very family person.

(L) When I'm 25 I'd like to either join the army or police.

(M) I think I will be interested in the same things as now.

The story in (K) has six complex t-units, while examples (L) and (M) only have one each. Although the narrative in (K) is undoubtedly more complex, all three have the same ratio of complex t-units ( $CT/T = 1$ ). The reason for this puzzling result lies in the distributional overlap between complex and simple t-units: because the term 't-unit' refers to a dominant clause and all the dependent clauses attached to it, all complex t-units are (simple) t-units by default. Example (N), for instance, contains one complex t-unit (highlighted in bold) and three simple t-units.

(N) **When I am 25 I want to be Manchester United's manager** / I would live in a big house in Manchester with a swimming pool and a large lounge and kitchen / I would have 2 double and 2 single beds / I would live with my wife and children.

Because the complex t-unit is by definition also a simple t-unit, the story actually contains four t-units one of which is also a complex t-unit ( $CT/T = 0.25$ ). When a narrative contains only complex t-units, however, this definition fails and returns a value of one regardless of how many complex t-units are found in the text, automatically obscuring the clear differences between examples (K), (L) and (M). The issues discussed here and in §2.3 suggest the ratio of verb phrases per t-unit might be a more reliable estimate of children's syntactic complexity. In fact, unlike the total amount and ratio of complex t-units, this measurement is simultaneously sensitive to text length and the differences between the following scenarios:

(3) a. **T-unit with one verb phrase**

I am 25 years old.

b. **T-unit with two verb phrases**

I will buy a house when I am 25 years old.

c. **T-unit with three verb phrases**

I will buy a house when I am 25 years old because I will have enough money.

Another limitation of our study is the use of a coding tool designed to automate the analysis of written language samples produced by advanced learners of English in the context of children's story writing. Consider the following example:

(O) I would live in a house. And I would work with my mum. And I would text my friends **and call my mum**. I would live in castle.

This child not only produced a 'proper' coordinate phrases (highlighted in bold), but also inserted 'and' at the beginning of two sentences. This usage, which resembles spoken language, is prescriptively condemned in the written language (i.e., something that would commonly be considered an error). Because the L2SCA had been designed to analyse samples consistent with this prescriptive rule (i.e., the writing of advanced English learners), the use of 'and' in sentence-initial position goes undetected.

In the context of children's future narratives, one might ask whether the boy in (O) actually wanted to produce a 'proper' coordinate phrase (e.g., I would live in a house and I would work with my mum) and failed to comply with the prescriptive rules of English. Given that this trend is common across both groups, our results suggest the ratio of coordinate phrases to the total number of verb phrases calculated using the L2SCA fails to fully capture children's use of coordination. A more informative analysis could consider whether typically developing children observe this prescriptive rule more consistently than children with DLD.

#### 5.4 Future research

The measures of syntactic complexity discussed in the current study are one of many factors influencing the quality of children's story writing. In order to fully evaluate children's future narratives, subsequent research should also consider the ratio of lexical words to the total

number of words (*lexical density*), the proportion of rare words (*lexical sophistication*) and the ratio of unique words types to the total number of word tokens in the text (*lexical diversity*). The Lexical Complexity Analyser (LCA), developed by Ai and Lu (2010), can be used to compute these measures of lexical richness and is available as a web-based interface accessible to researchers with limited programming skills ([aihaiyang.com/software/lca](http://aihaiyang.com/software/lca)).

The software’s indices of lexical diversity, however, are dependent on text length: type-to-token ratio is insensitive to the fact that more words are likely to be repeated in longer texts resulting in lower scores of lexical variability. Over the years, different measures of lexical diversity have been proposed to correct for this dependence on text length (for a review, see Zenker and Kyle, 2021). These more sophisticated indices of lexical complexity can be computed using the Lexical Complexity Analyser for Academic Writing (LCA-AW, version 2.2; Nasserri & Lu, 2020) and the lexical-diversity package (Kyle, 2020). Unlike the LCA, however, these softwares require familiarity with the command-line interface as well as some knowledge of part-of-speech tagging and lemmatisation.

Another interesting venue for future research is comparing a ‘future’ diary entry (e.g., narrative J) with an ‘autobiographical’ memory (e.g., my first day of primary school) from the same child to investigate whether the two stories display different levels of syntactic complexity. While both ‘autobiographical’ memories and ‘future’ diary entries engage a combination of episodic and semantic memory, only the latter requires the adaptation of this past knowledge to a new context (e.g., what would happen on the first day of sixth form). Using a paired set-up, researchers could explore whether children’s ‘autobiographical’ memories are generally more complex than their ‘future’ diary entries and whether children with limited language skills find generating a ‘future’ diary entry significantly harder than writing an autobiographical story.

## 6. Conclusion

Previous studies suggest developmental language disorder has a negative impact on the syntactic complexity of children’s spontaneous speech. Consistent with these results, our

analysis shows that developmental language disorder has a negative influence on the syntactic complexity of children's future-oriented narratives. These difficulties with complex grammar affect children's ability to engage in future-oriented behaviours: reduced syntax limits the extent to which children with DLD can imagine and plan for the future. For this reason, teachers and SLTs should foster the acquisition of future-thinking skills by supporting children with DLD in the development of their syntactic competencies.

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