

Primary Language Impairment and Developmental Dyslexia

A two-case study

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Primary Language Impairment (PLI) and Developmental Dyslexia (DD) are developmental disorders which primarily affect language (and language-related abilities) from childhood onwards. Recent studies on DD have evidenced morphosyntactic weaknesses, in conjunction with a core phonological impairment. Therefore, compelling parallelism between children with DD and PLI is inferred. In the present paper, we will address the trivial issue of the relationship between the two disorders by discussing Italian data from a two-case study. In order to do so, we collected, transcribed and analyzed samples of spontaneous and elicited speech of two Italian speaking children. In addition, we proved their linguistic abilities by conducting standardized tests in order to evaluate the disruption of any linguistic level, with particular reference to phonology and morphosyntax. We intend to support the Comorbidity Model, which holds the view that PLI and DD are distinct but potentially comorbid developmental disorders.

Keywords: developmental language disorders, Primary Language Impairment, Developmental Dyslexia

1. Introduction

Both Primary Language Impairment¹ (henceforth referred to as PLI) and Developmental Dyslexia (henceforth referred to as DD) are developmental disorders that cannot be attributed to any neurological, psychological or physical handicapping condition; consequently, they are not caused by hearing loss, low IQ, or

¹ For a long time PLI has been referred to as Specific Language Impairment (SLI), according to Leonard's well-known definition (Leonard 1998, 2014). In the present paper, we prefer the PLI label in recognition of the fact that the disorder involves some disturbances, albeit mild, in additional areas other than language (Ebert & Kohnert 2009).

neurological damage (DSM-5 2014: 77 ss.; Leonard 2014: 3). According to epidemiological studies, the two disorders affect between 5% and 10% of the child population (Tomblin *et al.* 1997; Snowling 2000; Leonard 2014; Verhoeven, Perfetti & Pugh 2019). Furthermore, both PLI and DD are of a genetic nature (Samples & Lane 1985; Bishop & Edmundson 1986; Lewis & Thompson 1992); indeed, it is common for these pathologies to run in families (Gilger, Pennington, & DeFries 1991; Rice, Haney, & Wexler 1998; Fisher & DeFries 2002). However, whereas PLI primarily impairs children's oral language abilities, DD affects their reading skills by leaving oral language almost apparently intact (Leonard 2014; Snowling 2000). Most importantly, dyslexic children are known to show persistent difficulties in acquiring written words decoding skills, reading fluency and accuracy (Ramus *et al.* 2003), which represent the prototypical symptoms of the disorder. Most scholars commonly hold the view that such difficulties arise from a phonological processing deficit (Brady 1986; Snowling & Hulme 1994; de Jong & van der Leij 2003; Ramus & Szenkowitz 2008; Goswami 2011; Ramus & Ahissar 2012). However, during the last decades, it has been shown that DD, just like PLI, also implies some morphosyntactic weaknesses (Scarborough 1990, 1991; Bar-Shalom *et al.* 1993; Joanisse *et al.* 2000; Rispens *et al.* 2004; Rispens & Been 2007; Altman *et al.* 2008; Casalis, Leuwers, & Hilton 2013; Cantiani *et al.* 2013), by which links between DD and PLI have become even more evident.

This paper aims to contribute to the debate on the complex relationship between PLI and DD by discussing some unpublished Italian data from a two-case study. After having briefly outlined the key terms of the issue, we will therefore discuss our data, which we consider to be in line with the hypothesis that PLI and DD simply tend to co-occur, as stated in the Comorbidity model (Ramus *et al.* 2013).

2. Definitions

Because of the numerous apparent similarities between PLI and DD, over time it has been assumed that these syndromes are strictly linked (Kamhi & Catts 1986; Bishop & Snowling 2004). Indeed, the overlap between the two disorders encompasses a broad range of linguistic features. In order to address the relevant topic of their relationship, it may be useful to resume the main manifestations of both PLI and DD.

2.1 Primary Language Impairment

As previously stated, PLI is a developmental disorder which implies difficulties in acquiring spoken language in absence of neurological and psychological damage, hearing loss and low non-verbal IQ and despite adequate learning environment (Leonard 1998, 2014). However, defining PLI is not straightforward, since it greatly varies from language type to language type (Leonard 2014: 150); furthermore, due to its profound interaction with the educational environment and because of its tendency to be comorbid with other developmental pathologies, PLI is not easy to detect.

Generally, children affected by PLI display specific linguistic deficits, with particular reference to phonology and morphosyntax (Jakubowicz & Tuller 2008). Whereas their phonological representations² are sometimes disrupted (Edwards & Lahey 1996; Gray & Brinkley 2011), their lexical retrieval abilities are often weakened (Marini, Tavano & Fabbro 2008). As far as grammatical encoding is concerned, PLI children do tend to omit function words and grammatical morphemes, such as particles, auxiliaries or inflections (Watkins & Rice 1991; Rice & Wexler 1996; Grela & Leonard 2000; Rice & Blossom 2013). In addition, they show specific difficulties in repetition (Bortolini et al. 2006; Marini, Tavano & Fabbro 2008), which may denote the presence of constraints on their phonological Working Memory. In conclusion, PLI subjects often fail to understand and make limited use of complex morphosyntactic structures such as clitic pronouns, passive and relative sentences (Friedman & Novogrodsky 2004; Contemori & Garraffa 2010; Arosio *et al.* 2014; Chondrogianni *et al.* 2015; Delage & Durrleman 2018).

Turning to Italian PLI, its main features can be thus summarized:

- low verbal productivity³ in conjunction with poor lexical, morphosyntactic and syntactical organization⁴ (Marini, Tavano & Fabbro 2008);

² Phonological representations are the ideal units which stand for linguistical sounds (*e.g.*, phonemes, syllables, *morae*). It seems that these units are sparser in dyslexics than in developmentally typical subjects (Ramus 2001).

³ In accordance with Marini, Tavano & Fabbro (2008), by verbal productivity we mean the number of words produced per minute during storytelling. As a result, verbal productivity is a measure of speech rate in terms of words per minute (words/m).

⁴ Lexical organization corresponds to the percentage of paraphasias (*e.g.*, slips of the tongue) per word, whereas morphosyntactic organization represents the percentage of paragrammatic errors (*e.g.*, substitutions or omissions of bound morphemes) and syntactical organization measures utterance's length and complexity.

- avoidance of non-canonical sentences accompanied by their poor comprehension (Contemori & Garraffa 2010);
- lack of function words, such as clitic pronouns and plural third person inflectional morphemes (Bortolini *et al.* 2006);
- disruption of repetition mechanisms (Bortolini *et al.* 2006).

2.2 Developmental Dyslexia

Children with DD fail to acquire reading and writing skills (Snowling 2000). In fact, their ability to recognize letters is reduced due to an inadequate acquisition of grapheme-phoneme conversion rules. Most scholars assume that this symptom is strictly linked to the damage and/or inaccessibility of phonological representations (Bryant & Bradley 1985; Snowling 2000; Goswami 2000; Ramus 2001; Ramus & Szenkovitz 2008; Ramus & Ahissar 2012)⁵. Indeed, it is commonly believed that a core phonological deficit lies behind dyslexia, something upon which scholars almost unanimously agree (Brady 1986; Snowling & Hulme 1994; de Jong & van der Leij 2003; Ramus & Szenkowits 2008; Goswami 2011; Ramus & Ahissar 2012). After being extensively investigated, phonology revealed its deep weaknesses in DD. The impairment involves each layer of that linguistic representational level, with particular reference to phonological awareness⁶ (Wagner

⁵ The subject of damage *versus* inaccessibility of the phonological level in DD is a much debated one. At first, scholars used to assume the degradation of phonological representations in DD (Wagner & Torgesen 1987; Goswami 2000). However, over time the hypothesis that the disorder instead affects information access mechanisms on a phonological level has become increasingly concrete (McCrory 2001; Ramus & Szenkovits 2008; Ramus & Ahissar 2012). This latter assumption has been further supported by neuro-scientific studies. Through the use of fMRI and multivoxel pattern analysis techniques, dyslexic brain's integrity has been found to be reduced. In particular, the phenomenon involves the arcuate fasciculus and its white matter. It is worth noting that the function of the arcuate fasciculus is to connect the left Frontal Inferior Gyrus (IFG), responsible for phonological processing, and the left Superior Temporal Gyrus (STG), containing the primary auditory cortex. This accounts for the designation of DD as a phonological disconnection syndrome (Boets *et al.* 2013).

⁶ Phonological awareness corresponds to one's consciousness of and access to the phonological representational layer of one's language (Mattingly 1972; Wagner & Torgesen 1987). It can be inferred from phonological tasks such as tapping out/reversing/putting together sounds in words and non-words (Lewkowicz 1980). Alphabetic systems lay upon speakers' phonological awareness, thus showing why subjects lacking such ability find the correspondence between grapheme and phoneme cryptic. However, phonological weaknesses in dyslexia do not concern phonological consciousness only. For instance, it has been proved that rhythmical perception and production difficulties are involved in dyslexia (Thomson & Goswami 2008; Leong *et al.* 2011; Huss *et al.* 2011; Goswami *et al.* 2013; Flaughnacco *et al.* 2014; Couvignou, Perets & Ramus 2019), which accounts for the frequent comorbidity between DD and amusia.

& Torgesen 1987; Ramus *et al.* 2003). In addition, lexical retrieval difficulties and limitation on Working Memory capacity are also frequent (Ramus 2001; Di Betta & Romani 2007).

Despite the undeniable literacy impairment, probably connected to a core phonological deficit, recent studies have pinpointed many other features of dyslexics' linguistic weaknesses. In particular, it has been shown that DD children struggle with inflectional morphology production (Joanisse, Manis, Keating, & Seidenberg 2000; Altman *et al.* 2008), with particular reference to the formation of past tense verbs. In addition, it has been proved that dyslexics' morphosyntactic processing is also undermined (Cantiani *et al.* 2013; Guasti *et al.* 2015; Rispens, Been, & Zwarts 2006; Rispens, Roeleven, & Koster 2004; Robertson & Joanisse 2010). Finally, like PLI children, dyslexic subjects strive to both understand and produce complex syntactic structures, such as relative and passive sentences, or clitic pronouns (Guasti *et al.* 2008; Wischart *et al.* 2009; Reggiani 2010; Zachou *et al.* 2013; Contemori & Marinis 2014; Cardinaletti & Volpato 2015; Arosio *et al.* 2017; Cardinaletti & Casani 2019).

2.3 PLI and DD: similarities and differences

To sum up, PLI and DD overlap in several respects, as the following table shows⁷:

Table 1. Overlaps between PLI and DD

Features	PLI	DD
Age	developmental	developmental
Origin	genetic	genetic
IQ	70(±5)	70(±5)
Brain Abnormalities	left peri-sylvian area	left peri-sylvian area
Phonology	weakened	impaired
Morphosyntax	impaired	weakened
Lexical Retrieval	weakened	weakened
Working Memory	weakened	weakened

Therefore, DD and PLI share common nature and similar features. A phonological processing deficit, considered the main cause for DD, is also frequent in children with PLI. It has even been hypothesized that phonological deficiencies lead to the onset of PLI (*i.e.*, *Surface Hypothesis*, Leonard 1989, 2014). By determining the

⁷ The data summarized in the table are taken from Snowling (2000) for DD and Leonard (2014) for PLI.

loss of scarcely salient elements, a phonological impairment could account for the occurrence of some representative features of PLI, such as the loss of inflectional morphemes (e.g., past tense *-ed* in English), often corresponding to unstressed syllables.

Understanding the relationship between PLI and DD is undoubtedly useful, mainly for rehabilitative purposes (Bishop & Snowling 2004). In the last few decades, at least three models have been outlined in an effort to describe that relation. The *Severity model* suggests that PLI and DD do not diverge in any respect, being different manifestation of the same phonological deficit (Kamhi & Catts 1986; Snowling 2014). The *Additional Deficit model*, although recognizing in both PLI and DD such kind of impairment, distinguishes between them on the basis of the presence of additional semantical and morphosyntactic disorders in PLI (Bishop & Snowling 2004). At last, the *Component model* simply describes the aforementioned relationship as an instance of comorbidity (Ramus *et al.* 2013).

Severity and Additional Deficit models provide a somewhat narrow interpretation of the topic. As for the former, by leaving subjects' morphosyntactic abilities unexplored, it offers partial results. Indeed, by formulating their Additional Deficit model, Bishop & Snowling (2004) promoted instead a qualitative distinction between PLI and DD, identifying a double dimension of variation along the tracks of phonological and non-phonological skills. However, further scientific evidence has led to the need to revise this latter model too. Indeed, it has emerged that the presence of a phonological deficit in both disorders is not informative as such, since its nature significantly varies between PLI and DD.

In fact, Ramus *et al.* (2013) pointed out that, unlike DD, PLI may be exempt from any phonological manifestation. Furthermore, these scholars have hypothesized differential patterns of phonological disturbance between the two disorders. By considering phonology as a hierarchical layer, it is indeed possible to admit the independent impairment of its components. Thus, according to Ramus and colleagues, phonological representations, fundamental for the acquisition of language, would be affected in PLI, whereas meta-phonological skills, whose role is essential for the development of reading skills, would be affected in DD.

As a consequence, as far as the phonological level is concerned, the two syndromes seem to vary. Further evidence comes from some studies conducted by Marshall and colleagues. For instance, by evaluating the production of consonant clusters in PLI and DD subjects through a non-words repetition task, Marshall & van der Lely (2009) have found differential factors acting on it between the two disorders. In particular, it seemed that clusters reduction was favored in DD by their medial position within the word in conjunction with the atony of the syllable

of which they constitute the onset. On the other hand, no effect of prosodic salience on the production of consonant clusters was found in PLI.

Then shifting to morphosyntax, scholars have also shown differential behavioral patterns between PLI and DD. One example out of all is that of accusative clitic pronouns. Being high demanding, these structures tend not to be employed by pathological populations. However, PLI and DD children differ in how they avoid the construct: whereas the former simply tend to dismiss the pronoun, thus producing pragmatically improper sentences, the latter instead simply tend to replace it through full DPs (for DD see Zachou *et al.* 2013; for PLI see Arosio *et al.* 2016). Furthermore, in DD scholars have also found instances of incongruous gender agreement between the clitic pronoun and its antecedent (Marotta 2017), which do not stand out – or stand out to a very small extent – in the case of PLI (Arosio *et al.* 2014). Still on grammar, intended as the very faculty of language in a generative sense, Marotta (2017) also pointed out that the agreement domain itself is mastered in a biased way in DD, especially in reference to the nominal syntagma. In addition, she has noticed an improper use of some function words, such as prepositions, by dyslexic subjects, thus highlighting both the complex status of grammatical competence in dyslexia and its potential linking with PLI.

Summing up, all these studies seem to suggest that PLI and DD merely tend to occur in comorbidity, in virtue of their numerous similarities.

3. Materials and methods

In this paper, we will discuss spontaneous and elicited data from a two-case study⁸. Such kind of research is not of statistical significance, in virtue of both the scarceness of the sample and the lack of a control group. Nevertheless, we chose this approach in accordance with Caramazza's point (Caramazza 1986)⁹, aiming to observe oral language performance of two developmentally atypical children in a qualitative case-by-case perspective.

⁸ Data have been collected during a training internship at the Azienda Ospedaliera Universitaria Pisana department of developmental neurocognitive rehabilitation and converged into the MA thesis of the Author (Marra 2018), written under the supervision of Professor Giovanna Marotta, University of Pisa.

⁹ Caramazza has shown that only case-by-case analyses may be capable of approaching researchers' theoretical question as "*Is it the case that patients of type R also necessarily manifest property y?*". Wishing to evaluate the behavioral patterns of PLI and DD, with particular reference to the presence of phonological impairments in PLI and of oral language difficulties in DD, in this paper we will then maintain a case-by-case perspective.

Speech and reading samples, collected in the presence of the Author during children's rehabilitation sessions at the AOUP (see note 8), have been audio recorded through a Zoom H2next Handy Recorder and then transcribed in accordance with Savy's (2007) transcribing norms. Since our study was conceived as a preparatory work, it was not our purpose to submit data to acoustic analyses. Therefore, the examples taken into account below are to be regarded as the result of mere auditory analysis of perceptual type. In the next sections, participants and materials employed in our research will be presented.

3.1 Subjects

Our informants are MC and LB, two Italian speaking children diagnosed with developmental linguistic disorders. The former was 4;9 y.o. at the time of testing. His parents referred familial heritability for language pathologies and labeled him as a Late Talker¹⁰. He was diagnosed with an expressive Language Impairment. Indeed, his main symptoms were phonological in nature, and therefore also compatible with Bortolini's (1995) definition of Phonological Disorder¹¹. The latter subject was LB, a 9;6 y.o. pupil with a certified diagnosis of Developmental Dyslexia.

3.2 Linguistic abilities assessment

General linguistic abilities were assessed by administering the following tests:

- *Test di Valutazione del Linguaggio* (TVL, Cianchetti & Sannio Fancello 1997): TVL allows the evaluation of morphosyntactic, lexical and semantic participants' abilities. It is set for children between 30 and 71 months, but may also be employed for developmental ages later on. Parameters taken into account are word and sentence comprehension, sentence repetition, naming and story-telling abilities;
- *Test di Articolazione Fanzago* (Fanzago 1983): Fanzago is a picture naming task based on 114 figures; it aims at evaluating articulatory abilities of

¹⁰ It is referred to as Late Talkers «children who at the age of two years show slow development of language based on formal tests and vocabulary checklists» (Leonard 2014: 153), such as MacArthur's checklist (Fenson *et al.* 1993).

¹¹ Developmental phonological disorder is characterized by the following phonological phenomena: delayed development of speech sounds; persistence of phonological processes previous in typical acquisition; high variability; preference for a small set of sounds; reduction in syllable structures (Ingram 1992; Bortolini 1995).

- children with reference to the whole Italian phonemes' inventory; each phoneme is thus triggered in initial, medial and final position;
- *Test di Comprensione Grammaticale per Bambini* (TCGB, Chilosi, Cipriani *et al.* 1995): TCGB is a picture matching task consisting of 76 stimuli. The examiner shows a four-figured table to the participant by simultaneously reading a sentence. The participant has to designate the figure corresponding to the stimulus by choosing it on the table. Each table contains three distractors (1 semantic, 1 phonological and 1 unrelated) other than the correct answer. It is set for children between 3;6 and 8;0 y.o.;
 - *Token Test* (Fabbro 1999): it is an acting-out task aiming to evaluate subjects' reception abilities. The examiner spells out some commands, and the participant has to accomplish them;
 - *Semantic Fluency task* (BVN 5-11, Bisiacchi *et al.* 2005): it is a lexical retrieval task; the subject has to enumerate as many items as possible into 90" on the ground of categorical belonging (*e.g.*, trigger is *food*: words are *pane, pasta, uova*, etc);
 - *Phonological Fluency task* (BVN 5-11, Bisiacchi *et al.* 2005): similar to the one mentioned before, it is a phonologically based lexical retrieval task. In this case the participant has to recall as many words as possible on the grounds of phonological belonging (*e.g.*, trigger is /t/: words are *topo, torre, tetto*, etc);
 - *Word Repetition Test* (Fabbro 1999): the task consists in the repetition of a list of words and non-words.

3.3 Oral language assessment

We collected samples of both spontaneous and elicited speech. The former was obtained through conversation, by asking questions about habits and/or events (*e.g.*, actions you perform before going to sleep; a party you attended); the latter, by assessing a picture description task. A cartoon story (*the balloon story*, Cianchetti & Sannio Fancello 1997), consisting of a series of drawings presented on the same page, was shown to the participants. Then, they were asked to describe the images, thus producing a brief narrative. Lastly, as far as it concerns LB, also reading samples, obtained by submitting the child to the MT tests (Prove MT, Cornoldi *et al.* 2017), have been taken into account.

4. Results

In the following table MC's and LB's scores are listed¹²:

Table 2. MC's and LB's scoring at testing

Test	MC	LB
TVL	±	+
Fanzago	-	/
TCGB	-	+
Token Test	-	±
SF	±	±
PF	-	-
WR	-	+

It is worth noting that MC performed worse than LB on each task. Although there is no doubt that the age difference could have affected participants' results, we believe that the nature of the disorder played its part as well. Indeed, MC's scores suggest that his linguistic abilities are more constrained than that of LB in several respects. Furthermore, it seems clear that MC suffers from an oral language disability, which apparently does not affect LB at all. In particular, MC's language impairment involves his phonological encoding abilities, notably decreasing his general performance. On the other hand, LB's results do not reveal any oral pathology. Indeed, out of his literacy difficulties, he does not show any kind of linguistic weakening.

Focusing now on MC's skills, out of all the tasks that he performed below the norm¹³, WR and TCGB proved particularly laborious for him. Firstly, MC's repetition skills are poor, revealing both a lack of control on phonological encoding and constraints on his verbal Working Memory capacity. Furthermore, his speech came out being filled with phonological simplification phenomena, a feature which we will refer to as being prototypical of MC's language later on (§5.1).

¹² Diacritics employed in the table are: + (*i.e.*, the score achieved is adequate to subject's chronological age); - (*i.e.*, the score is 2 Standard Deviations below the norm, thus revealing a pathological condition); ± (*i.e.*, the score is 1 Standard Deviation beneath the average); / (*i.e.*, the test was not conducted). For instance, we did not perform Fanzago test on LB, having found his lexical abilities to be good by means of the TVL test. As a result, since he did not show any articulatory disorder, we considered that it was unnecessary to perform further tasks.

¹³ As for the tests employed, it was possible to compare the scores achieved by our informants with the average standard values per age group reported for each test.

Lastly, it is worth emphasizing that function words tend to be omitted¹⁴ even during the WR task. Turning now to TCGB, it is to be noted that only a few specific constructions have proven particularly challenging for MC. These are reflexive, passive and negative sentences, all acquired late by developmentally typical children (Guasti, 2007)¹⁵.

As for LB, we noticed that he did not show manifest difficulties at linguistic testing. His poor performance on TT, SF and FF may then be due to factors inherent to the dyslexic disorder. For instance, the SF task revealed that LB's lexical retrieval abilities are constrained. However, we hypothesized that the presence of reformulation phenomena (*e.g.*, target word *paracadute*: paratu+ <sp> paracu+ <sp> para+ <lp> paracadute) or phonemic paraphasias (*e.g.*, target word *spiga*: output *spina*) may depend on the core dyslexic deficit, which is phonological, rather than being of a semantic nature. Indeed, his major difficulties concern his literacy skills, by leaving oral language intact.

In the next section we will then focus on examples from MC's and LB's oral production.

5. Discussion

Our findings seem to be in line with previous studies that prove the existence of differential impairments' patterns between PLI and DD (Marshall *et al.* 2009; Ramus *et al.* 2013). In particular, considering the data at our disposal, we noticed that PLI involves a greater degree of difficulties than dyslexia, especially in the areas of phonology and morphosyntax. In fact, whereas MC displays a phonological encoding deficit accompanied by morphosyntactic weaknesses even at the oral language coding level, LB only shows a main literacy impairment.

In the next sections, some recurrent phonological and morphosyntactic phenomena found in MC and LB speech will be discussed.

5.1 Phonological phenomena

First, consonant clusters' reduction is very common in MC's spontaneous oral language samples (1-5):

¹⁴ That's the case of determiners (*e.g.*, *il gatto miagola*), prepositions (*e.g.*, *vado a scuola*), pronouns (*e.g.*, *io ti do*).

¹⁵ For instance, MC decoded the passive sentence *la bambina è pettinata dalla mamma* as the transitive *la bambina pettina la mamma*.

-
- (1) ['pi:ne] // (MC)
spine
 - (2) ['sempe] // (MC)
sempre
 - (3) ['pa:k:o] // (MC)
parco
 - (4) [ba'b:i:na] // (MC)
bambina
 - (5) [i's:ɛ:gwe] // (MC)
insegue

As examples (1-5) show, MC tends to avoid consonant clusters. This leads to the activation of phonological simplification processes, such as dropping (1-2) and assimilating (3-5) phenomena. In particular, Example 1 illustrates the tendency to dismiss fricatives in /sC/ clusters, while Example 2 proves the fallacy of the trill in /Cr/ clusters. Trills' and nasals' weakness in consonant groups is then also validated by the regressive assimilation phenomena reported in (3-5).

In this regard, it should be noted that in MC's spontaneous production assimilatory phenomena are frequent too, as the following examples reveal (6-11):

- (6) ['gɔf:ja] // (MC)
gonfia
- (7) ['kwad:o] // (MC)
quando
- (8) ['mɔt:o] // (MC)
molto
- (9) ['at:o] // (MC)
altro
- (10) [pe'k:e] // (MC)
perché
- (11) [fa'f:al:a] // (MC)
farfalla

The aforementioned examples prove MC's tendency to avoid those phonemes typically acquired late by Italian children (Savoia 2014). In particular, these are nasals (6-7), laterals (8-9) and trills (10-11), whose presence in MC's phonological inventory seems blocked by the preconsonantal context.

Phoneme substitution is also particularly recurrent, in agreement with Bortolini's (1995) phonological speech disorder definition. Indeed, we noticed MC's tendency to replace velar plosives with the alveolar ones, as the following examples show (12-15):

(12) ['gɔ] // (MC)
do

(13) ['ga:k:o] // (MC)
gatto

(14) ['ku:f:o] // (MC)
tuffo

(15) ['gɛ:k:i] // (MC)
denti

In (12) the substitution concerns the voiced alveolar plosive /d/ which turns into the voiced velar plosive /g/. More prevalent, however, is the substitution of the unvoiced alveolar plosive /t/, as shown by Examples in (13-14). Then, the case in (15), in which we observe the substitution of both voiced and unvoiced alveolar plosives, is interesting too.

MC's production is then characterized by a further recurrent phonological phenomenon, which consists in the anteriorization of the post-alveolar affricates /tʃ/ (*i.e.*, /tʃ/ > /ts/) and /dʒ/ (*i.e.*, /dʒ/ > /dz/) as in (16-21):

(16) ['tʃe:lo] // (MC)
cielo

(17) ['fa:tʃo] // (MC)
faccio

(18) [pal:on'tʃi:ni] // (MC)
palloncini

(19) [mad'dʒa:ko] // (MC)
mangiato

(20) ['dzo:ka] // (MC)
gioca

(21) ['ɔddzi] // (MC)
oggi

It is worthy to note that example (19) also contains a further occurrence of the alveolar plosives' substitution, which reveals how different phenomena are simultaneously triggered during pathological language processing.

As for the affricates, these phonemes are often avoided. Plosive and, less frequently, fricative sounds are in fact preferred to them, as the following stopping¹⁶ (22-24) and frication¹⁷ (25) cases show:

(22) ['bi:ti] // (MC)
bici

(23) ['pit:a] // (MC)
pizza

(24) ['ba:t:o] // (MC)
braccio

(25) ['pja:se] // (MC)
piace

Further phenomena ascribable to language phonological disorder are the idiosyncratic use of phonemes (26-28), the inversion of phonemes' linear order (29-30), some epenthetic cases (31-32):

(26) ['ko:ɣ:e] // (MC)
corre

(27) ['fjɔ:ɣi] // (MC)
fiori

(28) ['faye] // (MC)
fare

¹⁶ Stopping is a simplification phenomenon which consists in replacing continuant consonants with stop consonants.

¹⁷ Frication is a simplification phenomenon which consists in replacing affricate consonants with fricative consonants.

- (29) ['kja:møn] // (MC)
camion
- (30) [mu'dønɛ] // (MC)
rumore
- (31) ['sfa] // (MC)
fa
- (32) ['spɔ:t.a] // (MC)
porta

In (27-28), it is worth mentioning the distortion of the alveolar trill /r/ into the voiced velar fricative /ɣ/, a phoneme that does not stand out in Italian. Example (29) contains a glide rise, whereas in (30) distortions and metathesis add up to the neological *mudone* for Italian *rumore*. Lastly, the fricative addition in (31-32) denotes the tendency to recreate a well-known Italian cluster (*i.e.*, /sC/).

As some previously mentioned examples show (26-28), the alveolar trill /r/ turns out to be deeply unstable in MC's speech, in line with acquisitional studies on Italian (Savoia 2014). In particular, we noticed the following tendencies:

- a) /r/ > /d/ / V_V;
b) /r/ > /l/ / V_V, V_#;
c) /r/ > /n/ / V_C;
d) /r/ > Ø / C_V.

Indeed, in MC's speech intervocalic trills turn into voiced alveolar plosives (33-35) or, less frequently, lateral approximants (36-37):

- (33) [tam'bu:do] // (MC)
tamburo
- (34) [bik'kje:di] // (MC)
bicchieri
- (35) [paʊ'dɔ:si] // (MC)
paurosi
- (36) [ru'mɔ:le] // (MC)
rumore
- (37) [z'ba:t:ele] // (MC)
sbattere

In preconsonantal position, the alveolar nasal phoneme often replaces trill (38-39), thus recreating another well-known Italian cluster (*i.e.*, /nC/):

(38) ['gwanda] // (MC)
guarda

(39) [ri'kɔndo] // (MC)
ricordo

In conclusion, trill turns into an approximant lateral even in word-final position (40):

(40) [kom'pju:tɛl] // (MC)
computer

Trill's instability is also corroborated by its drop in postconsonantal context within clusters, a phenomenon that confirms the language system's tendency to be simplified in pathological contexts (41-43):

(41) ['tɔp:o] // (MC)
troppo

(42) ['fut:a] // (MC)
frutta

(43) ['sta:da] // (MC)
strada

Trill's precariousness is ultimately confirmed by the overlapping outcomes for the same item, as is the case for *ancora* (44-45):

(44) [ak'koda] // (MC)
ancora

(45) [an'kola] // (MC)
ancora

The last phonological phenomenon worth mentioning here is the unstressed syllable omission, shown by Example (46):

(46) ['pa:ro] // (MC)
imparo

The dropping of unstressed syllables in MC's spontaneous oral production makes a very interesting point, which we will, however, discuss in detail later when dealing with morphosyntactic aspects of his speech. Suffice it to say here that the phenomenon represents the main *trait d'union* between MC's spontaneous production and LB's reading abilities, which are also characterized by the loss of scarcely salient elements such as unstressed syllables or part of them. As noted above (§4), LB's performance at language testing did not reveal major difficulties. However, these clearly emerge in those tasks that make use of his literacy skills, as is appropriate in the case of dyslexia. Indeed, some phonological processes observed in MC's oral production are also found in LB's reading, accompanied by additional characteristic phenomena due to dyslexia.

First of all, it is worth noting LB's tendency to omit unstressed phonemic material (47-48), which sometimes leads to neological formulations (49), in reading:

(47) [ten.'ta:.va] // LB
tentennava

(48) [z've:..ʎ:a] // LB
sorveglianza

(49) [in.ke.'ra:.re] // LB
inzaccherare

Very common are also paralexias¹⁸, both phonologically (50-52) and semantically based (53-55):

(50) ['ordine] // LB
odore

(51) [grat'ta:ta] // LB
portata

(52) [ten'tando] // LB
tenendo

(53) [bam'bi:na] // LB
bimba

¹⁸ Paralexia consists in replacing target words with similar items during reading; it may be due to phonological or semantic assonance.

(54) [ˈfjo:ri] // LB
foglie

(55) [ˈritorˈno] // LB
ritornando

Occasionally, phonemes' linear order in reading is reversed, as we observe, for instance, in the following Example (56):

(56) [asflatˈta:ta] // LB
asfaltata

The following Examples show that the lesser-known and longer¹⁹ words – for this reason, more difficult – are the ones that challenge the dyslexic subject; this emerges from the following further cases of phonemic substitution (57-59):

(57) [ˈpromuˈro:si] // LB
premurosi

(58) [ˈriˈemprono] // LB
riempiono

(59) [ˈivitano] // LB
evitano

Similar anomalies reveal LB's tendency to prefer the lexical route of reading over the phonological one²⁰.

Lastly, the case of degemination should be mentioned. It reveals dyslexics' unawareness for the consonantal duration contrast (Leppänen *et al.* 2002; Richardson *et al.* 2003):

(60) [ˈanasˈpɔ] // LB
annaspò

It is worth noting that most of LB's reading anomalies are due to the inaccessibility of the phonological route in reading; that means that he struggles with

¹⁹ Long items are made up by three or more syllables.

²⁰ The Dual Route model of Reading (Coltheart *et al.* 2001) posits that we read by means of two processes: a phonological one, which consists in converting graphemes into phonemes, and a lexical one, based on our previous contextual knowledge.

phoneme-grapheme conversion rule, thus preferring a lexical reading. As a result, only a few examples, such as loss of unstressed phonemes (47-49), phonemes linear encoding difficulties (56) or unawareness of phonological contrasts (60), may be due to phonological weaknesses.

5.2 Morphosyntactic phenomena

MC's and LB's spontaneous speech are also characterized by a few noteworthy morphosyntactic peculiarities. Let's consider the following Examples (61-63):

- (61) *fa* *molto* *rumore* *i*
 make-PRS.3S lots-ADV noise-ACC.S DET.PL
palloncini
 balloon-NOM.PL
 'Balloons make lots of noise' // MC
- (62) *i palloncini* *quando* *scoppia*
 balloon-NOM.PL when-ADV explode- PRS.3S
fanno *musica*
 make-PRS.3PL music-ACC.S
 'When they explode, balloons make music' // MC
- (63) *i* *succhi* \emptyset *frutta*
 DET.PL juice-PL PREP fruit-S
 'Fruit juices' // MC

As noted above (§5.1), one of the main features of developmental language pathologies such as PLI and DD is the dropping of unstressed phonetic material. Examples (61-63) all contain unstressed syllables' omissions, a feature that Leonard and colleagues (Leonard *et al.* 2006; Bortolini *et al.* 2006) identified as the main marker of Italian PLI. Here, the phenomenon involves both bound inflectional morphemes (61-62) and free function words (63), thus causing morphosyntactic inconsistencies. These examples clearly highlight the existing links between phonological impairment and morphosyntactic weaknesses in language developmental pathologies. Indeed, what has been referred to as the deletion of prosodically unstressed material (61-62) leads to apparent agreement violations between subject and verb phi-features.

When considering syntax, MC undoubtedly prefers plain periods. Indeed, his speech shows syntactic conciseness and ease, which may prove his language development delay. However, apart from sporadic errors coinciding with syllable

dropping phenomena such as the above-mentioned cases (61-63), we did not find any further noteworthy phenomena.

Turning now to the morphosyntactic aspects of LB's speech, it should be noted that we did not record cases comparable to those observed in (61-63). However, some inconsistencies emerged.

First of all, it is useful to highlight the syncretic use of the dative clitic pronoun *gli* (64-66), a feature which we have found even in MC's speech (67):

- (64) *(ad Anna) gli era caduto*
 Anna-DAT.F CL.M drop-PST.3S
 'It had dropped out of her hand' // LB
- (65) *(ad Anna) gli scivolò*
 Anna-DAT.F CL.M slip-PST.3S
 'It had slipped away from her' // LB
- (66) *(alla luna) gli ha fatto un regalo*
 moon-DAT.F CL.M make-PST.3S DET.M gift-ACC.M
 'He made her a gift' // LB
- (67) *(a Leandra) gli volevo bene*
 Leandra-DAT.F CL.M love-PST.3S
 'I loved her' // MC

The phenomenon, while not constituting an instance of fault²¹, confirms our former assumption, namely that pathological language systems tend towards simplification. In addition, we also noticed the following instance of agreement violation (68):

- (68) *e tutta la classe inventarono*
 CONJ QNT DET class-NOM.S invent-PST.3PL
 'And the whole class invented' // LB

The last Example is clearly due to the interference between morphosyntax and semantics. Out of these sparse cases, LB's speech was fluent and grammatically correct, which means that dyslexia did not also affect his oral language abilities.

²¹ In particular, the overextension of CL.M.SING *gli* in place of CL.F.SING *le* is attested in contemporary neo-standard spoken Italian in all social classes and registers (Berruto 2012).

6. PLI and DD: conclusive remarks

Before we proceed to any conclusions, it may be necessary to consider the limitations of the present study. First and foremost is that it lacks statistical significance. Indeed, our results are tentative. However, it should be borne in mind that, in virtue of the low number of subjects involved, our study was not designed to provide generalizations. In addition, we firmly believe that such kind of qualitative case-by-case analysis may represent a felicitous starting point for future research. Another possible limitation may be that we cannot be sure that MC is a PLI-only case. Indeed, comorbid PLI + dyslexia cases may not detect differential sources of variation between the two disorders (Messoud-Galusi & Marshall 2010). It would therefore be necessary to observe how MC's competencies evolved through time, in order to evaluate whether he did develop dyslexia or not.

Nevertheless, we believe that our study allows for some insights. Firstly, grammatical difficulties did not emerge in our participant with DD, whereas they clearly distinguish our PLI subject, as detected by a standardized assessment of morphosyntax (*i.e.*, TCGB) and by the observation of his spontaneous speech. As a consequence, we are tempted to assume that grammatical difficulties in DD, although emphasized in the last few decades (Rispen, Roeleven & Koster 2004; Rispen, Been & Zwarts 2006; Robertson & Joanisse 2010; Reggiani 2010; Cantiani *et al.* 2013; Cardinaletti & Volpato 2015; Guasti *et al.* 2015; Marotta 2017; Cardinaletti & Casani 2019), may be the result of PLI under-identification in this population, as already proposed by Arosio *et al.* (2016).

In addition, although PLI children do not always show a phonological deficit, sometimes they could experience such an impairment, as MC's case clearly show. In particular, our results also suggest differential patterns of phonological impairment between DD and PLI, as well as a specific link between prosody and grammar in PLI that did not stand out in the case of DD. Indeed, in line with Leonard's (1989) *Surface Hypothesis*, the current single-case study seems to highlight a significant relationship between prosodic salience and morphosyntactic features specific of PLI.

Turning now to DD and PLI relationship, there have been scholars who have hypothesized the identity between them (Khami & Catts 1986), as mentioned above (§2.3). However, our research seems to support the possibility that the two disorders occur in comorbidity, as Ramus *et al.* (2013) stated. Indeed, their *Component model* explicitly predicts the existence of PLI-only children with poor phonological skills, just like MC, as well as it predicts pure dyslexia: being exempt from morphosyntactic deficits, our LB could apparently be a dyslexia-only

subject. As a result, it seems to us that such a multiple-component model of language abilities best describes the relationships between PLI and DD.

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