

8 Dyslexia and Syntactic Deficits: Overview and a Case Study of Language Training of Relative Clauses

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1 – Introduction

Developmental Dyslexia (DD) refers to a learning difficulty in reading which manifests itself as difficulties in written word decoding and/or reading comprehension. Individuals with dyslexia may have difficulties in spelling words, reading fluently and accurately, reading aloud, and understanding what they read. The definition by the International Dyslexia Association is the following: ‘Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language’.¹

There is however increasing evidence that the difficulties faced by children and adults with dyslexia often concern not only the written

¹ <https://dyslexiaida.org/definition-of-dyslexia/>

dimension of language, but also its oral dimension. Individuals with dyslexia may encounter difficulties in oral comprehension and/or production tasks. Furthermore, the deficit may not only concern phonological skills, but other components of language as well.

This chapter contributes to the discussion of syntactic deficits in individuals with dyslexia, which appear to be similar to those observed in individuals with specific language impairments (SLI), or developmental language disorders. Syntactic deficits are often not detected by standardized tests used in clinical settings. Catts *et al.* (2005: 1380) point out that oral language difficulties ‘were typically not severe enough for children to have been identified as having SLI (Scarborough & Dobrich, 1990). This has also been the case for other studies that have documented oral language problems in children with a family risk for dyslexia (e.g. Gallagher *et al.*, 2000)’.¹ This raises the issue of language assessment in individuals with dyslexia and the need to develop specific language tests to detect difficulties in vulnerable areas of grammar.

The relationship between developmental language disorders (DLD) and learning difficulties (LD) is a matter of much debate. We do not enter this long-standing discussion, whether the two are one and the same disorder due to a phonological deficit which is more severe in DLD than LD (the severity model, Kamhi & Catts, 1986; Tallal *et al.*, 1997), whether in DLD, other components of grammar are impaired in addition to phonology, as is typical for dyslexia (the additional deficit model, Bishop & Snowling, 2004), or whether they are different disorders which may

both be present in one and the same individual (the comorbidity model, Bishop *et al.*, 2009; Catts *et al.*, 2005; McArthur *et al.*, 2000; Pennington & Bishop 2009; Ramus *et al.*, 2013; Talli *et al.*, 2016; Casalini *et al.*, this volume).²

In this chapter, we concentrate on syntactic deficits detected when Italian-speaking children, adolescents, and adults with dyslexia are administered oral tasks. We focus on those syntactically complex constructions which are typical of the formal register used at school and university, namely, genitive and prepositional relative clauses (see examples (5) and (6) below). Note that many constructions of the formal register are acquired late through reading rather than speaking (for genitive and prepositional relative clauses in Italian, see Guasti & Cardinaletti, 2003).

Finally, we discuss syntactic training administered to a high school student with dyslexia. This student's performance in a sentence repetition task and an elicited production task assessing the competence of syntactically complex constructions improved after syntactic training. Explicit teaching of those syntactic properties which have not developed implicitly may contribute to the development of syntactic competence and efficient reading skills.

2–Language Deficits in Individuals with Dyslexia

Cross-linguistically, individuals with dyslexia have been reported to

display deficits in different language components: phonological deficits (Ramus *et al.*, 2003) and difficulties in the repetition of non-words (Brady *et al.*, 1983; Elbro, 1997); poor lexicon (Snowling *et al.*, 2003) and difficulties in naming tasks (Manis *et al.*, 2000); syntactic deficits in verb morphology (Rispen *et al.*, 2004) and in the comprehension and production of relative and passive clauses (Bar-Shalom *et al.*, 1993; Mann *et al.*, 1984; Robertson & Joanisse, 2010; Stein *et al.*, 1984; Talli *et al.*, 2016; Wischart *et al.*, 2009), just to name a few studies.

When directing attention to syntactic difficulties in Italian, we note that empirical evidence is also accumulating. Clitic pronouns (Arosio *et al.*, 2016; Guasti, 2013; Zachou *et al.*, 2013), *wh*-questions (Guasti, 2013; Guasti *et al.*, 2015), and negation (Vender & Delfitto, 2010) are difficult to comprehend and produce by children with a diagnosis of dyslexia.

Children with dyslexia also exhibit difficulties in comprehending and producing syntactically complex sentences such as those containing subject and object relative clauses (Arosio *et al.*, 2017; Cardinaletti, 2014; Guasti *et al.*, 2015; Pivi, 2014; Pivi & Del Puppo, 2015; Pivi *et al.*, 2016). The difficulty with relative clauses persists in adulthood. University students with dyslexia (age range: 20-25 years) have a performance different from age-peers and similar to younger typically developing individuals in producing and comprehending subject and object relative clauses in oral tasks; passive sentences are less demanding, but their production by students with dyslexia is still below their age-peers' performance (Cardinaletti & Volpato, 2011, 2015).

One might wonder why such different constructions like clitic pronouns, *wh*-questions, and relative clauses have been the object of recent research on the competence of Italian individuals with dyslexia. These constructions have one common property: they are all derived by syntactic movement. A clausal constituent appears to the left of the position where it is interpreted. For instance, in (1) and (2), the pronominal complement of the lexical verb ends up appearing to the left of the canonical object position in Italian, namely before the auxiliary and the modal verb, respectively:

(1) *Maria lo ha visto <lo>*.

Maria him has seen

(2) *Maria lo vuole vedere <lo>*.

Maria him wants [to] see

The clitic pronoun *lo* ‘him’ is interpreted as the complement of *vedere* ‘see’ in the canonical object position signalled by angle brackets, but pronounced elsewhere. A long-distance relationship is established between the two positions. Similarly, in relative clauses, the subject (3) or the complement (4) of the embedded verb ends up appearing before the complementizer *che* ‘that’ of the relative clause:

(3) *Conosco il professore [che <professore> ha visto Maria]*.

[I] know the professor that has seen Maria

(4) *Conosco il professore [che Maria ha visto <professore>].*

[I] know the professor that Maria has seen

It is well-known that constructions derived by syntactic movement are impaired in individuals with DLD (for English: van der Lely & Battell, 2003; for Hebrew: Friedmann & Novogrodsky, 2007; for Italian: Arosio *et al.*, 2014, 2017, Arosio & Guasti, 2019). The studies mentioned in this section point out that they are also demanding for individuals with dyslexia.

Most research has focused on Italian children with dyslexia, and the first data on Italian adults with dyslexia have become available only recently (Cardinaletti & Volpato, 2011, 2015). The language competence of Italian adolescents with dyslexia has been investigated by Del Puppo *et al.* (2018). They used an oral repetition task of complex sentences derived by syntactic movement (cleft sentences, long-distance *wh*-questions, left-dislocated sentences with resumptive clitic pronouns, relative clauses; test developed by Del Puppo *et al.*, 2016) in order to investigate language competence in a group of middle school students (seven adolescents with dyslexia aged 12;2-14;0, $M_{\text{age}} = 13;1$) and a group of high school students (11 adolescents with dyslexia aged 16;3-18;9, $M_{\text{age}} = 17;7$). The younger group of students with dyslexia differs significantly from age-peers (age range: 12;1-14;2, $M_{\text{age}} = 13;1$) in all sentence types but cleft sentences, which is the sentence type with the highest rate of correct repetitions

(90%). Relative clauses are particularly demanding for this group: They are repeated correctly only 22.5% of times. The older group differs significantly from age-peers (age range: 17;0-19;9, $M_{\text{age}} = 17;9$) only in relative clauses, which are still repeated correctly only 39.5% of times. While younger and older typically developing students performed in a comparable way, the language competence of students with dyslexia appears to develop from middle to high school.

Using the sentence repetition task developed by Del Puppo *et al.* (2016), in this chapter we investigate a variety of syntactically complex structures derived by syntactic movement in a group of high school students. We then focus on the most complex relative clauses, namely genitive and prepositional relative clauses, through an oral elicited production task designed to this aim. As shown by Guasti and Cardinaletti's (2003) experimental data, these constructions are produced by typically developing children no earlier than 10 years of age. We do not have data for typically developing (TD) adolescents. Our experiment also aims at filling this gap.

3-Relative Clauses in Italian adolescents with Dyslexia

3.1-Participants

Forty-eight students recruited in a high school in the province of Verona participated in the experiment. They were enrolled in the second

(N=18, age range: 15;1-16;10), fourth (N=14, age range: 16;10-19;2), and fifth (N=16, age range: 17;10-20;8) class in the school year 2016/17 (tenth, twelfth, and thirteenth grade, respectively). Five of the students had a diagnosis of developmental dyslexia (DD students); three of them were attending the second class (age 15;2, 15;3, 15;11, respectively), one of them the fourth class (age 18;2), and one the fifth class (age 18;2). Forty-three students (age 15;1-20;8) are control students (TD participants).³

3.2-Methodology

Two tasks were administered: a sentence repetition task and an elicited production task. Each test was administered individually in a quiet school room in 15-minute sessions. Both tasks were presented on a computer screen. The stimuli of the sentence repetition task were presented by a recorded voice, the stimuli of the elicitation task were presented by the experimenter (the second author of the paper). The former task was administered in December 2016 and January 2017, the latter between the end of March and the beginning of April 2017. All 43 TD students participated in the sentence repetition task. Only 39 TD students participated in the elicited production task.

The repetition task, developed by Del Puppo *et al.* (2016), consists of 49 complex sentences: 33 experimental sentences (six subject and object clefts, 12 subject and object long-distance *wh*-questions, six left-dislocation sentences with resumptive clitic pronouns, nine genitive and prepositional relative clauses) and 16 filler sentences (SVO sentences,

complex sentences with sentential complements, coordinated sentences, and passive sentences) of the same length as experimental sentences. This allows experimenters to distinguish between difficulties due to syntactic deficits and to memory deficits.

A sentence repetition task has many advantages. The performance on sentence repetition is a good indicator of a child's grammatical ability given that only what belongs to the subject's competence can be repeated (Del Puppo *et al.*, 2016; Friedmann & Szterman, 2011; Lust *et al.*, 1996; Marinis & Armon-Lotem, 2015; Polišenská *et al.*, 2015; Szterman *et al.*, 2015; Theodorou *et al.*, 2017, among others). A repetition task allows experimenters to directly control the constructions to be tested. It also allows for the testing of language competence in several different constructions by using one and the same task, thus eliminating the potential confounding factors of the tests themselves. Sentence repetition tasks are also used as good indicators of DLD, showing high levels of sensitivity and specificity for children speaking different languages (see Conti-Ramsden *et al.*, 2001 and Archibald & Joanisse, 2009, among others).

In (5), examples of the relative clauses present in the sentence repetition task are provided:

- (5) a. Genitive relative clause:

Il postino saluta la signora il cui figlio disegna.

the postman greets the lady whose son draws

- b. Prepositional genitive relative clause:

La mamma bacia la bambina al cui fratello piacciono le tigri.

the mother kisses the child to whose brother please the tigers

‘Mum is kissing the child whose brother likes tigers.’

- c. Prepositional relative clause with *cui* ‘which’:

La bambina lava il cane a cui il padrone dà i biscotti.

the child washes the dog to whom the owner gives the
biscuits

- d. Prepositional relative clause with *il quale* ‘the which’:

Il cane morde i ragazzi ai quali il nonno compra il gelato.

the dog bites the boys to whom the granddad buys the ice-
cream

The elicited production task is meant to elicit relative clauses, which turned out to be particularly impaired in the repetition task, and to check for production errors and answering strategies used by the participants to avoid particularly demanding constructions. It is an adaptation of the test by Mulas (2000), whose results were reported in Guasti & Cardinaletti (2003). The new test has 20 trials intended to elicit relative clauses on the subject, the object, the indirect object, the locative, and the genitive. Four trials for each sentence type were presented. Examples for each type of elicited relative clause are provided in (6):

- (6) a. Subject relative clause:

il bambino che salta

the child that is jumping

- b. Object relative clause:

il gattino che il cane lecca

the kitten that the dog is licking

- c. Indirect object relative clause:

lo studente a cui il professore spiega un argomento di storia

the student to whom the professor explains a history topic

- d. Locative relative clause:

lo scatolone in cui/nel quale/dove entra il lupetto

the box in which/in. the.MS.SG which.SG/where is
entering the wolf

- e. Genitive relative clause:

il gemello il cui coniglio dorme

the twin whose rabbit is sleeping

In all trials, noun phrases are singular and masculine, and refer to either individuals or animals.

The test was administered using a PowerPoint presentation. In each slide, the pictures of two individuals or animals were shown to the participant and described by the experimenter. A blindfolded puppet was present in the experimental setting together with the experimenter and the participant. Then, an arrow appeared in the PowerPoint presentation pointing to one of the two referents. At this point, the experimenter asked the participant the following question: how can you ask the puppet to touch this one? In the meantime, the puppet was given the possibility of looking at the screen. In this context, the participant was expected to produce a complex sentence containing a restrictive relative clause in

order to discriminate between the two referents (e.g. *Tocca il bambino che salta* ‘Touch the child that is jumping’).

3.3–Results

In this section, results are reported for both tasks.

In the repetition task, trials were considered as correct if they were repeated verbatim. Table 8.1 shows the number and percentages of sentences correctly repeated by the group of students with dyslexia (DD) and the group of typically developing students (TD) for each sentence structure:

Table 8.1

Repetition task: General results	DD		TD	
	No.	%	No.	%
Cleft sentences	11/30	37%	142/258	55%
Wh-questions	58/60	97%	492/516	95%
Left Dislocations	30/30	100%	242/258	93%
Relative clauses	17/45	38%	222/387	57%
Subtotal: experimental sentences	116/165	70%	1098/1419	77%
Filler sentences	74/80	93%	673/688	98%
Total	190/245	78%	1771/2107	84%

Given the categorical (dichotomic) nature of the collected data, repeated measure logistic regression analyses in a mixed model were carried out using the statistical software R (R Development Core Team, 2018, R Version 3.5.0) to investigate between-group and within-group performance.

Overall, the percentages of correct sentences repeated by the DD group are lower than those of the TD group. The comparison between the two groups showed that the latter group performed significantly better than the former group (Wald $Z=1.985$, $p=.04$). A significant difference between the two groups was also found in the repetition of relative clauses (Wald $Z= -2.081$, $p=.04$). The comparison in all the other constructions did not yield any significant difference between DD and TD students ($p>.05$).

In order to investigate class performance, Table 8.2 provides the number and percentages of correct answers in the different constructions distinguishing the different school classes attended by the students (also keeping the distinction between students with DD and TD students):

Table 8.2

Repetition task:	2 nd class		4 th class		5 th class	
	Students with DD	TD students	Student with DD	TD students	Student with DD	TD students
General results per class						
Cleft sentences	5/18 27.7%	59/90 65.5%	6/6 100%	20/78 25.6%	0/6 0%	63/90 70%
Wh-questions	34/36 94.4%	174/180 96.6%	12/12 100%	141/156 90.3%	12/12 100%	177/180 98.3%
Left Dislocations	18/18 100%	86/90 95.5%	6/6 100%	74/78 94.8%	6/6 100%	82/90 91.1%
Relative clauses	10/27 37%	68/135 50.3%	5/9 55.5%	75/117 64.1%	2/9 22.2%	79/135 58.5%
Subtotal: experimental sentences	67/99 67.6%	387/495 78.1%	29/33 87.8%	310/429 72.2%	20/33 60.6%	401/495 81%
Filler sentences	42/48 87.5%	236/240 98.3%	16/16 100%	203/208 97.6%	16/16 100%	234/240 97.5%
Total	109/147 74.2%	623/735 84.7%	45/49 91.8%	513/637 80.5%	36/49 73.5%	635/735 86.4%

Overall, the comparison between the three classes showed that a

significant difference was found only between the TD students in the fourth and fifth classes (Wald $Z=2.552$, $p=.01$). The scores in the fifth class are significantly higher than those in the fourth class.⁴

Considering the individual performance of the students with DD, we found that in the second class, two participants out of three were 2.6 and 1.9 SD below the mean of the TD students attending the same class, and in the fifth class the student with LDD was 2.2 SD below the mean of her classmates.

The structures that proved to be most demanding for all students, and especially for those with DD attending the second and fifth classes, were cleft sentences and relative clauses. The student with DD in the fifth class was 2.1 SD below the mean of her classmates in the repetition of relative clauses.

Since relative clauses were among the most problematic structures, we now focus on the repetition of these structures. Table 8.3 provides the number and percentages of correctly repeated sentences for each type of relative clause investigated:

Table 8.3

Repetition task Results on relative clauses	2 nd class		4 th class		5 th class	
	Students with DD	TD students	Student with DD	TD students	Student with DD	TD students
Genitive relatives	3/6 50%	24/30 80%	2/2 100%	18/26 69.2%	2/2 100%	29/30 96.6%
Preposition + genitive relatives	2/6 33.3%	12/30 40%	0/2 0%	19/26 73%	0/2 0%	13/30 43.3%

Preposition + <i>cui</i>	1/3 33.3%	7/15 46.6%	1/1 100%	8/13 61.5%	0/1 0%	7/15 46.6%
Preposition + <i>il quale</i>	4/12 33.3%	25/60 41.6%	2/4 50%	30/52 57.6%	0/4 0%	30/60 50%
Total	10/27 37%	68/135 50.3%	5/9 55.5%	75/117 64.1%	2/9 22.2%	79/135 58.5%

In the elicited production task, which is focused on relative clauses, results confirm difficulties with this sentence type for students with dyslexia. Table 8.4 shows the number and percentages of sentences correctly produced by the group of students with DD and the group of TD students for each relative clause type:

Table 8.4

	DD		TD	
	No.	%	No.	%
Subject relatives	20/20	100%	149/156	96%
Object relatives	1/20	5%	7/156	4%
Indirect object relatives	3/20	15%	39/156	25%
Locative relatives	6/20	30%	87/156	56%
Genitive relatives	1/20	5%	48/156	31%
Total	31/100	31%	330/780	42%

Overall, the percentages of target relative clauses produced by the DD group are lower than those of the TD group. However, the difference between the two groups is only marginally significant (Wald $Z=1.931$, $p=0.054$). Subject relatives were the structures with the highest percentage of accuracy for both groups, and a clear asymmetry emerges between subject and object relatives. Pied-piping structures, namely indirect object

and locative relatives, which are built with a preposition, and genitive relatives, are particularly problematic, especially for the DD group. However, no significant differences were observed between the two groups in any of the different relative clause types.

In order to investigate class performance, Table 8.5 provides the number and percentages of correct answers in the different relative clause types distinguishing the different school classes to which the students belonged (also keeping the distinction between DD and TD students):

Table 8.5

Elicited production task:	2 nd class		4 th class		5 th class	
	Students with DD	TD students	Student with DD	TD students	Student with DD	TD students
Subject relatives	12/12 100%	52/56 92.8%	4/4 100%	50/52 96.1%	4/4 100%	47/48 97.9%
Object relatives	1/12 8.3%	2/56 3.5%	0/4 0%	2/52 3.8%	0/4 0%	3/48 6.2%
Indirect object relatives	2/12 16.6%	15/56 26.7%	1/4 25%	9/52 17.3%	0/4 0%	15/48 31.2%
Locative relatives	2/12 16.6%	30/56 53.5%	2/4 50%	21/52 40.3%	2/4 50%	36/48 75%
Genitive relatives	1/12 8.3%	20/56 35.7%	0/4 0%	11/52 21.1%	0/4 0%	17/48 35.4%
Total	18/60 30%	119/280 42.5%	7/20 35%	93/260 35.7%	6/20 30%	118/240 49.1%

Overall, the comparison between the three classes showed that a significant difference was found only between the fourth and fifth classes when considering TD students exclusively (Wald $Z=2.745$, $p=.006$). The scores in the fifth class are significantly higher than those in the fourth class.⁵

Instead of target relative clauses, which belong to the formal register of Italian, both groups produce non-target correct sentences as in (7) (TD group 42%; DD group 50%) and ungrammatical sentences as in (8) (TD group 6.7%; DD group 9%). In (7a) and (7d), relative clauses are avoided altogether; subject relatives are produced instead of object (7b), indirect object (7c), or genitive (7e) relatives:

- (7) a. *Tocca il leone con le fauci spalancate.*
touch the lion with the jaw wide-open
Target: *Tocca il leone che sta ruggendo.*
touch the lion that is roaring
- b. *Tocca il gattino spaventato dal topo.*
touch the kitten scared by the mouse
Target: *Tocca il gattino che il topo spaventa.*
touch the kitten that the mouse scares
- c. *Tocca il maiale che riceve una calza rossa piena di dolci.*
touch the pig that receives a red sock full of sweets
Target: *Tocca il maiale a cui il gallo regala una calza rossa piena di dolci.*
touch the pig to whom the rooster gives a red sock full of sweets
- d. *Tocca lo scatolone con il lupo all'interno.*
touch the carton with the wolf inside
Target: *Tocca lo scatolone in cui entra un lupo.*

touch the carton in which enters the wolf

e. *Tocca il gemello che ha il coniglio che dorme.*

touch the twin that has the rabbit that sleeps

Target: *Tocca il gemello il cui coniglio dorme.*

touch the twin whose rabbit sleeps

In (8), the relative pronoun is replaced by *dove* (8a), the wrong preposition (8b) or the wrong type of relative (8c) is chosen:

(8) a. **Tocca il cucciolo dove il suo papà pesca un pesce.*

touch the puppy where its dad is fishing a fish

Target: *Tocca il cucciolo il cui papà pesca un pesce.*

touch the puppy whose dad is fishing a fish

b. **Tocca il tetto nel quale scende lo spazzacamino.*

touch the roof in which descends the chimney sweep

c. **Tocca il tetto il cui spazzacamino scende.*

touch the roof whose chimney sweep descends

Target: *Tocca il tetto da cui/dal quale scende ...*

touch the roof from which descends ...

Only students with dyslexia produced relative clauses typical of sloppy or informal registers, with just *che* (9a), or containing *che* and dative clitic pronouns (9b, c):

(9) a. *Tocca il papà che il figlio gioca a calcio.*

touch the dad that the child plays soccer

Target: *Tocca il papà il cui figlio gioca a calcio.*

touch the dad whose child plays soccer

- b. *Tocca il maiale che il gallo gli regala una calza rossa piena di dolci.*

touch the pig that the rooster DAT gives a red sock full of sweets

Target: see (7c)

- c. *Tocca il gattino che il cane gli dà un bacio.*

touch the kitten that the dog DAT gives a kiss

Target: *Tocca il gattino che il cane lecca.*

touch the kitten that the dog licks

3.4–Discussion

In this study, we have focused on the competence of Italian high school students with a diagnosis of dyslexia in the use of complex syntactic structures. Two oral tasks were administered: a sentence repetition task including different types of syntactically complex sentences and an elicited production task focused on relative clauses.

In the repetition task, the percentage of correct sentences repeated by the DD group is significantly lower than that of the TD group. Focusing on sentence types, a significant difference between the two groups was found in the repetition of relative clauses. Note that relative clauses are also repeated in low percentages by the TD group (57%, Table 8.1); adults (university students aged 23-36) reach 88% of correctly repeated relative clauses (Del Puppo & Volpato, 2016). The test contains the most complex relatives, namely genitive and prepositional, which

belong to the formal register of Italian.

Our results are in line with those of Del Puppo *et al.* (2018), whose older group of eleven students with dyslexia aged 16;3-18;9 ($M_{\text{age}} = 17;7$) only significantly differ from age-peers in the repetition of relative clauses. Our results are higher than those by younger, middle school students with dyslexia analyzed by Del Puppo *et al.* (2018) (seven students aged 12;2-14;0, $M_{\text{age}} = 13;1$). Although the number of tested students is admittedly low, the data seem to suggest that the language competence of individuals with dyslexia improves with increasing age. This should be verified with larger samples.

Also note that the experimental sentences were repeated with lower percentages than the filler sentences of the same length (see Tables 8.1 and 8.2). Our results also replicate those of Del Puppo *et al.* (2018). This shows that the difficulties observed are not due to limited memory resources but should be attributed to the syntactic properties of experimental sentences.

In the production task, object relatives are avoided by all students, replicating previous results on TD adolescents (Volpato, 2010). The students with dyslexia not only produced fewer relative clauses than their TD age-peers, but also produced more ungrammatical sentences and sentences typical of sloppy or informal registers.

Note that the student with dyslexia attending the fourth class (twelfth grade), who performed better than the other students with dyslexia and repeated the complex sentences correctly most times

(91.84%), however failed in the two most complex structures, namely the prepositional genitive relatives, which he did not repeat at all, and the prepositional relatives with *il quale*, which he repeated 50% of the time (see Table 8.3). In the elicited production task, he produced subject relatives instead of object relatives, on a par with his age-peers. However, he did not produce any genitive relative, which were always replaced by two subject relatives, as in (7e). Furthermore, he never produced the agreeing relative pronoun *il quale*, but always the non-agreeing form *cui*, differently from the younger and older TD students.

In conclusion, our results confirm a clear difficulty with complex sentences in oral tasks in all students with dyslexia. Relative clauses, in particular prepositional and genitive, are especially demanding for these students.

4–Language Training on Relative Clauses: A Case Study

One of the students with dyslexia in the second class (age 15;2) was administered a specific syntactic training on relative clauses. This student showed poor performance in both tasks. In particular, his performance in the repetition task was lower than the group of students with dyslexia in his class.

Syntactic training was modeled on Levy and Friedmann's (2009) syntactic intervention administered to a 12.2 year-old Hebrew-speaking adolescent with a diagnosis of learning difficulty ('significant reading

comprehension impairment'), who turned out to also have a syntactic-DLD after assessment with oral comprehension, repetition, and production of constructions derived by syntactic movement. While he had normal performance in lexical, phonological, and verb argument structure tasks, he was poorer than the age-matched control group in relative clauses, focalizations, *wh*-questions, and sentences with verb movement.⁶

Levy and Friedmann's (2009) syntactic intervention lasted six months. In our case, the syntactic training was administered during the months of April and May 2017, after the elicited production task, and was composed of eleven 90-minute sessions. The first session was devoted to the discussion of verb argument structure and the different verb classes depending on the number and type of arguments. In the second session, thematic theory was introduced, namely the property that all and only the arguments selected by the verb appear in the sentence. Sentences may not lack an obligatory argument of the verb (**Maria ama* 'Maria loves'), nor can they contain more arguments than they should (**Maria ama Gianni la musica* 'Maria loves Gianni the music; **Maria ride zucchero* 'Maria laughs sugar'). The crucial role of the verb was illustrated via a theatre backstage video: the stage director selects the actors and coordinates each actor's work; similarly, the lexical properties of the verb specify how many arguments should appear in the sentence and which syntactic category they have (noun phrase, prepositional phrase, clause, etc.). In the next seven sessions, the syntactic derivation of relative clauses was illustrated through card games. Movement of constituents was shown from

one position to another position in the sentence. The seven sessions which focused on relative clauses were organized as follows: relative clauses on the subject and the object (two sessions), the indirect object (one session), the locative argument (two sessions), and genitive relative clauses (two sessions). One session was devoted to recap activities. In the last session, the sentence repetition and elicited production tasks were administered again.

4.1 –Results

In this section, results before and after training are reported for the student with dyslexia attending the second class of high school (tenth grade) who participated in the syntactic training program. His results are compared with those of both the whole group of students with dyslexia attending the second class and the group of typically developing students attending the same class. Table 8.6 provides the number and percentages of correctly repeated sentences, while Table 8.7 focuses on relative clauses:

Table 8.6

Repetition task

General results

	2 nd class				2 nd class: Student with DD			
	Students with DD		TD students		Before Training		After Training	
Cleft sentences	5/18	27.7%	59/90	65.5%	2/6	33%	3/6	50%
Wh-questions	34/36	94.4%	174/180	96.6%	9/12	75%	12/12	100%

Left Dislocations	18/18	100%	86/90	95.5%	6/6	100%	6/6	100%
Relative clauses	10/27	37%	68/135	50.3%	2/9	22%	7/9	78%
Subtotal: experimental sentences	67/99	67.6%	387/495	78.1%	19/33	58%	28/33	85%
Filler sentences	42/48	87.5%	236/240	98.3%	13/16	81%	16/16	100%
Total	109/147	74.1%	623/735	84.7%	32/49	65%	44/49	90%

Table 8.7

Repetition task

Results on relative clauses

	2 nd class				2 nd class: Student with DD			
	Students with DD		TD students		Before Training		After Training	
Genitive relatives	3/6	50%	24/30	80%	1/2	50%	1/2	50%
Preposition + genitive relatives	2/6	33.3%	12/30	40%	0/2	0%	2/2	100%
Preposition + <i>cui</i>	1/3	33.3%	7/15	46.6%	0/1	0%	1/1	100%
Preposition + <i>il quale</i>	4/12	33.3%	25/60	41.6%	1/4	25%	3/4	75%
Total	10/27	37%	68/135	50.3%	2/9	22%	7/9	78%

As Tables 8.6 and 8.7 show, before language training, the student was able to repeat only 65% of the sentences verbatim. Cleft sentences and oblique relative clauses were particularly demanding for him. After training, his performance improved reaching 90% of correctly repeated target sentences. Note that cleft sentences and *wh*-questions improved even if they were not treated directly. As stated above, syntactic training was focused on relative clauses only. As for relative clauses, his performance rose from 22% to 78% of sentences repeated verbatim. After training, he was also able to repeat prepositional genitive relatives and prepositional relatives with agreeing *il quale*, which are the most complex sentences in Italian.

In Table 8.8, the number and percentage of target sentences produced

in the elicited production task are reported. The results of the student who was administered the syntactic training are compared with those of both the whole group of students with dyslexia attending the second class and the group of TD students:

Table 8.8

Elicited production task: General results	2 nd class			2 nd class: Student with DD				
	Students with DD		TD students		Before Training		After Training	
Subject relatives	12/12	100%	52/56	92.8%	4/4	100%	4/4	100%
Object relatives	1/12	8.3%	2/56	3.5%	1/4	25%	4/4	100%
Indirect object relatives	2/12	16.6%	15/56	26.7%	1/4	25%	2/4	50%
Locative relatives	2/12	16.6%	30/56	53.5%	0/4	0%	2/4	50%
Genitive relatives	1/12	8.3%	20/56	35.7%	0/4	0%	2/4	50%
Total	18/60	30%	119/280	42.5%	6/20	30%	14/20	70%

Table 8.8 shows that the elicited production of relative clauses also improved, from 30% of produced target relative clauses before training to 70% after training.

4.2-Discussion

One of the students with dyslexia attending the second class of high school (tenth grade) was administered a syntactic training on relative clauses which lasted less than two months. His performance improved after training, when he was able to correctly repeat 90% of sentences verbatim. He improved not only on relative clauses, which were the focus of syntactic training, but also on untrained sentences, namely cleft sentences and *wh*-questions. These generalization effects are

expected since (i) cleft sentences and *wh*-questions are derived by the same type of syntactic movement as relative clauses, (ii) relative clauses are more complex than cleft sentences and *wh*-questions, and (iii) training of most complex sentences generalizes to less complex sentences. The same generalization effects were found in previous experiments on syntactic training administered to different populations: aphasic patients (Thompson *et al.*, 1996, 1997, 2003, 2007), a Hebrew-speaking adolescent with LD and DLD (Levy & Friedmann, 2009), and Italian children with cochlear implants (D’Ortenzio, 2018).

Although the student did not reach 100% of target sentences, he was able to produce fewer errors than before training. Some examples are provided in (10)-(12). While the sentences repeated before training were ungrammatical (10a, 12a) or belonging to the informal register (complementizer *che* + dative clitic pronoun *gli*) (11a), the sentences repeated after training (10b)-(12b) are all target-like:

- (10)a. *La mamma bacia la bambina a cui il fratello piacciono le tigri.*
the mum kisses the child to whom the brother “please” the tigers
- b. *La mamma bacia la bambina al cui fratello piacciono le tigri.*
the mum kisses the child to whose brother “please” the tigers
“The mum is kissing the child whose brother likes tigers.”
- (11)a. *La bambina lava il cane che il padrone gli dà i biscotti.*
the child washes the dog that the owner DAT gives the biscuits
- b. *La bambina lava il cane a cui il padrone dà i biscotti.*

the child washes the dog to whom the owner gives the biscuits

(12)a. *Il lupo guarda la bambina che la nonna dona un fiore.*

the wolf looks at the child that the grandmother gives a flower

b. *Il lupo guarda la bambina alla quale la nonna dona un fiore.*

the wolf looks at the child to the.FEM.SG whom.SG the
grandmother gives a flower

As stated above, interrogative sentences also improved. While before training, he turned object questions into subject questions, as in (13a), after training he was able to produce object questions correctly agreeing the embedded verb with the plural postverbal subject (13b):

(13) a. *Quale pulcino hai detto che ferma le giraffe?*

which chick [you] have said that stops the giraffes?

b. *Quale pulcino hai detto che fermano le giraffe?*

which chick [you] have said that stop the giraffes?

In the elicited production task, he was able to produce all types of relative clauses and reached 70% of produced complex sentences containing relative clauses. He not only produced object relatives, showing that he had fully acquired this sentence type, but also prepositional and genitive relative clauses, which were not produced before training.

Note that if we only consider oblique (i.e. indirect object, locative, genitive) relatives to make the comparison with the sentence repetition

task possible, the percentage of correctly produced oblique relative clauses rises from 8% before training (1/12) to 50% (6/12) after training. In (14)-(16), his productions before (a. sentences) and after treatment (b. sentences) are provided. In (14a), a subject relative replaced an indirect object relative by changing the verb; in (15a), the complementizer *che* and the dative clitic pronoun *gli* were produced instead of a pied-piped locative PP containing a relative pronoun (*attorno a cui*); in (16a), an ungrammatical sentence was produced. The sentences in (14b)-(16b) contain target relative clauses:

(14)a. *Tocca lo studente che sta parlando con il professore.*

touch the student that is talking with the professor

b. *Tocca lo studente a cui il prof spiega un argomento di storia*

touch the student to whom the professor explains a topic of history

(15)a. *Tocca il gatto che il topo gli sta girando intorno.*

touch the cat that the mouse DAT is turning around

b. *Tocca il gatto attorno a cui gira il topo.*

touch the cat around which turns the mouse

(16)a. *Tocca il papà quello che gioca a calcio.*

touch the dad that that plays soccer

b. *Tocca il papà il cui bambino gioca a calcio.*

touch the dad whose child plays soccer

5- Conclusions

In this chapter, we have studied the competence of complex syntactic structures in Italian high school students with a diagnosis of dyslexia, comparing their performance with that of age-peers attending the same school and the same class. Two oral tasks were administered: a sentence repetition task including different types of syntactically complex sentences and an elicited production task focused on relative clauses. Our results confirm a clear difficulty with complex sentences in oral tasks for all students with dyslexia. These difficulties are often under-estimated in individuals with dyslexia and raise the issue of the need for more focused language assessment to detect syntactic deficits in the most vulnerable areas of grammar. A sentence repetition task like the one used in our study might contribute to the assessment of syntactic competence and to the distinction between different language profiles of individuals with dyslexia.

One of the students attending the second class of high school (tenth grade) was administered a syntactic training focused on relative clauses, which turned out to be the most impaired structures for all students with dyslexia. After training, he was able to correctly repeat 90% of sentences. His performance improved not only in the repetition and production of relative clauses, but also in the repetition of cleft sentences and *wh*-questions, which were not part of the teaching program. These generalization effects were found in similar syntactic treatment approaches administered to other populations and show that training of the most complex structures generalizes over less complex

structures of the same syntactic type.

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Notes

(1) For recent studies on family risk of dyslexia, see Snowling and Melby-Lervag (2016) and van Viersen *et al.*, (2018).

(2) The presence of language deficits in individuals with a diagnosis of dyslexia has been acknowledged in two lines of the *Linee guida per il diritto allo studio degli studenti con disturbi specifici di apprendimento*, issued by the Italian Ministry of Education and University (MIUR) on July 12, 2011: “La comorbilità può essere presente anche tra i DSA e altri disturbi di sviluppo (disturbi di linguaggio, [...])” (Comorbidity can be present between LD and other developmental disorders (specific language impairments, [...])).

(3) Three bilingual students and five L2 Italian speakers also participated in the experiment. Their data are not included in this paper.

(4) This comparison was not possible for LD students given the low number of participants in each class.

(5) This comparison was not possible for LD students given the low number of participants in each class.

(6) Levy & Friedmann’s (2009) syntactic intervention was modeled on Thompson & Shapiro’s (2005, 2007) and Thompson *et al.*’s (1993, 1996, 1997, 2003) language intervention with aphasic patients.

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