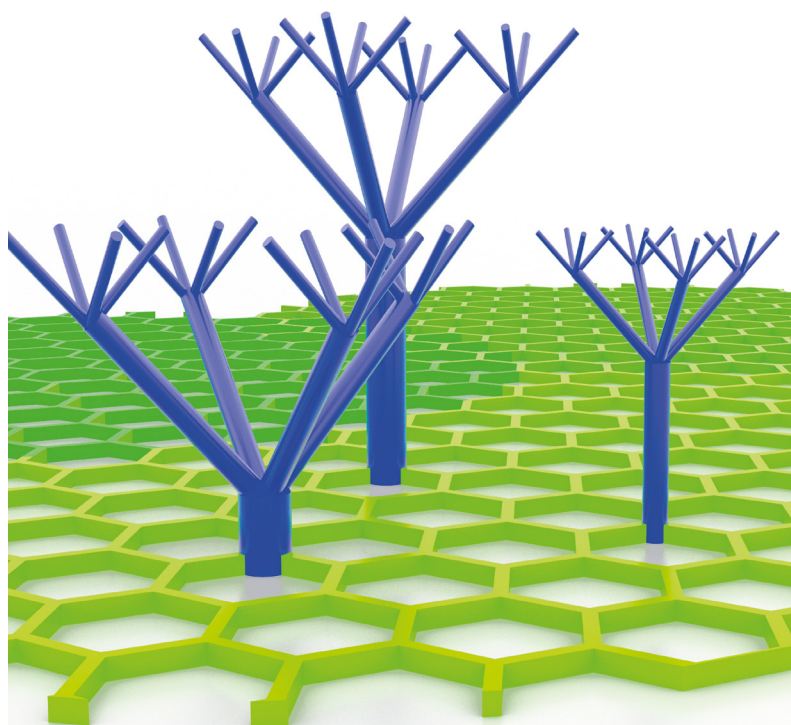Edited by
Markéta Janebová, Joseph Emonds, and Ludmila Veselovská

Language Use and Linguistic Structure

Proceedings of the Olomouc Linguistics Colloquium 2021

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Part III. Explorations in Language Use across Modalities

Oblique Relative Clauses in Italian Students with Developmental Dyslexia: Language Assessment and Syntactic Training

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Abstract: This study investigates the linguistic competence of 6 Italian-speaking high-school students with Developmental Dyslexia (DD) in comparison to a group of typically developing age peers. Language assessment was carried out using a sentence repetition task that included different types of complex movement-derived structures (left dislocation sentences with clitic pronouns, long-distance *wh*-questions, cleft sentences, and oblique relative clauses). Results showed that the group of DD participants performed lower than controls. All DD students were below the mean of the controls in more than one sentence type. In order to improve their linguistic competence, they were administered a syntactic training consisting in teaching explicitly the syntactic rules involved in the derivation of complex sentences, namely relative clauses. Replicating results of previous studies, training proved effective, and the participants showed improvement in the trained relative clauses and in untrained structures (clefts and *wh*-questions). Improvement was maintained over time.

1. Introduction

Dyslexia is a reading disorder. Children with Developmental Dyslexia (DD) fail to acquire age-appropriate reading skills despite normal intelligence, good instruction, and adequate learning opportunities. Individuals with dyslexia typically experience difficulties in reading, word recognition, spelling, writing, and pronouncing words. It is well-grounded that spoken language may be impaired as well. Indeed, as for lexicon and

vocabulary, individuals with dyslexia may struggle with accessing lexical information and rapid automatized naming speed (Jones et al. 2016), and they may have difficulties in mastering spoken vocabulary; as for the syntactic domain, children with dyslexia may manifest difficulties in oral comprehension and production of complex syntactic structures, in particular movement-derived constructions such as sentences containing clitic pronouns (Arosio et al. 2016; Vender et al. 2018), *wh*-questions (Guasti et al. 2015), cleft sentences (Pivi et al. 2016), and subject and object relative clauses (Arosio et al. 2017; Cardinaletti 2014; Pivi et al. 2016). In all these cases, an argument of the verb occupies a position different from the position in which it is interpreted. We exemplify this property here with an object relative clause:

(1) Il bambino che   la mamma   sta baciando   \<il bambino\>
     the child   that the mother is kissing   \<the child\>

In individuals with dyslexia, the difficulties with relative clauses persist in adolescence and adulthood. Italian-speaking university students differ from their age-matched peers and are as accurate as younger typically developing adolescents in the oral comprehension of subject and object relatives (Cardinaletti and Volpato 2011, 2015). Adolescent high-school students make more errors than typically developing age-matched peers in the repetition and the production of oblique relative clauses (Piccoli 2018; Cardinaletti et al. 2022).

Through a spoken sentence repetition task, this study aims to investigate the knowledge of oblique relatives in comparison to other different types of syntactically complex structures containing long-distance dependencies (cleft sentences, long-distance *wh*-questions, left-dislocated sentences with resumptive clitic pronouns) in a larger group of Italian high-school students with and without DD, to determine whether adolescent students with dyslexia perform differently from age-matched peers without dyslexia. Then syntactic training was proposed to the participants with dyslexia to improve their language competence.

The paper is organised as follows: section 2 introduces the type of structures that were investigated in the repetition task, sections 3 and 4 present data on the acquisition of complex sentences, based on generative and usage-based approaches. Section 5 offers an overview on previous research on syntactic training. Section 6 presents the methodology and the test results at the group and the individual levels before training. In section 7, the training activities are described, and section 8 shows the post-training results. All results are discussed in section 9.

2.   The Investigated Structures

Different types of complex syntactic structures were investigated using a sentence repetition task: sentences with a left-dislocated object and a resumptive clitic pronoun (2),

long-distance *wh*-questions (3), contrastive cleft sentences (4), prepositional (5a) and genitive (5b) relative clauses.

(2) *La bambina*,   il signore   la   saluta   spesso   *<la bambina>*
    the child.FEM   the man   her.CL   greets   often   <the child.FEM>
    "The child, the man greets her often."

(3) *Quale gallina*   hai detto   che   *<quale gallina>*   sgrida   le papere?
    which hen   did you say   that   *<which hen>*   scolds   the ducks

(4) È   *IL PINGUINO*   che   le mucche   fermano   *<il pinguino>*
    it is   *THE PENGUIN*   that   the cows   stop   *<the penguin>*

(5) (a) La bambina   lava   *il cane*   a cui/al quale *<cane>*
       the girl   washes   the dog   to whom <dog>
       il padrone   dà   i biscotti   *<a cui/al quale cane>*
       the owner   gives   the cookies   *<to the dog>*

    (b) Il maestro   pettina   la signora   la cui *<signora>* figlia
       the teacher   combs   the lady   whose <lady> daughter
       lavora
       works

All constructions are derived through the displacement of a sentence constituent to a position at the beginning of the sentence, namely the left-periphery (Rizzi 1997). A relationship is established between the displaced element and the thematic position in which it is interpreted.

In sentences with left dislocation (2), the object is pronounced at the beginning of the sentence, and a resumptive clitic pronoun is placed before the finite verb. The object and the clitic pronoun share same gender and number features.

Long *wh*-questions (3) involve long-distance movement of the *wh*-element out of embedded clauses (*quale gallina* in the example) to the left periphery of the sentence.

Cleft sentences (4) include a copular verb, a fronted discourse prominent phrase (the clefted (focused) constituent), and the embedded, cleft clause introduced by the complementizer *che* ('that'). Oblique relative clauses are formed through movement of the head of the relative (Kayne 1994) and 'pied-piping', namely the dative preposition (5a) or the whole noun phrase (5b) is displaced together with the relative pronoun.

A complexity hierarchy exists between the different structures with relative clauses being the most difficult. Relative clauses are then followed by clefts. *Wh*-questions and left dislocations are the simplest, with a comparable difficulty

degree. This hierarchy was suggested by Thompson et al. (2003) who proposed to participants with agrammatic aphasia a treatment approach aimed at training and improving the use of object *wh*-questions, object clefts, and relative clauses. Some participants were trained on *wh*-questions, and the other participants were trained on relative clauses. When relative clauses were treated, improvement was also observed in clefts and *wh*-questions. The reverse did not occur: clefts and relative clauses did not improve when *wh*-questions were trained. Thompson et al. (2003) proposed the Complexity Account of syntactic Treatment Efficacy in aphasia (CATE), namely, syntactic intervention focused on the most difficult structures (relative clauses) contributes to improving less complex sentences obtained by the same linguistic processes (clefts and *wh*-questions).

Complexity is also measured in terms of length of syntactic dependencies and/or number of displacements of an element from the position in which it is initially interpreted to the final position in which it is pronounced.

3. Acquisition and Development of Italian Complex Structures

In Italian, most structures are almost fully acquired when children enter primary school. However, some constructions may be acquired later.

Sentences containing clitic left dislocation are comprehended at the rate of 70% at around 5;7 years (Manetti et al. 2016). However, children are already able to produce clitic left dislocations at around 5 years (Manetti and Belletti 2017). In repetition tasks, accuracy in individuals between 11 and 14 years is above 90% (Del Puppo et al. 2018).

For long *wh*-questions, repetition accuracy is 95% for subject questions and 91% for object questions between 7;6 and 8;7 years. Between 11 and 14 years, it is very close to 100% (Del Puppo et al. 2018).

Cleft sentences are hardly produced by children when elicitation tasks are used. Indeed, at the age of 9;6, the rate of cleft sentences is very low (3%) (Del Puppo 2016). However, at the age of 7;5, the percentage noticeably increases in sentence repetition tasks, reaching a level of accuracy of 95%. Ceiling effects are observed between 11 and 14 years (Del Puppo et al. 2018).

Oblique relative clauses are acquired late by typically developing children. They are complex structures typical of the formal register and are acquired during school years through formal teaching and exposure to written texts (Guasti and Cardinaletti 2003; Piccoli 2018; Cardinaletti et al. 2022) addressed the issue of the acquisition of these constructions in Italian. Using an elicitation task, the authors assessed a group of children aged 5;2–10;1 and found that oblique relatives are acquired not earlier than 10 years of age. At this age, children have not yet learnt the complex system of relative pronouns and their syntax. In repetition tasks, accuracy is around 60% at the age of 13–14 years (Del Puppo et al. 2018). Both children and adults prefer more colloquial alternatives (Guasti and Cardinaletti 2003; Piccoli 2018) in which the relative clause

is introduced by the complementizer *che* 'that', and the goal argument is expressed by the clitic pronoun *gli* 'to-him' (6), or, more rarely, sentences typical of sloppy registers, where the goal argument is missing altogether (7).

(6) il bambino   che   il papà   gli   dà   un bacio
     the child   that   the dad   him   gives   a kiss
     "the child that the dad gives him a kiss"

(7) il bambino   che   il papà   dà   un bacio
     the child   that   the dad   gives   a kiss

In our study, we expect that relative clauses will be the most difficult structure compared to all the other structures, given the number of steps involved in their derivation and the late age at which they are acquired. Moreover, DD participants are expected to show more difficulties with sentences that are learnt through exposure to written texts.

4. The Acquisition of Complex Structures: A Usage-Based Approach

In addition to the analyses developed in the generative framework and presented above, the acquisition of complex sentences was analysed by Diessel and Tomasello (2005) by adopting a usage-based approach. In this study, English-speaking and German-speaking children (age: 4;3–4;9 years) were assessed in the repetition of different types of relative clauses: subject relatives (*The man who saw the farmer*), direct object relatives (*The cat that the dog chased*), indirect object relatives (*The girl who the boy gave his ball to*), oblique relatives (*the boy who the girl played with*), and genitive relatives (*the man whose cat caught a mouse*). Overall, subject relatives were the most accurate structures. When non-subject relatives were targeted, the participants turned the target sentence into a subject construction in most cases.

To account for their findings, the authors suggested that the acquisition of relative clauses is enabled by the frequency with which they occur in the language environment. Hence, frequent sentences, such as subject relatives, are learnt earlier than less frequent structures (non-subject relatives). Subject relatives are also more similar to simple non-embedded sentences and to some forms found in early child speech, like *That's doggy turn around*.

In sum, frequency, processing phenomena, and similarities among various structures contribute to explain the acquisition process. Subject relatives are more frequent and more similar to simple (non-embedded) sentences than object, oblique, and genitive relatives. The most complex relative clauses are less frequent in the language environment, are dissimilar to simple constructions, and involve a higher computational load, so that they are avoided even by adult speakers.

If this approach is correct, structures that conform to distributional patterns that are more frequent in the input will be more accurate than those for which exposure is lower.

5. Explicit Syntactic Training

Syntactic training consists in explicitly teaching the syntactic rules involved in the derivation of some linguistic constructions. Over the years, these approaches proved to be effective with different populations, such as patients with agrammatic aphasia (Thompson et al. 1994, 2003, 2007), children with developmental language disorders (Ebbels and Van der Lely 2001; Levy and Friedmann 2009), deaf individuals (children with cochlear implants: D'Ortenzio et al. 2017; Benedetti 2018; D'Ortenzio 2019; D'Ortenzio et al. 2020; adult signers: Segala 2017), adolescent students with dyslexia (Piccoli 2018, Cardinaletti et al. 2022), and typically developing individuals with Italian as a second language (Bozzolan 2016; De Nichilo 2017; Volpato and Bozzolan 2017; Piccoli 2018; Volpato and De Nichilo 2020).

The above-mentioned studies were based on the teaching of verb argument structure, Theta Criterion (Chomsky 1981), and syntactic movement. The first step consisted in explaining verb argument structure, namely the fact that a verb requires a certain number of arguments to complete its meaning (e.g., the verb *break* requires two arguments). The second step consisted in explaining Thematic theory and the Theta Criterion, which requires that all and only the selected arguments are realised in the sentences. The thematic grid determines the semantic relationship between the verb and its arguments (e.g., the verb *break* assigns Agent and Theme roles, and therefore it must assign both roles in each sentence it appears in). The third step consisted in teaching syntactic movement, by explaining that in some sentences, an element may be pronounced in a position different from the one in which it is interpreted (< >). A chain (shown by the arrow in example (8) is created between the two positions.

(8) Sto aggiustando   *il bicchiere*   che   mio fratello   ha rotto   *<il bicchiere>*
     I am repairing   *the glass*   that   my brother   broke   *<the glass>*

In addition to improved scores in the trained structures, the teaching of syntactic rules also provides generalisation effects to untrained structures derived by the same linguistic process (a.o., Thompson et al. 2003; Levy and Friedmann 2009; D'Ortenzio et al. 2020). Generalisation occurs to untrained structures that are less complex than the trained ones. For example, teaching activities focused on relative clauses can also improve the use of cleft sentences and *wh*-questions, but cleft sentences cannot improve after training *wh*-questions (see section 2).

6. Language Assessment

6.1 Participants

Sixty-seven Italian-speaking students attending a high school in the province of Verona (Italy) participated in this study. Sixty-one participants (age range: 14-20, mean age: 17;2; SD: 0.31) showed typical language development (TD) and 6 students (age range: 14-20, mean age:15;11; SD: 0.56) had a diagnosis of Developmental Dyslexia. No Developmental Language Disorder was diagnosed.

6.2 Materials and Methods

To assess language proficiency, the sentence repetition task developed by Del Puppo et al. (2016) was administered orally to all participants. The sentence repetition task consisted of 33 experimental sentences and 16 control sentences. The experimental sentences included: 6 left dislocations, 12 long-distance subject and object *wh*-questions, 6 clefts, 9 oblique relative clauses (including dative relatives with *cui* or *quale*[1], genitive relatives, and prepositional genitive relatives). The control sentences were simple sentences and were matched to the experimental ones by length (12 to 21 syllables).

The repetition task makes it possible to investigate different syntactic structures by using one and the same task (e.g., Szterman and Friedmann 2015), and it is effective to detect deficits in the syntactic language component. It involves a process of decoding, interpretation, and subsequent reproduction of the target sentence. Only those syntactic structures that are part of the language competence of an individual may be correctly repeated. Control sentences are useful to detect errors due to memory or attention (Szterman and Friedmann 2015). If experimental and control sentences of the same length are repeated inaccurately, the error would be ascribed to memory. Conversely, if the repetition of control sentences is accurate and the repetition of experimental sentences is not, the problem would lie in the syntactic complexity of the sentence.

The participants' productions were audio-recorded, transcribed, and double-checked by the first author and a colleague of hers.

6.3 Results

6.3.1 Group Analysis

In the sentence repetition task, only trials that were repeated verbatim were considered target sentences. Table 1 shows proportion (Mean) and standard deviation (SD) of target responses at the group level in the sentence repetition task.

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1   *Cui* is the non-agreeing relative pronoun, while *quale* agrees in number and gender with the antecedent.

	DD		TD	
	Mean	SD	Mean	SD
Left dislocations	0.89	0.17	1	0.06
wh-questions	0.89	0.09	0.97	0.07
Clefts	0.36	0.16	0.90	0.29
Oblique relative clauses	0.37	0.13	0.62	0.17
Control sentences	0.91	0.08	1	0

Table 1: proportion, and standard deviation (SD) of sentences that DD and TD group repeated verbatim

Following Dixon (2008) and Jaeger (2008), a repeated logistic regression analysis was carried out to analyse accuracy, using the statistical software R (R Development Core Team, 2018, R Version 4.0.1). Control sentences were at ceiling for typically developing students and almost at ceiling for the participants with dyslexia. Typically developing participants were at ceiling in left dislocations and almost at ceiling in long *wh*-questions. DD participants were less accurate than controls in these sentence types. Clefts and oblique relatives were the most problematic structures for both groups, especially for the DD participants. Within-group analyses showed that experimental sentences were significantly less accurate than control sentences (Wald Z=1.564, p<.001). This result suggests that the difficulties observed in the groups are not due to limited memory resources, but to the derivation of this type of structures. Clefts and oblique relative clauses were significantly less accurate than all the other structures for both groups, as shown in Table 2.

	DD		TD	
	Wald Z	p value	Wald Z	p value
Control sent.-Clefts	1.224	<.001	1.882	<.001
Control sent.-RCs	0.225	<.001	1.476	<.001
Left disl.-Clefts	2.930	<.001	1.347	<.001
Left disl.-RCs	5.497	<.001	6.823	<.001
WhQ-Clefts	2.800	.002	3.467	.003
WhQ-RCs	6.823	<.001	2.598	.01

Table 2: Z-values and p-values for the Sentence Type factor

The DD group performed significantly lower than the TD group, especially in the repetition of clefts and oblique relative clauses (Wald Z=1.456, Wald Z=1.788, p<.001 in both cases).

Table 3 shows the proportion and SD of target responses on oblique relatives.

	DD		TD	
	Mean	SD	Mean	SD
Dative relative clause with *cui*	0.50	0.55	0.75	0.45
Dative relative clause with *quale*	0.46	0.19	0.56	0.24
Genitive relative clause	0.42	0.20	0.88	0.23
Prepositional genitive relative clause	0.08	0.20	0.42	0.36

Table 3: Proportion (Mean) and standard deviation (SD) of oblique relative clauses that DD and TD group repeated verbatim

By analysing separately the different types of oblique relative clauses, it comes to light that for both groups, the most difficult structures were prepositional genitive relatives. This structure is particularly taxing for DD participants. TD participants were more accurate in the repetition of genitive relative clauses than dative relative clauses (p=.03). TD students showed higher percentages than the DD individuals in all oblique sentences. The level of accuracy of the DD group was much lower in genitive relatives and in prepositional genitive relatives (p<.001 in both cases).

6.3.2 Error Analysis
This section shows the most frequent errors in the repetition of the different structures.

When left dislocations were targeted (9a), some participants produced sentences with the clitic pronoun agreeing with the embedded subject (9b).

(9) (a) I leoni,   il pinguino   li   colpisce   forte
         the lions,   the penguin   them   hits   heavily
         "The lions, the penguin hits them heavily"

    (b) I leoni,   il pinguino   lo   colpisce   forte
         the lions,   the penguin   it   hits   heavily
         "The lions, the penguin hits it heavily"

The most frequent error in the repetition of target subject (10a) and object (11a) *wh-* questions was the production of object questions in place of subject questions (10b) and subject questions instead of object questions (11b).

(10) (a) Quale persona   hai detto   che   saluta   i ragazzi?
          which person   did you say   that   greets   the boys

     (b) Quale persona   hai detto   che   salutano   i ragazzi?
          which person   did you say   that   greet   the boys
          "Which person did you say that the boys greet?"

(11) (a) Quale gallina   hai detto   che   sgridano   le papere?
       which hen   did you say   that   scold   the ducks
       "Which hen did you say that the ducks scold?"

      (b) Quale gallina   hai detto   che   sgrida   le papere?
       which hen   did you say   that   scolds   the ducks

When contrastive clefts were targeted (12a), the only error consisted in the production of the incorrect prosody (lack of focus on the dislocated argument) (12b).

(12) (a) è   IL PINGUINO   che   le mucche   fermano
       it is   THE PENGUIN   that   the cows   stop

      (b) è   il pinguino   che   le mucche   fermano
       it is   the penguin   that   the cows   stop

When dative relatives with *cui* were targeted (13a), some participants produced ungrammatical genitive relatives (13b).

(13) (a) La bambina   lava   il cane   a cui   il padrone   dà
       the girl   washes   the dog   to whom   the master   gives
       i biscotti
       the biscuits

      (b) La bambina   lava   il cane   il cui padrone   dà   i biscotti

       the girl   washes   the dog   the whose master   gives   the biscuits
       "The girl washes the dog whose master gives the biscuits"

When dative relatives with *quale* were required (14a), some students produced sentences with incorrect number agreement on the determiner and the relative pronoun (14b).

(14) (a) Il cane   morde   i ragazzi   ai quali   il nonno
       the dog   bites   the boys   to.the whom.PL   the granddad
       compra   il gelato
       buys   the ice cream
       "The dog bites the boys to whom the granddad buys the ice cream."

(b) Il cane   morde   i ragazzi   al quale   il nonno
the dog   bites   the boys   to.the whom.SG   the granddad
compra   il gelato
buys   the ice cream

When genitive relative clauses were targeted (15a), the participants produced ungrammatical sentences by substituting the pronoun *quale* for *cui* (15b).

(15) (a) Il postino   saluta   la signora   il cui figlio   disegna
the postman   greets   the lady   the whose son   draws
"The postman greets the lady whose son draws."

(b) Il postino   saluta   la signora   il quale figlio   disegna
the postman   greets   the lady   the which son   draws

When prepositional genitive relatives were targeted (16a), some participants produced ungrammatical dative relatives with *cui* (16b).

(16) (a) La mamma   bacia   la bambina   al cui fratello   piacciono
the mother   kisses   the girl   to.the whose brother   "please"
le tigri
the tigers
"The mother kisses the girl whose brother like the tigers"

(b) La mamma   bacia   la bambina   a cui   il fratello   piacciono
the mother   kisses   the girl   to whom   the brother   "please"
le tigri
the tigers

6.3.3 Individual Analysis

Individual performance was also examined calculating how many standard deviations each participant was away from the mean of the group of TD students. Table 4 shows the z-scores for each DD student for each structure.

	DD1	DD2	DD3	DD4	DD5	DD6
Left dislocations	-	**-5.75**	**-5.75**	-	-	-
wh-questions	**-1.56**	0.28	**-3.68**	-0.28	**-3.68**	**-3.68**
Clefts	**-4.38**	**-3.39**	**-3.39**	**-3.39**	-1.40	-1.40
Oblique relative clauses	-0.79	-0.79	-0.30	**-1.78**	**-1.78**	**-1.78**

Table 4. Individual performance (z-scores) of students with DD compared to TD peers

Four DD participants were below the mean of TD peers in the repetition of *wh*-questions, four of them were below in clefts, and two were below in left dislocation sentences. Although the TD group showed low accuracy in the repetition of oblique relatives, three students with DD performed below them also in this sentence structure.

7. Syntactic Training

In this study, the training given to six participants with DD focused on (complex) relative clauses and was inspired by previous research. The aim was to investigate whether explicit teaching of the syntactic rules involved in the derivation of relative clauses is effective in improving syntactic skills in adolescents with DD. Only relative clauses were trained in order to investigate whether untrained structures would also improve after training.

Syntactic training consisted in explicitly teaching verb argument structure, thematic theory, and syntactic movement, in order to turn implicit knowledge into explicit knowledge. To explain verb argument structure, the students were shown three pictures and asked to describe them with a sentence, and to discuss the link between each verb and its arguments. These syntactic rules were explained using the metaphor of a film cast: the verb is like a film director, while its arguments are represented by his staff: make-up artists, film makers, actors, and dancers. The director is the person who decides the number of people who are part of the cast and their role in the production of the film. In the same way, the verb selects the number and the type of arguments needed to derive a grammatical sentence.

Movement was taught using coloured cards on which the different elements of the sentence were reported (Figure 1). Cards were used to show participants that movement-derived sentences are created by the movement of elements from one position to another in the sentence.

Figure 1 illustrates the derivation of an object relative. Before movement, the agent is in its canonical position before the verb, and the theme occurs after the verb.

Figure 1: Derivation of an object relative

Then, the object moves to a position to the left leaving a trace behind (marked by T). The trace is connected to the moved phrase through a "chain", represented here by the phone charger. The same procedure was used for oblique relatives (Figure 2).

Figure 2: Derivation of a prepositional relative

Different types of relative clauses were trained (subject, object, and oblique relatives).

The syntactic training lasted less than two months and consisted of 11 to 13 sessions each lasting 90 minutes. All students were also assessed during follow-up sessions: two students after 6 months, three after 9 months, and one after 12 months.

8. Comparison of Pre- and Post-Training Results

Table 5 shows accuracy at the group level for DD before and after training in the different sentence types. After training, repetition was assessed twice, immediately after the end of the training and some months later in follow-up sessions.

	Before training		After training		Follow-up	
	Mean	SD	Mean	SD	Mean	SD
Left dislocations	0.89	0.17	0.97	0.07	1	0
wh-questions	0.89	0.09	1	0	0.97	0.07
Clefts	0.36	0.16	0.83	0.11	0.89	0.09
Oblique relative clauses	0.37	0.13	0.87	0.05	0.88	0.07

Table 5. Group performance (proportion of target responses and SD) of DD students before, after training, and in the follow-up sessions.

Immediately after the training, the six students with dyslexia showed improved performance in all structures. Improvement was maintained over time several months after the intervention was finished.

Table 6 shows individual performance. We compare the z-scores of the participants before and after syntactic training.

	Before training	After training	Follow-up
DD1	**-4.16**	1.86	0.84
DD2	**-4.47**	-0.64	0.43
DD3	**-4.21**	1.02	1.24
DD4	**-4.21**	-0.41	0.84
DD5	**-3.50**	0.20	0.84
DD6	**-3.22**	0.61	0.84

Table 6. Individual performance (z-scores) of students with DD before and after training

Before training, all participants with dyslexia were more than 3 standard deviations below the mean of the controls. Immediately after the training and in the follow-up sessions, the scores of all participants were within the normal range.

9. Discussion

In this study, we assessed the linguistic competence of a group of high-school students with dyslexia using a sentence repetition task to determine whether they display difficulties with complex syntactic structures. The difficulties were not found with all sentence types, most students with dyslexia behaved comparably to their age-matched peers in left dislocations, where a constituent of the clause occupies a sentence-initial position and a resumptive clitic pronoun is placed before the verb. Students with dyslexia repeated fewer long *wh*-questions than their peers. Still, long *wh*-questions are repeated more accurately than clefts and oblique relative clauses.

Diessel and Tomasello (2005) explained the difficulties of young children with relative clauses, claiming that frequency in the input shapes children's early linguistic knowledge. Oblique relatives are less frequent and, for this reason, they are avoided. Although (Italian) oblique relatives are typical of formal (written) registers and are less frequent in colloquial speech, low frequency of a structure cannot be the (only) reason for the difficulties that the participants in our study display. The level of accuracy of cleft sentences, which are frequent in the colloquial speech, was also low. Some errors were also found in the repetition of subject *wh*-question, which are more frequent than object *wh*-questions, and are fully acquired at adolescence age. A usage-based approach cannot explain our data also when considering the participants' errors. The children in Diessel and Tomasello's study were claimed to simplify the structure producing sentences that adhere to frequent patterns in which the first NP is the agent. In our study, the main error in oblique relatives consisted in replacing the non-agreeing relative pronoun *cui* with the agreeing (less frequent and more complex) relative pronoun *quale*, without modifying word order. The only error in the repetition of clefts was the incorrect prosody, regardless of the type of clefts investigated (subject or object).

We investigated whether DD participants' difficulties can be attributed to memory deficits. Individuals with learning difficulties may have reduced memory skills

(Stanford et al. 2019, Stanford and Delage 2019). We did not assess memory directly, but we used control sentences to disentangle difficulties with syntax and deficits in memory skills, as control sentences have the same number of syllables as experimental sentences. Since control sentences were not problematic for students with dyslexia, we conclude that the (complex) syntactic properties of the experimental constructions caused the low-level accuracy in the task. Oblique relatives were taxing for both groups, and the most difficult structure for both groups was prepositional genitive relative clauses (8% for DD and 42% for TD). The difficulty depends on the syntactic complexity of this sentence type, namely the presence of a larger number of syntactic derivational steps than in the other structures, in addition to pied piping of the relative pronoun together with both a preposition and a DP. Once again, frequency cannot be the reason for the errors found, as all types of oblique relatives included in the task are typical of the formal register and rarely used in colloquial speech.

In addition to the language assessment, we proposed syntactic training activities to the group of adolescent students with dyslexia, following previous studies on the enhancement of language skills in populations with typical and atypical language development. Before training, the participants showed difficulties with some complex structures derived by syntactic movement. All participants were below the mean of the controls in more than one construction. After training, the level of accuracy noticeably improved.

The explicit syntactic training consisted in teaching verb argument structure, the Theta Criterion and syntactic movement involved in the derivation of relative clauses. Only relative clauses were trained. After training, performance also improved in structures that were not trained, namely clefts and *wh*-questions. The DD students were below the mean of the TD group before training; after training, their performance was within normal range. These results are expected since relative clauses are more complex than clefts and *wh*-questions and are derived by the same type of movement. The effectiveness of syntactic training is further confirmed by the fact that improvement was maintained some months after the end of the training.

10. Conclusion

In this paper, we investigated the repetition of movement-derived constructions in Italian high-school students with and without dyslexia.

Results showed that the acquisition of oblique relatives is still in progress during school years for all students. Results also showed that a complexity hierarchy exists in the use of the different complex structures, among which oblique relatives were the most demanding. This is probably due to the fact that they are constructions of the formal register which are acquired very late, at school and via reading. However, the type of register alone cannot explain our results since cleft sentences, which are also used in colloquial speech, proved demanding especially for DD participants. Prepositional genitive relatives are the most demanding constructions because of complex pied

piping and a high number of steps involved in their derivation. The six DD participants were administered syntactic training activities focusing on the most complex structures, namely relative clauses. Their accuracy scores in the repetition of this construction increased noticeably after training. Furthermore, their performance also improved in untrained structures, namely clefts and *wh*-questions. These generalisation effects were observed in similar syntactic treatments administered to other populations and show that training of the most complex structures generalises over less complex structures of the same syntactic type.

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