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Recommendations for multilingualism and developmental communicative disorders[1]

WP4

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1. Setting the Problem

Although nowadays a growing number of people is aware of the benefits of bilingualism and of the importance to support bilingualism at any age and independently from the languages at stake, it is also known that bilinguals can display difficulties in some linguistic domains. While they understand the arbitrariness of language and the separation of form and meaning earlier than monolinguals (Bialystok, 1986), bilinguals typically have a poorer vocabulary in comparison to that of monolinguals in each of their languages, with marked length and frequency effects (Bialystok et al., 2010). They can display deficits in grammatical tasks, too, especially if fine morphosyntactic skills are required, although these difficulties are likely to disappear, once a full mastery of the second language (L2) is achieved (Vender et al., 2018). Phonological abilities, instead, seem to be less affected by bilingualism: bilinguals and early L2 learners are indeed typically reported to perform similarly or even better than monolinguals in phonological tasks.

Problems in literacy acquisition may also arise, especially if reading and spelling are learnt for the first time in the L2 and if this language has not been fully mastered yet; a normal performance in literacy tests may indeed be achieved later in bilinguals than in monolinguals (August & Shanahan, 2006; Bellocchi et al., 2016).

Based on this picture, two aspects are gaining growing interest in bilingual research, concerning on the one side the identification of language and reading disorders in bilingual children and, on the other side, the interaction between bilingualism and these disorders in children who have been officially diagnosed as communicatively impaired. In the following sections, we will address these issues, focusing in particular on developmental dyslexia (section 1), and discussing the results of the studies that we administered to monolingual and bilingual children, with and without dyslexia, with the aim of disentangling the effects of bilingualism and dyslexia in tasks assessing phonological abilities (2.1), morphological abilities (2.2), grammatical abilities (2.3) and implicit learning (2.4). As we will show, our results suggest that bilingualism, far from being a disadvantage, can offer

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linguistic and cognitive benefits that extend also to impaired children. We will then build on these results to indicate some best practices and recommendations for parents, educators and health professionals that deal with children suffering from specific communicative impairments (section 3).

1.1 Diagnosing communicative impairment in bilingual children

As anticipated above, some aspects of language development and literacy achievements can be troublesome for (early) bilinguals, who might score in the at-risk range on language or reading tests administered in the L2. However, the correct interpretation of these problems can be difficult, given both the paucity of normative data on the trajectory of language development in sequential bilinguals and the absence of specifically-designed diagnostic tools for the identification of language disorders, including Specific Language Impairment (SLI; also known as Developmental Language Disorder, DLD) and dyslexia, in these children (Bedore & Peña, 2008).

Health professionals and teachers working in multilingual settings have indeed long denounced the difficulty of distinguishing children whose problems are related to a still immature proficiency in the L2 from those suffering from a real impairment. This often leads to an inflation of overdiagnoses (*mistaken identities*, Genesee et al. 2014), when unimpaired children are identified as disordered, as well as underdiagnoses (*missed identities*), when diagnoses of existing impairments are not provided for excessive caution. It goes without saying that the optimal way to identify a reading (or language) impairment in bilinguals would be that of assessing them in both their languages (Gutiérrez-Clellend & Simon-Cereijido, 2010). However, it must be noted that this is hardly feasible, especially in multilingual countries characterized by great linguistic heterogeneity, where it would be fairly impossible to have health professionals (and diagnostic tools) for each of the languages spoken by the children.

Providing additional tools to support the identification of reading disorders in the majority language is thus becoming imperative.

Within the AThEME Project, the research team at the University of Verona guided by Denis Delfitto (Work Package 4) aimed at addressing this issue, by developing and administering an experimental protocol aiming at studying the possibility to develop diagnostic tools which could assist in the diagnostic procedure for the identification of developmental dyslexia in (monolingual) and bilingual children. The results of this protocol and their implication for clinicians will be discussed in section 3.4.

1.2 Understanding linguistic difficulties in impaired and typically developing bilingual children

Another way of tackling the problem of misdiagnoses in bilingualism is that of comparing bilingual and monolingual children in specific linguistic areas, in order to provide a more complete picture of the linguistic abilities that characterize children speaking more than one language. By becoming aware of the developmental trajectories of bilinguals in distinct linguistic domains, as well as of the possible differences that they might present with respect to their monolingual peers, we may be able to develop more specific predictions about their pattern of acquisition of these aspects, and this will in turn allow a better interpretation of the possible linguistic anomalies displayed by multilingual children.

Including children with diagnosed impairments in the picture is also crucial, since it permits to directly verify how bilingualism interacts with these disorders. By comparing monolingual and bilingual impaired children in specific linguistic areas, indeed, it will be possible to measure which effects bilingualism has on language impairments, and to ascertain whether these effects are positive or negative.

This will in turn permit to answer to the very widespread concerns about the opportunity to support and maintain bilingualism also in children suffering from communicative disorders. Parents, teachers and educators often fear that bilingualism may have a negative impact on these disorders and may thus discourage bilingualism and foreign language learning in impaired children. To address these issues, we developed an experimental protocol focused on developmental dyslexia, whose main results will be discussed in the following sections.

2. Linguistic Profile of Bilingual Children with Dyslexia: Experimental Protocols

The experimental protocol developed at the University of Verona had the main aim of investigating the effects of bilingualism in dyslexia, by comparing the performance of four groups of school-aged children: 25 Italian monolingual dyslexic children (mean age 10;08 years old), 33 Italian monolingual typically developing children (9;99 years old), 25 bilingual dyslexic children with Italian as L2 (10;31 years old) and 31 bilingual typically developing children with Italian as L2 (10;30 years old). Children with dyslexia, both monolinguals and bilinguals, were recruited from clinical speech centers or public schools in the area of Trento and Verona (Italy); they were diagnosed as having dyslexia on standard criteria (ICD-10; World Health Organization, 2004) and they did not have diagnosed or reported oral language problems or hearing disorder. By controlling these aspects, we aimed at making sure, as far as possible, that our children did not suffer from SLI. Typically developing children, both monolinguals and bilinguals, were recruited in the same schools as the dyslexic children, and they had no diagnosed or referred cognitive deficit, nor language problems, hearing disorders or reading difficulties. For what concerns bilingual children, all participants acquired Italian as their second language and used a different language at home. We have decided not to restrict the choice of the L1 spoken by the subjects, due to the complexity of recruiting bilinguals with a diagnosis of dyslexia and speaking the same L1. However, we gathered complete information regarding the amount of exposure to both languages of our bilingual children by administering the Bilingual Language Exposure Questionnaire in Italian, which was adapted from the Utrecht Bilingual Language Exposure Calculator (UBiLEC) (Unsworth et al., 2012) to collect information about the children's Age of First Exposure (AFE) to Italian, their current Quantity of Exposure (QE) to the L2, the Traditional Length of Exposure (TLE), which is calculated as the child's chronological age minus their age at first exposure to Italian, and the Cumulative Length of Exposure (CLE), which is a more precise measure considering other variables to determine the actual exposure to the L2.

Each participant was then administered a set of linguistic and cognitive tasks tapping phonological abilities (section 2.1), morphological abilities (section 2.2) and morphosyntactic abilities (section 2.3). Implicit learning has been also tested, by administering a modified Simon Task assessing artificial grammar learning developed by our WP4 partners at the University of Reading (section 2.4).

2.1 Phonological Abilities: The Repetition of Nonwords

Phonological abilities constitute the core deficit of developmental dyslexia; conversely, bilinguals perform similarly to monolinguals in phonological tasks, although the distance between the L1 and the L2 seems to play a role. In section 2.1.1. we will provide a review of phonological deficits in dyslexics, followed by a discussion of the studies investigating phonological skills in bilingualism in section 2.1.2. A special emphasis will be devoted to nonword repetition, a task which has proven to be particularly sensitive to language impairments, including dyslexia, and to reliably predict reading and language difficulties. In section 2.1.3, instead, we will present the results of an experimental protocol conducted by Vender, Delfitto & Melloni (submitted) assessing nonword repetition abilities in monolingual and bilingual children with and without dyslexia, with the twofold aim of (i) studying how bilingualism and dyslexia interact in nonword repetition and (ii) verifying whether this task could be successfully employed to support the identification of reading impairments in both monolingual and bilingual children.

2.1.1 Phonological Abilities and Nonword Repetition in Dyslexia

Developmental dyslexia is typically defined as a disorder affecting the ability to read and spell properly, occurring in children with adequate intelligence, opportunity, social background and classroom exposure, in absence of physical, neurological, emotional and socio-economic problems (Vellutino, 1979).

Although reading and spelling deficits remain the most evident symptoms of this dyslexia in children who are otherwise intelligent and apparently unimpaired in other aspects of their cognitive and linguistic profile, it is well-established that these manifestations are just the tip of the iceberg of a multifaceted disorder. Dyslexic people, across ages and languages, have been indeed reported to suffer from phonological deficits, morphosyntactic difficulties, especially in grammatically complex tasks (Byrne, 1981; Rispens, 2004; Vender et al., 2018a) and problems in lexical access and retrieval (Fawcett & Nicolson, 1994). In addition, more general difficulties have been reported in processing abilities and WM (Nicolson and Fawcett, 2008; Vender, 2017).

Phonological deficits, in particular, have been extensively reported as one of the core features of dyslexia: dyslexics, indeed, display severe deficits affecting all the components of phonological skills, including phonological awareness, phonological memory and phonological access (Melloni & Vender, submitted; Brady & Shankweiler, 1991; Share & Stanovich, 1995). Difficulties are particularly evident in phonological awareness tasks, as in rhyme detection, spoonerisms and phoneme segmentation (Bradley & Bryant, 1978; Ramus et al., 2013), but also in speech perception and production (Adlard & Hazan, 1997; Manis et al., 1997).

Considering the tight causal and reciprocal relationship between phonological competence and reading achievements, phonological impairments in dyslexia are believed to hamper the learning of grapheme-phoneme correspondences, rendering the processes of reading and spelling slow, effortful and inaccurate. This is further supported by the effectiveness of intervention studies which have focused on the rehabilitation of phonological abilities, indicating that this type of training is particularly beneficial for dyslexics, leading to positive effects on literacy development (Bradley & Bryant, 1983; Blachman, 2000).

Phonological impairments in dyslexia have been found across different languages and ages: they can be already identified in preschool children at risk for dyslexia (Scarborough, 1990), and persist also in adults, even when they have apparently compensated for their literacy difficulties (Bruck, 1992).

Moreover, they appear to affect the totality of dyslexics: Ramus et al. (2003), in particular, tested a group of dyslexic university students on a range of phonological, visual and motor tasks, and found that all subjects were less skilled than controls in phonological measures, including spoonerisms, rapid naming and nonword repetition (NWR), whereas only a subset presented additional visual and motor deficits.

Since the majority of the tests employed by the studies assessing phonological abilities in dyslexia were actually based on phonological awareness (PA), thus involving also metalinguistic skills and processing resources, Desroches et al. (2006) used the eyetracking technique to tap phonological knowledge more directly. Specifically, they asked subjects to simply look at a named item in an array of pictures which could or not include rhyme or cohort competitors of the target, thus considerably lowering processing costs and metalinguistic awareness. The authors found that, although both dyslexics and controls were sensitive to cohort competitors, as indicated by lower recognition rates, only controls showed slower fixations in presence of a rhyme competitor. This suggests that dyslexics were not sensitive to rhyming, and pointing to impaired competence in rhyme detection in dyslexia, which is not imputable to extraneous factors, such as metalinguistic skills, attention and memory.

NWR has received abundant attention too. As mentioned above, despite its apparent simplicity (subjects are simply asked to repeat sequences of pronounceable but meaningless sounds modeled after the phonotactic structure of their language) this task involves different processes. Phonological memory is required to keep the novel word in memory and to allow the analysis of the sound structure, while PA and processing abilities, which are both representationally and computationally independent from memory, are needed to create a well-specified acoustic representation of the nonword and to support articulation (Snowling et al., 1991).

Taken together, these aspects contributed to render NWR a much-investigated test in language disorders research. Specifically, NWR is dramatically impaired in children suffering from SLI and is considered a clinical marker for this disorder in different languages (Bishop et al., 1996; Bortolini et al., 2006).

Deficits in NWR tasks have been reported also in dyslexia, with impaired subjects performing significantly worse than both chronological-age and reading-age matched children (Kamhi & Catts, 1986; Szenkovits & Ramus, 2005; Tijms, 2004, among others) and independently from the languages tested (Paulesu et al., 2001). Difficulties are particularly severe as the length of the nonwords increases, probably related to the higher involvement of memory resources required, although they arise with shorter stimuli too (Couture & McCauley, 2000). Moreover, correlational and regression studies have also revealed that NWR tasks could be employed to predict and identify reading difficulties (De Bree et al., 2010).

Importantly, longitudinal studies have shown that phonological deficits persist over time in dyslexics, who underperform with respect to both chronological-age and reading-age matched children. This indicates that dyslexics do not simply lag behind their peers in phonological tasks and that poor phonological skills are one of the most distinctive features of dyslexia across the lifespan (Grivol & Hage, 2011; Snowling et al., 1996).

Summarizing, phonological deficits are severe and widespread in dyslexia, with phonological awareness and nonword repetition being the most investigated areas. In particular, NWR abilities can provide a reliable predictor for reading difficulties across different languages.

2.1.2 Phonological Skills in Bilingualism

As in the case of dyslexia, the areas which have received the most attention in bilingual research are phonological awareness and NWR, probably also in the light of the strict relationship they both have to reading development and literacy achievements; studies typically consider early sequential bilinguals.

Bialystok et al. (2003) reported the results of two studies involving quite large samples of L1-French L2-English bilingual children being equally competent in both of their languages, and found that bilinguals displayed a monolingual-like performance in a range of phonological tasks in English, including phoneme segmentation and substitution. Moreover, in a third study they compared performance of two groups of bilinguals having Spanish or Chinese as their L1 and English as their L2, and found an advantage in phonemic segmentation for Spanish bilinguals, but a disadvantage for Chinese bilinguals. Language similarity is held responsible for this discrepancy: Spanish is indeed much more similar to English in sound structure with respect to Chinese.

The issue of cross-linguistic transfer has been investigated by other studies reporting bilingual advantages. In particular, Campbell and Sais (1995) found that L1-Italian L2-English preschoolers outstated English monolinguals in a phonemic odd-man-out task and in syllable deletion; similarly, Bruck and Genesee (1995) found that L1-French L2-English bilinguals outperformed English monolinguals in syllable awareness and Chen et al. (2004) reported better performance in L1-Cantonese L2-Mandarin bilinguals over Mandarin monolinguals in tone awareness. These advantages have been interpreted in terms of cross-language transfer, according to which the learning of a language can facilitate the learning of another language if they share a linguistic feature which is more prominent and complicated in the former (Durgunoğlu et al., 1993). Specifically, the better performance of bilinguals in the studies reported above has been attributed respectively to the more regular syllable structure of Italian and to the higher saliency of syllables in French compared to English, and to the greater richness of tones in Cantonese over Mandarin.

An issue that has been recently much debated concerns the role of phonological abilities, and in particular of PA, across languages. Durgunoğlu, et al. (1993), for instance, reported evidence for cross-language transfer of PA skills. Specifically, they tested L1-Spanish and L2-English bilinguals and found that children with good PA in Spanish had higher proficiency in reading English words and pseudowords than children with lower PA skills, indicating that PA can predict reading abilities both within and across languages. Similarly, Erdos et al. (2014) found that bilingual children's abilities in PA, phonological access, sentence repetition and letter-sound knowledge in their L1 could predict reading difficulties in the L2 and language difficulties in both L1 and L2. These results thus indicate that the phonological skills developed in one language can transfer to reading abilities in the other, suggesting that phonological skills constitute a unitary ability within and across languages. This was also confirmed by the results of three meta-analysis on PA (Branum-Martin et al., 2012; 2015; Melby-Lervag & Lervag, 2011) supporting the hypothesis that PA is a single, language general construct across languages and thus implying that phonological instruction could enhance performance in both languages and possibly have positive effects on reading acquisition too.

As for NWR, the majority of the studies conducted on bilinguals aimed at comparing their performance to that of monolingual children with language impairments, since, as discussed above, it is considered a reliable clinical marker of SLI across languages. Although studies unanimously report higher accuracy in unimpaired bilinguals in comparison to monolinguals with SLI (Girbau & Schwartz, 2008; Thordardottir & Brandeker, 2013), data comparing typically developing monolinguals and bilinguals have yielded mixed results. Kohnert et al. (2006) showed that L1-Spanish and L2-English bilinguals underperformed English monolinguals in a task based on English phonotactics. Similarly, Messer et al. (2010) reported lower accuracy in L1-Turkish and L2-Dutch bilinguals with respect to Dutch monolinguals. Conversely, comparable performance was reported by two studies assessing NWR with tasks modeled after Italian: Vender et al. (2016) observed monolingual-like performance in bilinguals with Arabic, Albanian or Romanian as L1, consistently with Guasti et al. (2013), who tested Arabic L1 bilinguals. Surprisingly, instead, a bilingual advantage was evidenced by Tamburelli et al. (2015), who showed that L1-Polish and L2-English bilinguals even outperformed English monolinguals in a NWR task modeled after English.

These different results could be reconciled by appealing to the complexity of the tested language's phonological system. Tamburelli and colleagues indeed proposed that the extremely high phonological complexity of Polish might have enhanced the mastery of a less phonologically complex language like English. The same reasoning permits to explain the results of the studies by Kohnert et al. (2006) and Messer et al. (2010), since English is arguably more complex than Spanish, and Dutch more complex than Turkish. Analogously, the good performance in NWR of L2-Italian bilinguals could be attributed to the simpler syllabic and phonemic structure of this language.

All in all, these results suggest that bilingualism does not a priori negatively affect phonological competence in second language learners, who typically perform similarly or even better than their monolingual peers. A (slight) disadvantage could however be observed under particular circumstances, related to competence in the L2 and to the differences between the two languages at stake; specifically, differences are more likely to arise if the L2 has a much more complex phonological system than the L1. Nonetheless, it is worth highlighting that phonological skills seem to transfer from one language to the other and that abilities in PA and NWR could equally predict reading achievements in both languages. These considerations have potentially interesting clinical implications: first, they suggest that it could be possible to build on the abilities that a child already has developed in the L1 to train phonological and reading skills also in the L2; second, they indicate that it could be possible to predict the children's reading abilities by analyzing their performance in phonological tasks in both languages and to identify possible reading disorders also in bilingual children. As will be discussed in section 3.4, NWR tasks could qualify as good candidates for this last purpose.

2.1.3 Nonword Repetition in Dyslexia and Bilingualism

The aim of our research was that of comparing performance in nonword repetition of monolingual and bilingual children, with and without dyslexia, in order to assess the effects of dyslexia and bilingualism in this task. Moreover, we aimed at verifying whether NWR could provide a useful measure to integrate reading tasks in ruling in or out reading impairments in both monolinguals and bilinguals.

With this purpose, we developed a task manipulating both complexity and length of nonwords, including two- to five-syllable nonwords with three levels of complexity (simple, intermediate and complex) and administered it to monolingual and bilingual dyslexics and unimpaired children. An example of the stimuli proposed in each condition are reported below in Table 1.

Table 1. Description and examples of each condition.

Condition	N° Syllables	Complexity Level	Example	N° items
2S	two	simple	Diso	3
2M	two	intermediate	Girvo	3
2C	two	complex	Prambio	4
3S	three	simple	Nosime	3
3M	three	intermediate	Lacombre	3
3C	three	complex	Flasterdi	4

	General Accuracy	2S	2M	2C	3S	3M	3C	4S	4M	4C	5S	5M	5C
BD	0.60 (0.12)	0.88 (0.16)	0.89 (0.21)	0.75 (0.20)	0.90 (0.18)	0.76 (0.30)	0.66 (0.24)	0.53 (0.32)	0.53 (0.34)	0.22 (0.24)	0.53 (0.34)	0.46 (0.34)	0.16 (0.21)
MD	0.66 (0.12)	0.81 (0.19)	0.90 (0.18)	0.74 (0.23)	0.90 (0.15)	0.75 (0.25)	0.80 (0.16)	0.58 (0.33)	0.74 (0.22)	0.43 (0.32)	0.54 (0.31)	0.56 (0.31)	0.24 (0.25)
BC	0.84 (0.11)	0.98 (0.08)	0.98 (0.08)	0.96 (0.12)	0.96 (0.12)	0.93 (0.14)	0.90 (0.18)	0.82 (0.32)	0.81 (0.21)	0.66 (0.30)	0.82 (0.23)	0.87 (0.21)	0.38 (0.28)
MC	0.86 (0.08)	0.97 (0.10)	1.00 (0.00)	0.95 (0.10)	0.99 (0.06)	0.95 (0.12)	0.95 (0.12)	0.89 (0.18)	0.88 (0.20)	0.65 (0.28)	0.92 (0.15)	0.81 (0.24)	0.43 (0.29)

4S	four	simple	Dusevopi	3
4M	four	intermediate	Sencutroma	3
4C	four	complex	Maspurvendio	4
5S	five	simple	Dumicefona	3
5M	five	intermediate	Fulestorinca	3
5C	five	complex	Chestangutoldri	4

Our results confirmed the presence of a NWR deficit in dyslexics, irrespective of bilingualism: both groups of impaired children, indeed, performed consistently worse than age-matched controls, even with the shortest and simplest nonwords. Conversely, no differences were found between monolingual and bilingual unimpaired children, suggesting that NWR is not impaired in bilingualism, at least when the L2 has a relatively simple phonotactic structure, like Italian (see Table 2 reporting means and standard deviations of each group in each condition).

Table 2. Mean accuracy (SDs) of the four groups in the total task and in each condition of the NWR task

The complexity of our stimuli affected similarly the four groups, with complex items being significantly more difficult than both simple and intermediate ones. Conversely, groups were differently affected by the increase in length of the nonwords. Comparing the subjects' performances with two-, three-, four- and five-syllables lengths, we found that dyslexics performed always worse than unimpaired children, and that, while bilingual and monolingual controls consistently showed a similar performance, bilingual dyslexics performed worse than monolingual dyslexics only with four-syllables nonwords. This could be explained by arguing that bilingual dyslexics are more markedly sensitive to the increase in length from three- to four-syllables than monolinguals. Indeed, the two groups of dyslexics showed a similar performance with five-syllables nonword. However, a sharp contrast between three- and four-syllable nonwords was reported for all groups, indicating that length alone is not able to explain the reported decrease in performance with four-syllable items. Besides an increase in length, indeed, four-syllable nonwords are composed by two trochaic feet, hence resulting in a greater prosodic complexity than two- and three-syllable nonwords. With four- (and five-) syllable items, the subject has to create an acoustic representation of a novel word containing two stressed syllables and has to keep it in memory for successive articulation. Therefore, prosodic reasons could explain the difficulties in this condition for all groups and could also account for the remarkably poor performance of the bilingual dyslexics, who are more impaired than monolingual dyslexics when dealing with this further prosodic complexity, though less impaired by the increase of syllable length (see their similar performance with items of four and five syllables, featuring a similar prosodic structure). Overall, it seems that the bilingual dyslexics are more sensitive to the strictly linguistic/phonological facets of the task than the monolingual dyslexics (arguably pointing to weaker phonological skills), who are instead more markedly sensitive to length issues (arguably related to phonological memory skills).

Correlation and regression analyses confirmed that NWR is a significant predictor of reading abilities, especially for accuracy, but also for speed, in both word and nonword reading. Moreover, the absence of significant correlations between vocabulary and exposure factors and NWR suggests that variables like language abilities, age of first exposure, as well as quantity and length of exposure, do not affect performance, rendering it an ideal task for the assessment of bilingual children with different exposure backgrounds and competence levels in the L2.

Once ascertained that dyslexics, irrespective of bilingualism, showed a poorer performance in NWR in comparison to controls, we aimed at evaluating whether NWR performance could provide a reliable index to assist in the diagnostic procedure, increasing the reliability of the procedure and diminishing the risk for missed and mistaken identities which is especially high with bilingual children. Indeed, the cut-off point of < .76 yielded likelihood ratios that were significantly in consonance with the independent clinical judgments which led to the diagnosis of dyslexia, suggesting that the task could be used to assist in the diagnostic procedure for the identification of dyslexia in both monolingual and bilingual children (see Table).

Table 3. Sensitivity and specificity values, positive and negative likelihood ratios associated to the 0.76 cut-off point.

Cut-off	Sensitivity	Specificity	LR+	LR-

< 0.76	83.33	85.70	5.83	0.19

As discussed in the introduction, this could be particularly useful for bilingual children, especially those with a lower competence in and exposure to Italian, who might struggle in comparison to monolinguals in the acquisition of literacy skills and, due to the absence of diagnostic measures designed for bilinguals, could be penalized in the assessment procedure, resulting in overdiagnosis of dyslexia. Adding a nonword repetition task to the commonly used diagnostic tests assessing reading abilities could thus be useful in discriminating bilingual children whose poor literacy skills are due to the presence of a learning disability, from those whose difficulties are more likely related to other factors, as will be discussed more in detail below.

2.2 Morphological Abilities: The Pluralization of Nonwords

In this section, we will present and discuss the results of an experimental protocol testing the abilities the pluralize invented words in monolingual and bilingual children with and without dyslexia (2.2.3), which have been published in a paper authored by Vender, Hu, Mantione, Savazzi, Delfitto & Melloni (2008) published in the *International Journal of Bilingual Education and Bilingualism*. We start by providing a review of the literature showing that dyslexics typically show morphological deficits in dyslexia (2.2.1), whereas bilinguals have been reported to show an advantage in this domain (2.2.2).

2.2.1 Morphological abilities in dyslexia

It has been shown that dyslexics display a different profile in comparison to unimpaired children in their morphological abilities, performing worse than both chronological and reading age-matched controls in tasks assessing the abilities to isolate and blend morphemes (Casalis, Colé, and Sopo 2004). Deficits are also reported in tasks assessing gender and number agreement, where dyslexics performed more poorly than both chronological and reading age-matched controls (Jiménez et al. 2004; Rispens 2004). Moreover, as shown by Joanisse et al. (2000), dyslexics are less skilled than controls in tasks tapping their mastery of inflectional morphology and requiring the application of past tense agreement and plural rules to both familiar words and nonwords. This outcome has been confirmed by a more recent study conducted by Vender, Mantione, Savazzi, Delfitto and Melloni (2017) with the aim of comparing the performance of dyslexics and unimpaired children in a task assessing their inflectional morphology. Taking Berko's (1958) original paradigm as a basis, we adapted it to the more complex context of Italian inflection system, in which plurals are typically obtained by modifying the phonological shape of the singular ending in accordance with the declension class and gender feature of the stem. In their study, the authors compared the performance of dyslexics and controls in five conditions, corresponding to the different declension classes of Italian and characterized by distinct levels of complexity, as briefly summarized in (1), with an existing noun for each of the relevant declension classes reported in brackets.

(1) Conditions

(i) Condition 1: Feminine *a* > *e*, e.g. la muv-*a* > le muv-*e* (Class I, e.g. la port-*a* > le port-*e*, 'door')

(ii) Condition 2: Masculine *o* > *i*, e.g. il fol-*o* > i fol-*i* (Class II, e.g. il gall-*o* > i gall-*i*, 'rooster')

(iii) Condition 3: Masculine *a* > *i*, e.g. il tred-*a* > i tred-*i* (Class IV, e.g. il pirat-*a* > i pirat-*i*, 'pirate')

(iv) Condition 4: Masculine *e* > *i*, e.g. il dort-*e* > i dort-*i* (Class III masc., e.g. il pesc-*e* > *i* pesc-*i*, 'fish')

(v) Condition 5: Feminine *e* > *i*, e.g. la stab-*e* > le stab-*i* (Class III fem., e.g. la nav-*e* > le nav-*i*, 'boat').

Conditions 1 and 2, which correspond respectively to Class I and II of Italian nominal morphology, are fully productive, predominant in the input and extremely salient from the acquisition perspective, due to their high regularity and predictability (Dressler and Thornton 1996; among others). Moreover, they show maximal discrepancy in gender and in phonological form (*a* > *e* – *o* > *i*). On the contrary, Conditions 4 and 5 comprise items belonging to Class III, which is numerically consistent, but totally unproductive and completely independent from gender specification. A noun ending in −*e* can be either masculine or feminine and takes the corresponding plural ending in −i independently of the stem's gender. Therefore, differently from Class I and II, there is no systematic gender-based rule or pattern for class determination. Finally, Condition 3, which corresponds to Class IV of Italian morphology, is numerically less pervasive than Class III, but opaque as far as gender manifestation is concerned. The majority of Italian nouns ending in −*a* are indeed feminine, whereas those in this class are masculine: hence, the learner must pay attention to agreement patterns in the singular to disentangle gender specification and devious phonological exponence, learning to produce the target plural marker −*i*. Given the peculiarities of these declension classes of Italian, Conditions 3, 4 and 5 were expected to be more challenging than Conditions 1 and 2. Consistently, the authors found that dyslexics performed significantly worse than controls, especially in Conditions 1, 2 and 3, suggesting that their morphological skills are less sophisticated than those of unimpaired children. In Conditions 4 and 5, instead, the two groups of children showed a similar and particularly inaccurate behavior, especially in the last condition, confirming thus that the relevant morphological rules were more difficult to apply to nonwords.

2.2.2 *Morphological abilities in bilingualism*

Metalinguistic awareness and morphological skills have been reported to be particularly enhanced in bilingualism. As Vygotsky (1962) first emphasized, bilinguals appear to be more familiar with the arbitrariness of the relationship between meaning and form in comparison to monolinguals, and therefore they are less reluctant to separate them. This consideration was confirmed by Bialystok (1986) who found that bilingual children were more competent than monolinguals to accept grammatically well-formed but anomalous sentences (e.g. Apples grow on noses), displaying therefore a better ability to separate form and content, which was taken to attest their more sophisticated metalinguistic awareness. This metalinguistic advantage has been explained by arguing that bilingualism seems to guarantee a higher symbolic flexibility, allowing children to experience an accelerated separation of meaning and form and to focus their attention on language form (Cummins 1978).

Another example of a metalinguistic task tapping morphological skills in which bilinguals have been reported to show advantages in comparison to monolinguals is the Wug Test, which was designed by Berko (1958) with the aim of assessing monolingual children's ability to generate inflections in English by means of nonwords.

Barac and Bialystok (2012) administered the Wug Test and two tasks assessing language proficiency (i.e. receptive vocabulary and grammatical ability) to a group of monolingual children and three groups of age-matched bilinguals (Spanish-English, French-English and Chinese-English), with the aim of comparing bilinguals and monolinguals, considering also other effects such as language similarity (Spanish and French are more similar to English than Chinese) and language of schooling (English for the vehicular language for Spanish L1 and Chinese L1 children, whereas French was used for the French L1 children). The authors found that the Spanish-English children, who did not differ in language proficiency from the monolinguals, outperformed them in the Wug Test, showing higher morphological abilities. Conversely, the other two groups of bilinguals performed worse than monolinguals in language proficiency, but their performance was better in the Wug Test than in the tasks tapping their language competence more directly. The differences between the groups of bilinguals were ascribed to the fact that only the Spanish-English bilinguals could have benefitted from both the linguistic similarity between Spanish and English and the use of English as language of instruction, whereas the other two groups could not take advantage of at least one of these essential aspects.

Bialystok, Peets, and Moreno (2014) investigated whether a bilingual advantage arose also in second language learners, by testing two groups of English children acquiring French in an immersion education program and attending to the second and fifth grade. They found that all bilingual children outperformed monolinguals in the Wug Test, whereas only the older bilingual children were more accurate than the monolinguals in a sentence-judgment task. Results suggest that the bilingual advantage emerges earlier and more clearly in the Wug Test, which can be considered less complex than the other task, since there is no misleading information to be filtered out or any need for particularly effortful processing (Bialystok et al. 2014). Summarizing, the studies reviewed in this section suggest that bilinguals, having access to two different linguistic systems, are prompted to develop a more sophisticated ability to focus and to reflect on the structures of their languages in comparison to monolinguals.

2.2.3 Bilingualism, Dyslexia and Morphological Abilities: Nonword Pluralization

In Vender, Hu, Mantione, Savazzi & Melloni (2018), published in the *Journal of Bilingual Education and Bilingualism*, we aimed at investigating the effects of bilingualism and dyslexia in a morphological task tapping the pluralization of nonwords, administering the same test developed by Vender et al. (2017), in which monolingual dyslexics were found significantly impaired. The study was administered with a three-fold purpose: first, confirming or disconfirming the presence of an advantage of bilingualism in morphological skills; secondly, verifying if morphological processing is compromised in dyslexia; and finally, exploring the relationship between bilingualism and dyslexia in order to establish whether bilingualism confers an advantage also in presence of dyslexia.

Results, summarized in Table 4, lead to three important findings.

Table 4. Mean (SD) accuracy for the Wug Test in the general task and in each condition

	Monolingual Dyslexics	Bilingual Dyslexics	Monolingual Controls	Bilingual Controls
Nonwords (total)	0.55 (0.15)	0.72 (0.17)	0.71 (0.16)	0.75 (0.19)
Feminine a>e	0.82 (0.26)	0.85 (0.27)	0.94 (0.12)	0.87 (0.21)
Masculine o>i	0.85 (0.22)	0.94 (0.13)	1.00 (0.00)	0.94 (0.15)
Masculine a>i	0.33 (0.31)	0.56 (0.36)	0.59 (0.40)	0.62 (0.38)
Masculine e>i	0.65 (0.35)	0.88 (0.26)	0.80 (0.28)	0.82 (0.30)
Feminine e>i	0.12 (0.27)	0.36 (0.46)	0.24 (0.36)	0.51 (0.40)

The first significant result is that the monolingual dyslexics displayed the worst performance, committing more errors than the two control groups, and crucially underperforming bilingual dyslexics. This allows us to answer our first research question, confirming that (monolingual) dyslexics are not able to apply inflectional rules to novel nouns as efficiently as typically developing children, and thus indicating that morphological skills are impaired in dyslexia.

The second important result concerns the advantage that bilingualism confers in this kind of task: we found indeed that bilingual children, both dyslexics and controls, performed significantly better than monolinguals in the pluralization of nonwords with the vowel ending in −*e*. This result provides an answer to our second research question, confirming that there is an advantage for bilingual children over monolinguals, even though this advantage is more evident in the most difficult conditions with the ending in −*e* corresponding to conditions 4 and 5 of the task.

Finally, the perhaps most interesting result concerns the interaction between dyslexia and bilingualism: data show that bilingual dyslexics outperformed monolingual dyslexics in all conditions, except for condition F *a* > *e*, where all groups had a similar performance, and condition M *a* > *i*, where all groups had a poorer performance and only the (negative) effect of dyslexia was observed. This latter result is possibly related to the very low frequency in the input of this declension class in Italian, as well as to its unproductivity and misleading phonological shape with respect to gender. All in all, our results point to a general positive effect of bilingualism in the production of plural noun inflections of nonwords which also extends, crucially, to dyslexia, suggesting that bilingual dyslexics are endowed with better morphological abilities than monolingual dyslexics, approaching and even outweighing, as in the most difficult conditions, the performance of monolingual unimpaired children.

2.3 Morphosyntactic Abilities: The Production of Clitic Pronouns

To study the interaction between bilingualism and dyslexia in morphosyntactic abilities we focused on the production of clitic pronouns (see section 2.3.1 for an overview of the main features of clitic production in Italian), which is reported to be particularly compromised in dyslexia (section 2.3.1), as well as in early bilingual children, especially if their proficiency is the L2 is still not high (section 2.3.2). We will present and discuss the results of a clitic elicitation task administered to monolingual and bilingual children, with and without dyslexia, which have been published in a paper authored by Vender, Hu, Mantione, Delfitto & Melloni (2018) in *Frontiers in Psychology* (section 2.3.3).

2.3.1 Clitic Pronouns in Italian: Main Features

Italian has three classes of pronouns, comprising strong pronouns, weak pronouns and clitics (Cardinaletti and Starke, 1999; Corver and Delfitto, 1999). Although Italian clitics include accusative, dative, genitive, partitive, locative and nominative clitics, we will focus only on accusative or direct object clitics (clitics henceforth) which have been investigated in this study. Clitics present some levels of complexity which make them particularly difficult to acquire. At the phonological level, differently from other pronouns, clitics are unstressed monosyllabic morphemes and therefore they are said to be phonologically weak. Moreover, they are not phonologically independent, since they cannot occur in isolation, but they must be coupled with an adjacent verb. Depending on the position that they occupy with respect to the verb and on the finiteness of the verb itself, they can be proclitic (when they precede a finite verb), as in (2), or enclitic (when they follow a non-finite verb), as in (3).

(2) Il bambino **la** mangia

The child $CL_{3SG.FEM}$ eats[2]

'The child eats it'

(3) Il bambino ha detto di mangiar**la**

The child said to eat.$CL_{3SG.FEM}$

'The child said to eat it'

At the morphosyntactic level, clitic pronouns encode gender and number information in four different forms: *la* (feminine singular), *lo* (masculine singular), *le* (feminine plural) and *li* (masculine plural). In addition, both number and gender agreement are required with compound tenses, like the Italian *Passato Prossimo*, as reported in (4), below. Contractions of the singular clitics, both masculine and feminine, are commonly attested in Italian, as shown in (5); conversely, the contraction of plural clitics is ungrammatical, as displayed in (6).

(4) Il bambino **la** ha mangiat**a**

The child $CL_{3sg.fem}$ has eat.$PP_{3sg.fem}$

'The child has eaten it'

(5) Il bambino **l**'ha mangiat**a**

The child c/CL has eat.$PP_{3sg.fem}$

'The child has eaten it'

(6) *Il bambino l'ha mangiate

The child c/CL has eat.$PP_{3pl.fem}$

'The child has eaten them'

As already mentioned above, proclitics have a specific position in the sentence: they precede the predicate, moving from the canonical post-verbal position of internal arguments, and thus determining a non-canonical Subject Object Verb word order.

At the syntactic level, clitics are the head of an impoverished DP (Determiner Phrase), originating as complements of the VP (Verb Phrase). Crucially, this head undergoes a complex movement operation, with further syntactic complications arising in the present perfect configuration (see Belletti, 1999). In this syntactic configuration, not only is the clitic pronoun moved to a (marked) preverbal position, but it also has to agree with the past participle, transmitting its gender and number features to the verbal form. As found by Moscati and Rizzi (2014), who compare the acquisition of different agreement configurations in Italian (Determiner-Noun, Subject-Predicate and Clitic-Past

Participle), the clitic-past participle agreement configuration is the most complex one, as it implies the formation of a complex movement chain. Accordingly, it is mastered later by children acquiring L1 Italian, who still make errors at age four (Moscati and Rizzi, 2014). The authors argued that the reasons for the late mastery of this configurations might reside in the extra computational resources and processing costs imposed by these complex syntactic structures, requiring both a complex movement and an agreement operation. Finally, from a pragmatic perspective, a clitic can be used appropriately only to refer to a salient antecedent, which must have been previously introduced in the discourse (Ariel, 1994). Importantly, only a sentence containing a clitic, like the one reported in (8), can be used felicitously to answer the question in (7), whereas the alternative sentence with the lexical or full DP, reported in (9), is infelicitous, though grammatically correct.

(7) Cosa fa il bambino con la mela?
'What does the child to with the apple?'

(8) La mangia
pro $CL_{3sg.fem}$ eats
'He eats it'

(9) Mangia la mela
pro eats the apple
'He eats the apple'

2.3.2 Clitic Production in Dyslexic and in Typically Developing Children

Normally developing and monolingual Italian children generally start to produce accusative clitics around 2 years of age, using them in an adult-like fashion, without displaying placement errors or replacing them with full pronouns (Guasti, 1993/1994; Caprin and Guasti, 2009; Moscati and Tedeschi, 2009). Moreover, past participle agreement under cliticization is correctly performed even from the youngest age, suggesting that agreement is successfully handled by young children (Belletti and Guasti, 2015).

Nevertheless, a stage of clitic omission has been reported in the literature, especially in spontaneous speech, suggesting that sometimes clitics are not produced in a context in which they would be expected. The omission stage is normally over at age 3–4, with constant progresses as they grow up (Leonini, 2006; Tedeschi, 2009).

Nine-year old children with dyslexia have been found to produce fewer clitics than age-matched controls, with a higher number of clitic substitutions, in which they produced a clitic wrongly inflected for gender or number, as la instead of lo (Guasti, 2013; Zachou et al., 2013). Besides assessing clitic production, Zachou et al. found that dyslexics were less skilled than controls in a grammaticality judgment task requiring them to detect omission errors.

Other studies focused on the processing resources involved in clitic production and investigated correlations between the subjects' linguistic performance and their working memory skills. To assess the impact of working memory (WM) in clitic production, Mantione (2016) developed a protocol aimed at testing clitic production across child populations, and at assessing the role of WM in this type of task. Specifically, Mantione examined clitic production in school-age dyslexics (mean age 9;4) compared to age-matched (mean age 9;4), grammar-matched (mean age 7;6) and younger controls (mean age 4;4). An elicited production task was used under two different levels of morphosyntactic difficulty and two different WM loads with the dual aim of (i) identifying and quantifying potential difficulties for dyslexics in the production of clitics and (ii) assessing whether sentence processing problems in dyslexia are more evident when WM demands are high. In this task, subjects were invited to produce sentences with a proclitic after seeing black and white drawings. Morphosyntactic difficulty was manipulated by eliciting sentences with clitic-past participle agreement [e.g., Li ha inseguiti "(He) has chased them"] in addition to sentences without agreement [e.g., Lo lava "(He) is washing him"]. Moreover, WM load was manipulated by varying the delay between the presentation of the drawing (and the sentence that described it) and the question about that drawing.

The overall results showed that dyslexics performed better than younger children, but significantly worse compared to both age-matched and grammar-matched controls, uttering a wrongly inflected clitic, as in Zachou et al. (2013), or an indirect clitic instead of the target one. Further analysis demonstrated that the probability of producing a target clitic decreased as the WM load increased, and that this was statistically significant only for two of the four groups of participants: dyslexics and younger controls (Mantione et al., in preparation). The results suggest that the presence of dyslexics' difficulties in clitic production might be explained as resulting from their WM limitations.

Difficulties with clitic production in dyslexia have been also reported by Arosio et al. (2016), who however found that dyslexics, instead of committing clitic substitution errors as reported by the studies reviewed above, tended to produce more full-DP structures in comparison to controls.

2.3.3 Clitic Production in Bilingual Children

Object clitic constructions are particularly difficult to master for EL2 individuals, both children and adults. A preliminary study conducted with preschool children acquiring Italian as their L2 and having Arabic as their L1 reported that EL2 children produced a lower number of clitics in comparison to monolinguals, uttering a full DP in place of the pronoun (Guasti, Maggioni & Vernice 2013). This result echoes back to the study by Leonini & Belletti (2004), who tested adult L2 speakers of Italian with different mother languages confirming the presence of difficulties in clitic production and the tendency to omit the clitic or to produce a full DP instead of the target pronoun. A more recent study conducted by Vender, Garraffa, Sorace & Guasti (2016) underlined the importance of taking into account the amount of exposure to the L2. Specifically, the authors assessed clitic production in the simple present in a group of 120 preschool EL2 children exposed to Italian as their L2 (3.5 years in average) and speaking Albanian, Arabic or Romanian as their first language, and compared their performance to that of 40 monolingual Italian children. In order to analyze the performance of the subjects more in detail, precise information was collected by means of a questionnaire gathering data concerning age of first exposure to Italian, quantity of exposure, traditional and cumulative length of exposure. The competence in the L2 was assessed by means of a receptive vocabulary task (i.e., PPVT-R, Peabody Picture Vocabulary Test–Revised; Stella, Pizzioli & Tressoldi, 2000) and a comprehension task (i.e., a subset of the test *Comprendo*; Cecchetto, Di Domenico, Garraffa & Papagno, 2012). The authors found that EL2 children produced a lower number of target structures in comparison to monolinguals, suggesting that clitic production is difficult for children who are still acquiring Italian, as it is for children with language disorders. However, the most common error committed by the EL2 was not clitic omission, as is typical for preschool Italian monolingual children with SLI, but rather the production of a wrong clitic, with a prevalence of gender errors. Moreover, the production of target clitics correlated with the amount of exposure to Italian of the children, as well as with their competence in Italian, measured by the PPVT-R and the comprehension task. This suggests that children having a higher (i.e. in quantity) and longer (i.e. in time) exposure to Italian and a better competence in their L2 performed more accurately than children with a lower exposure and competence in Italian. Consistently, the authors predicted that unimpaired bilingual children with a longer exposure and a better competence in their L2 should not exhibit difficulties in clitic production, at least for what concerns the simple present, performing similarly to monolingual children. This prediction has been borne out by Vender, Delfitto & Melloni (2018), who found that 10-years-old typically developing children with on average 8 years of exposure to Italian performed very accurately and similarly to monolingual children in clitic production. Finally, all three groups of EL2 children manifested a similar behavior, independently from the L1 spoken, suggesting that their performance was not related to their L1.

The role of transfer from the L1 to the second language in clitic production has been tested also by Grüter & Crago (2012), who assessed clitic production and comprehension in EL2 children learning French as their L2 and having Spanish (a language with pronominal clitics disallowing the presence of referential null objects) or Chinese (a language without clitics but allowing the presence of null objects) as their L1. They found evidence for positive transfer in the rate of omissions, with an advantage in Spanish L1 over Chinese L1 children, but no evidence for negative transfer (omission errors were detected equally well by Spanish and Chinese children). Moreover, the authors found a correlation between WM and clitic production, indicating that performance in clitic production is linked to the subjects' WM and processing abilities, as will be discussed in the following section.

2.3.4 Clitic Production in Bilingualism and Dyslexia

In the light of what discussed above, we administered a clitic elicitation task to monolingual and bilingual children with and without dyslexia to provide an answer to three research questions. First, we wanted to verify how children with dyslexia performed in clitic production. Second, we aimed at verifying how bilingual children with a longer exposure and a good competence in Italian as their L2 compared to monolinguals in this task. Our last goal was to disentangle the relationship between bilingualism and dyslexia, verifying if bilingualism has an effect on dyslexia with respect to clitic production. Results, reporting mean accuracy and typology of errors of each group in the present and the present perfect, are summarized in Table 5.

Table 5. Mean (M) (and SDs) and Number (N/total score) of responses in the clitic production task for each group.

	Monolingual dyslexics	Monolingual controls	Bilingual dyslexics	Bilingual controls
Simple Present				
Target	0.88 (0.14) 336/384	0.95 (0.14) 503/528	0.79 (0.25) 299/384	0.94 (0.13) 465/496
Gender/Number Error	0.04 (0.06) 17/384	0.01 (0.02) 2/528	0.09 (0.12) 35/384	0.01 (0.03) 5/496
Omission	0.02 (0.05) 7/384	0.00 (0.01) 1/528	0.03 (0.08) 13/384	0.01 (0.03) 6/496
Full DP	0.05 (0.10) 20/384	0.04 (0.14) 21/528	0.07 (0.14) 28/384	0.02 (0.05) 10/496
Indirect Clitic	0.00 (0.01) 1/384	0.00 (0.01) 1/528	0.01 (0.03) 5/384	0.00 (0.00) 0/496
Other	0.01 (0.02)	0.00 (0.00)	0.01 (0.04)	0.02 (0.09)

	3/384	0/528	4/384	10/496
Present Perfect				
Target	0.83 (0.17) 320/384	0.94 (0.13) 496/528	0.69 (0.23) 267/384	0.92 (0.13) 455/496
Gender/Number Error	0.01 (0.03) 5/384	0.00 (0.00) 0/528	0.05 (0.10) 20/384	0.00 (0.02) 2/496
Omission	0.03 (0.08) 10/384	0.01 (0.03) 3/528	0.05 (0.13) 18/384	0.01 (0.09) 8/496
Full DP	0.03 (0.06) 10/384	0.04 (0.09) 19/528	0.07 (0.11) 28/384	0.02 (0.03) 10/496
Indirect Clitic	0.00 (0.00) 0/384	0.00 (0.01) 1/528	0.01 (0.02) 2/384	0.00 (0.01) 1/496
Other	0.01 (0.02) 2/384	0.01 (0.03) 4/528	0.02 (0.08) 9/384	0.01 (0.03) 5/496

As for our first research question, we found that dyslexics, both monolinguals and bilinguals, performed worse in comparison to controls, both in the simple present and in the present perfect, confirming our prediction. Analyzing the typology of errors committed by the children, we found that, as for the present, impaired children produced more incorrect clitics and Full DP than controls, committing mainly gender errors. In the present perfect, instead, dyslexics produced more incorrect clitics than controls, more wrong contractions (e.g. **L'ha seguite*) and more non-target PP (e.g. *L'ha seguito* instead of *L'ha seguita*). Conversely, no differences were found among the four groups with respect to the other typologies of errors, including omissions and full DPs.

As for our second research question, we aimed at verifying how bilingual children performed in comparison to monolinguals in a clitic elicitation task. As expected, and extending the results by Vender et al. (2018) which were obtained only from unimpaired children, we found that bilingual controls showed an almost ceiling performance in clitic production in both the simple present and the present perfect, approaching the monolingual standards and thus indicating that they had completely mastered it. Although performing worse than controls, bilingual dyslexics too performed similarly to monolingual dyslexics in both conditions. This result confirms our predictions, suggesting that bilingual children with a longer exposure to Italian do not display deficits in clitic production. Importantly, this holds for both impaired and unimpaired bilinguals, indicating that dyslexia does not interfere negatively with bilingualism on clitic production. Nevertheless, it must be observed that the children's vocabulary is causally related to their performance in clitic production, suggesting that children with a higher competence show a better performance. This is certainly an aspect to watch out for, especially considering that bilinguals tend to show a poorer vocabulary in comparison to monolinguals.

As for our third research question, we addressed the relationship between bilingualism and DD in clitic production. We found that bilingual dyslexics performed similarly to the monolingual dyslexics in both conditions, committing also very similar errors. This suggests that the difficulties shown by bilingual dyslexics are related to dyslexia itself, and not to an alleged negative consequence of bilingualism in dyslexia. This is an important result confirming that bilingualism must not be seen as an obstacle that can hamper the acquisition of the second language in disordered children. Conversely, our results suggest that the linguistic deficits shown by bilingual dyslexic children would have been exactly the same, had they been monolinguals.

Summarizing, as expected, we found that both groups of dyslexics were less accurate in this task, underperforming in comparison to typically developing children. Conversely, no negative effect of bilingualism was found. Bilingual typically developing children showed a very accurate performance, reaching the monolingual standards and confirming that bilingual children with a longer exposure to the L2 could achieve a complete mastery even of complex structures of their second language, as clitic production in Italian, and thus indicating that the difficulties in clitic production typically reported in EL2 individuals are related to linguistic immaturity and are likely to disappear. Also, bilingual dyslexic children exhibited the same difficulties shown by their monolingual peers, suggesting that being bilinguals did not affect negatively their linguistic competence in clitic production, and thus indicating that bilingualism should not at all be discouraged in linguistically impaired children.

2.4 Implicit Learning: An AGL study featuring the Fibonacci Grammar

In this section, we present the preliminary results of a study conducted in collaboration by the University of Verona and the University of Reading and assessing implicit learning in monolingual and bilingual children with and without dyslexia in a modified version of the classic Simon Task, in which the sequence on the stimuli is predictable on the basis of the rules of an artificial grammar, the Fibonacci grammar. In the following sections we discuss Artificial Grammar Learning (AGL; 2.4.1), discussing the literature studying AGL in dyslexics (2.4.2) and bilinguals (2.4.3). Then we present the results of our study (2.4.4).

2.4.1 Artificial Grammar Learning

Artificial grammar learning (AGL) is an experimental paradigm employed to investigate how sequences of symbols generated by a system are learnt. Once exposed to an artificial grammar (a set of rules that applies to an alphabet of symbols to generate strings), participants are assumed to develop some 'implicit' knowledge of the regularities associated with it. In a typical AGL task, subjects perform a first training session in which they are exposed to stimuli arranged according to an invented grammar and are asked to pay attention to them. After this training phase, they are explained that these stimuli complied with a set of rules and they are then instructed to provide grammaticality judgements for new sets of items which may be consistent with these rules (i.e. grammatical) or violate them (i.e. ungrammatical). To date, AGL tasks have primarily used grammars in 'canonical form' (Jäger & Rogers, 2012). These grammars consist of 1) an alphabet which includes a start symbol, rewriteable symbols, and non-rewriteable symbols and 2) a set of rewrite rules which determine how the grammar is developed by rewriting symbols in the alphabet. By applying these rewrite rules left-to-right sequentially, grammatical 'strings' are generated, also termed 'words' or 'sentences' (Hopcroft & Ullman, 1969).

Results of classical AGL studies (e.g., Reber, 1967), which have been extensively replicated, indicate that people are successful in discriminating grammatical from ungrammatical stimuli, although they do not display conscious knowledge of the rules, which typically remain, at least in part, implicit (see Pothos 2007 for a general review of the different theoretical accounts of AGL performance). The ability to detect patterns and statistical regularities in an artificial grammar has been found also in very young children. This ability provides evidence for statistical learning based on transitional probabilities to compute distributional information and formulate the relevant hypotheses (Saffran et al. 1996; Gerken, Wilson & Lewis 2005). Moreover, this capacity correlates with natural language learning and processing (Christiansen et al. 2012), indicating that AGL can provide a useful tool for investigating the ways in which humans perceive and process stimuli, as well as for understanding higher-order cognitive functions, including language (Pothos 2007; De Vries et al. 2009). Therefore, AGL offers new ways to investigate specific aspects of language learning that are not easily testable with natural languages, such as analysing language acquisition and processing, while also investigating the underpinnings of the human language faculty in a controlled setting (Ettlinger et al. 2016). Using language-independent rules (which nonetheless share properties with the kind of computational devices that are hypothesized to underlie grammatical competence) and non-linguistic stimuli has several practical advantages in implicit learning paradigms: in particular, it allows speakers of different native languages to be compared across one medium (Culbertson, Smolensky & Wilson, 2013); it allows young children who may not have a fully acquired language as well as nonverbal populations to be tested on that medium (Gomez & Gerken, 1999); and it allows researchers to fine-tune the paradigm with a precision that is limited only by their understanding of the mathematical properties of the rules and the structures thereby generated.

2.4.2 Artificial Grammar Learning in Dyslexia

AGL has more recently been used also to explore implicit learning in atypical populations, including individuals suffering from language-related impairments, such as aphasia (Christiansen et al. 2010) and SLI (Evans et al. 2009). As for developmental dyslexia, deficits in AGL have been reported by Pavlidou and Williams (2014), who found that school-aged children with dyslexia showed difficulties in implicit learning, and specifically in higher-order rule-like learning. Using a nonverbal task assessing AGL by means of geometric shapes which could be arranged sequentially or in an embedded way, Pothos & Kirk (2004) found evidence for a different learning strategy in dyslexic adults in comparison to controls; specifically, impaired subjects were less skilled in processing the individual elements of the stimuli. Other studies confirmed that dyslexics are impaired in implicit learning tasks, indicating that they struggle in identifying and assimilating systematic patterns of stimuli in a structured setting, independently of the learning materials (Folia et al. 2008; Goldberg, 2014).

However, intact AGL abilities in dyslexia were reported by other studies (Rüsseler et al. 2006), suggesting that the complexity of the learning environment could play a major role (Vicari et al. 2005; Roodenrys & Dunn, 2007; Nigro et al. 2015, Pavlidou et al. 2010). Consistently, Katan and colleagues (2016) administered to the same groups of children two AGL tasks differing for the level of complexity of the grammars adopted, and found that children with dyslexia, although performing worse than controls with the most difficult grammars, showed intact learning when the complexity was lower, suggesting that they manage to extract the relevant regularities from the input under less demanding conditions.

All in all, these results seem to suggest that dyslexics, despite exhibiting problems in the implicit detection and abstraction of rules under complex conditions, show nevertheless a sensitivity to structural regularities in AGL (Pavlidou et al. 2010). Their difficulties could then be attributed to working memory restrictions, which could limit the number of hypotheses that can be formulated and simultaneously considered (Baddeley, 1983); this is also in line with studies pointing to a processing/working memory inefficiency in dyslexia (Nicolson & Fawcett, 2000; Vender 2017).

2.4.3 Artificial Grammar Learning in Bilingualism

AGL in bilingualism has not been extensively studied and the limited results available are mixed: Onnis et al. (2018) reported heightened performance in bilinguals in two AGL tasks, while controlling for the role of individual variables; similarly, a bilingual advantage in statistical learning has been reported by other studies (Bartolotti et al. 2011, Escudero et al. 2016). Conversely, no differences were found by Yim & Rudoy (2013). Poepsel & Weiss (2016) compared monolingual and bilingual adults in a statistical word learning task, reporting similar performance of the two groups with 1:1 mappings but a bilingual advantage with 2:1 mappings, suggesting that basic forms of statistical learning are not affected by bilingualism, whereas a bilingual advantage could arise in more complex tasks presenting sources of interference.

2.4.4 Artificial Grammar Learning in Bilingualism and Dyslexia

In this section, we present the preliminary results of an experimental protocol assessing AGL in monolingual and bilingual children with and without dyslexia, developed and administered thanks to the collaboration between the University of Reading and the University of Verona. The results of the protocol will be discussed in a paper which is currently in preparation.

Our study investigates AGL using a radically different methodology: instead of asking grammaticality judgments, which involve a certain amount of awareness in the subjects about the nature of the task, we administered a modified version of the Simon Task, in which the sequence of the stimuli is not random, but entirely predictable on the basis of the rules of a Fibonacci grammar, representing a simple version of the broader class of Lindenmayer grammars. Since detailed discussion of the aspects characterizing Lindenmayer grammars falls beyond the scopes of this report, we will only briefly present the main features of the task.

As in traditional Simon Tasks, participants were presented with four experimental conditions (blue congruent, blue incongruent, red congruent and red incongruent) and they were instructed to press 1 (on the left side of the keyboard) if they saw a red square and 0 (on the right side of the keyboard) if they saw a blue square, irrespective of the position of the squares, which could occur either on the left or on the right side of the screen.

In our modification, the order of the coloured squares presented to the subject was not random but determined by a simple deterministic recursive grammar, the Fibonacci grammar. The string of stimuli the grammar delivers encodes a set of regularities ranging from very simple local dependencies to much higher order dependencies. From the subject's perspective the Simon task is unchanged; however, for the researcher it is possible to track the subjects' implicit learning of the regularities via reaction time and accuracy responses across the duration of the task.

The Fib-grammar comprises two rules which, applied to the Simon task, are:

(10) Red → Blue (i.e. every red in the sequence is rewritten as blue)

(11) Blue → Red Blue (i.e. every blue in the sequence is rewritten as a red, blue)

These two rules give rise to the following first-order transitional regularities:

(12) a red is always followed by a blue (the sequence of two reds is forbidden by the grammar)

(13) two blues must be followed by a red (the sequence of three blues is illegal)

(14) a blue can be followed by a red or a blue.

By employing this modified Simon Task, we aimed at identifying differences in performance between monolingual and bilingual normally developing and dyslexic children, by assessing their ability to unconsciously pick up the regularities of the Fib-grammar.

First, we wanted to compare the four groups in their general performance in the task, considering both RTs and accuracy rates, to evaluate the effects of bilingualism, dyslexia and their interaction. In the light of the literature on the Simon task discussed above, we expected an advantage in bilinguals, and a poorer performance in dyslexics.

Second, we aimed at verifying whether children learnt the regularities presented above. The fact that a red is always followed by a blue was expected to be the easiest to acquire. That two blues are followed by a red was instead predicted to be more difficult, since the memory load was higher: to succeed in this task, it is not sufficient to consider the item which has just appeared, but it is necessary to remember also the one occurring immediately before it. Finally, to verify whether improvements across blocks possibly found in the previous analyses were actually determined by the learning of the relevant regularities, and not by a general effect of habituation to the task, we compared RTs and accuracy in unambiguous/predictable trials (determined by 12 and 13) and ambiguous/unpredictable ones (see 14); lower or no improvements were expected in the unpredictable condition, were subjects could not benefit from AGL in predicting the colour of the upcoming item.

Results confirmed our predictions (see Table 6 for a summary of the general performance of the four groups in the task).

Table 6. Mean (*Standard Deviation*) Reaction times in ms in each condition for each group

	Blue congruent	**Red congruent**	**Red Incongruent**	**Blue Incongruent**
BD	473.61	515.49	641.60	685.91
	53.00	*64.93*	*63.44*	*89.46*
MD	511.34	547.86	672.00	695.22
	61.17	*57.93*	*76.75*	*72.33*
BC	485.29	515.00	642.86	641.82
	53.00	*61.20*	*80.91*	*77.35*
MC	495.76	538.78	673.67	666.89

	68.85	*68.61*	*77.26*	*78.64*

Table 7. Mean (*Standard Deviation*) accuracy in each condition for each group

	Blue congruent	Red congruent	Blue Incongruent	Red Incongruent
BD	0.94	0.91	0.65	0.63
	0.04	*0.52*	*0.15*	*0.19*
MD	0.93	0.88	0.63	0.69
	0.07	*0.10*	*0.14*	*0.14*
BC	0.96	0.94	0.69	0.72
	0.04	*0.05*	*0.12*	*0.16*
MC	0.97	0.96	0.75	0.78
	0.03	*0.04*	*0.13*	*0.15*

Considering their overall performance across the three blocks of stimuli, we found that bilinguals, including both dyslexics and controls, were generally faster than monolinguals in reacting to the stimuli appearing on the screen, both with congruent and with incongruent trials, pointing to a generalized bilingual advantage, consistently with other studies reporting shorter response times in the Simon task for bilinguals, as discussed in the introduction. Interestingly, our results provide a confirmation for the extension of this advantage also to impaired children, indicating that bilingualism could be beneficial for dyslexics, who in some cases performed even at the level of the monolingual controls, at least in the domain of executive functions and controlled attention. Conversely, dyslexics, including both monolinguals and bilinguals, were generally less accurate than controls, indicating that they struggled more than their peers in performing the task; as predicted by the literature arguing that dyslexia is characterized by a processing inefficiency, this effect could be related to lower processing and memory resources in impaired children, leading to lower levels of controlled attention and interference suppression. This is also compatible with the fact that problems were more marked in presence of items requiring a more complex processing (as with incongruent trials) or being less frequent in the input (as with red squares).

As in traditional Simon tasks, incongruent trails were more difficult to process than congruent ones, for all groups of children. Moreover, red items yielded longer response times; dyslexics, in particular, reacted overall more slowly to reds, whereas controls showed this difference only in congruent trials. The higher difficulty related to the red items is arguably due to their lower frequency in the input (reds are half as frequent as blues). However, the difference found between dyslexics and controls seems to suggest that controls pay more attention in correspondence to incongruent trials, thus neutralizing the frequency effect, something that apparently dyslexics cannot accomplish, presumably related to the complexity of the task which could excessively tax their processing resources. Remember that also the occurrence of the incongruent trials followed in fact a precise succession (every 6 items), which could be learnt by subjects.

All in all, these results confirm our expectations about the general performance in the task, with dyslexics showing difficulties, arguably due to their processing/memory limitations, and bilinguals displaying on the contrary an advantage over monolinguals, which interestingly extends also to impaired subjects, and which could be interpreted as reflecting bilinguals' higher abilities in tasks requiring controlled attention.

Beyond these general considerations concerning the Simon task, our aim was also that of verifying whether there was any learning of the regularities yielded by the Fibonacci grammar: results clearly indicated that learning took place, as confirmed by the shorter reaction times and the higher improvements found with predictable trials, which could be correctly foreseen once these regularities were learnt, in comparison to unpredictable trials, for which the grammar did not provide any cues.

Although RTs decreased for both types of trials, as a possible effect of habituation to the task, we found indeed that the improvements were significantly higher for the predictable trials, which were also reacted to more accurately. Moreover, improvements in predictable trials were already found between Blocks 1 and 2, not only between Blocks 2 and 3, whereas they were found only between Blocks 1 and 3 for unpredictable trials, indicating that learning of the regularities induced by the Fib grammar took place relatively early (after the exposure to more or less 150 trials) and anyway before the appearance of a habituation effect to the Simon task. Finally, group effects were similar across the predictable and unpredictable trials, with bilinguals being faster and dyslexics being less accurate.

After establishing that learning generally took place, we verified whether each of the two first-order transitional regularities examined had been learnt. According to the first regularity, red trials could only be followed by blue ones: results confirmed that this regularity was successfully acquired by all groups of children, as testified by increasingly shorter reaction times, with differences detected already between Block 1 and Block 2 (see Tables 8 and 9).

Table 8. Mean (*Standard Deviation*) Reaction times in each condition for each group

	C_1	**C_2**	**C_3**	**I_1**	**I_2**	**I_3**
BD	463.98	453.66	415.90	662.77	638.84	614.80
	73.47	*62.76*	*70.89*	*85.30*	*80.96*	*95.61*
MD	506.92	492.17	456.06	700.45	670.73	660.53
	71.91	*67.06*	*62.41*	*82.47*	*110.16*	*97.25*
BC	489.94	471.39	424.96	672.23	650.49	611.65
	65.58	*64.90*	*60.17*	*83.88*	*105.10*	*112.70*
MC	479.59	480.50	437.86	695.48	700.25	637.17
	75.08	*79.61*	*70.97*	*93.29*	*95.09*	*91.45*

Note: C = Congruent; I = Incongruent; 1 = Block 1; 2 = Block 2; 3 = Block 3.

Table 9. Mean (*Standard Deviation*) accuracy in each condition for each group

	C_1	C_2	C_3	I_1	I_2	I_3
BD	0.97	0.96	0.97	0.79	0.79	0.82
	0.04	*0.04*	*0.04*	*0.19*	*0.18*	*0.21*
MD	0.97	0.92	0.96	0.77	0.71	0.80
	0.07	*0.16*	*0.06*	*0.17*	*0.25*	*0.22*
BC	0.99	0.97	0.98	0.79	0.80	0.81
	0.02	*0.04*	*0.03*	*0.21*	*0.17*	*0.14*
MC	0.99	0.99	0.99	0.88	0.92	0.92
	0.02	*0.02*	*0.02*	*0.13*	*0.12*	*0.10*

Note: C = Congruent; I = Incongruent; 1 = Block 1; 2 = Block 2; 3 = Block 3.

Importantly, this improvement was found for both congruent and incongruent trials, with the latter being reacted to more slowly and less accurately. As for accuracy, we found in this case a negative effect of dyslexia limited to the monolingual children: specifically, bilingual dyslexics were more accurate than monolingual dyslexics, and as accurate as the two control groups, in reacting to incongruent trials. This suggests that bilingualism could confer an advantage to the impaired children in the most difficult conditions.

Learning also took place for the second regularity, according to which a sequence of two blues must be followed by a red: again, this was acquired for both congruent and incongruent trials by all groups, who showed improvements in RTs between Block 2 and 3, suggesting that this regularity was acquired later than the first one (see Table 10 and 11). This is arguably related to its higher complexity, which requires participants to consider not only the immediate predecessor of the current stimulus, but also the preceding one. In this case as well, group differences were found: dyslexics were slower, especially with incongruents, and also less accurate than controls, whereas bilinguals tended to be faster than monolinguals. In this case, we found also a decrease in performance concerning accuracy: all groups of children, despite being more rapid in predicting the occurrence of a red trial after two blues, were less accurate as the task progresses. This is arguably an effect of fatigue, particularly evident in this more difficult condition.

Table 10. Mean (*Standard Deviation*) RTs (in ms) in each condition for each group

	C_1	C_2	C_3	I_1	I_2	I_3
BD	528.16	546.49	499.90	673.46	686.13	669.20
	70.58	*73.52*	*65.09*	*88.34*	*107.40*	*132.18*
MD	569.47	566.88	534.42	708.33	701.03	703.35
	58,422	*69.52*	*72.04*	*101.76*	*103.91*	*85.99*
BC	531.51	532.75	491.25	634.39	634.70	609.51
	63.87	*65.40*	*59.47*	*100.54*	*101.41*	*93.11*
MC	551.39	553.10	512.23	646.68	682.91	620.45
	76.47	*89.07*	*78.23*	*103.00*	*96.45*	*120.53*

Note: C = Congruent; I = Incongruent; 1 = Block 1; 2 = Block 2; 3 = Block 3.

Table 11. Mean (*Standard Deviation*) accuracy in each condition for each group

	C_1	C_2	C_3	I_1	I_2	I_3
BD	0.93	0.89	0.90	0.77	0.64	0.60
	0.05	*0.07*	*0.11*	*0.16*	*0.28*	*0.27*
MD	0.93	0.85	0.86	0.83	0.65	0.72
	0.07	*0.17*	*0.11*	*0.17*	*0.30*	*0.25*
BC	0.96	0.93	0.92	0.82	0.80	0.69
	0.07	*0.07*	*0.08*	*0.21*	*0.23*	*0.29*
MC	0.97	0.94	0.95	0.79	0.81	0.76
	0.05	*0.07*	*0.06*	*0.23*	*0.18*	*0.22*

Note: C = Congruent; I = Incongruent; 1 = Block 1; 2 = Block 2; 3 = Block 3.

Summarizing, our data lead to the important conclusion that all groups of subjects, including the children suffering from dyslexia, were able to learn the first-order regularities characterizing the Fibonacci grammar, generated as a specific instantiation of the Lindenmayer system and assessed by means of a revised Simon task. This prompts two interesting considerations related to the aspects of novelty of our protocol. On the one side, we showed that AGL takes place even with respect to an artificial grammar that more closely simulates natural language (i.e. the Fib grammar as an instantiation of the L-system), significantly extending the results obtained with the finite-state grammars traditionally employed. On the other side, we crucially demonstrated that learning of grammar-induced regularities can be detected with a serial reaction time task, which has the advantage of eliminating metarepresentational awareness effects from AGL investigation, since the subjects are never aware of being involved in potential grammatical learning, and are thus less likely to provide “chance” responses while trying to cope with the explicit task they face, as in standard AGL trials. Therefore, our results more convincingly show that learning can actually take place in a completely implicit way, while subjects are focused on a specific task (correctly reacting to blue and red squares independently from their position on the screen, as in our revised Simon Task) and are completely unaware, across the whole process, of computing potential regularities in the sequence of items.

As for group differences, our results point to a general bilingual advantage in reaction times and a general dyslexic disadvantage in terms of accuracy. As discussed above, the higher speed of bilinguals can be attributed to their enhanced controlled attention and specifically to their ability to maintain high levels of attention in performing the task, whereas the difficulties exhibited by dyslexics are arguably imputable to their lower processing resources.

Crucially, the bilingual advantage has been found also in impaired children: bilingual dyslexics performed indeed always better than the monolingual dyslexics, reaching the accuracy levels of the two control groups in the acquisition of the easiest regularity, predicting that a red is always followed by a blue. This result suggests that bilingualism does not produce negative effects in dyslexics, as is sometimes erroneously believed, but that, on the contrary, it can lead to significant cognitive advantages (see Vender et al. 2018 for a study identifying linguistic benefits of bilingualism in dyslexia).

However, it must be emphasised that it is not appropriate to attribute these group differences exclusively to the grammatical component of the task, as distinguished from the improvement in executive function normally observed in a Simon Task. In fact, we showed that group differences were detected both with ambiguous and unambiguous trials, to the effect that it is at the moment difficult to disentangle the cognitive effects induced by the two tasks. We leave this issue to future research; a natural follow up could be that of administering subjects a traditional Simon task, in which the sequence of the items is really random, besides our modified Simon Task, in order to evaluate the emergence of group differences based on direct comparison between the measurement of group effects in implicit learning and the measurement of group effects in executive function enhancement.

Another exciting direction of development aims at disentangling the AGL effects which may be exclusively rooted in the computation of statistically-based transitional probabilities (independently of their level of complexity: red-blue (simple) vs. blue-blue-red (complex)) from the (possible) from the AGL effects that must be rooted in the subject's capacity of inducing a hierarchical structure on the linear sequences generated by the Fib grammar. As shown in detail in Krivochen et al. (2018), this is in fact the condition that must be satisfied in order for a sequence *red-blue-red-blue* to define a *real* point of *non-ambiguity*, with respect to the sequences *blue-blue-red-blue* that we have used in the present study to define *real* points of *ambiguity*.

In this way, the undoubtful methodological advantages of our revised Simon Task might be relevant not only for measuring and evaluating learning differences between different populations but also for assessing the precise nature of AGL, discriminating between different AGL theories and bringing AGL research to deal with the cognitive roots of the essentially hierarchical structure of human language.

3. What does research tell us? Best practices and recommendations

In the preceding sections, we have discussed the results of the experimental protocols that we have administered to investigate the complex relationship between bilingualism and dyslexia, with the twofold aim of (i) verifying whether bilingualism can be encouraged also in children suffering from language disorders, without providing an additional source of difficulty and (ii) giving indications for a more precise assessment of specific impairments in bilinguals. We believe that our studies provided interesting results in both directions. In the following paragraphs, we will thus try to answer some of the most crucial questions that have guided our research.

3.1 Always support multilingualism! Never give up the native language!

In our increasingly cosmopolitan world, where being bilingual is no longer the exception but the norm for many individuals, a growing number of children, especially those coming from migrant families, acquire a second (often the majority) language, alongside their native one. Unfortunately, however, these children tend to lose their native language proficiency, becoming more and more linguistically assimilated into the majority language of the society. This frequently happens because, although people are generally aware of the benefits of bilingualism, they tend to attribute them only to prestigious and widespread languages, considering their home languages as less important. However, it must be strongly emphasized that the advantages provided by bilingualism are independent from the languages at stake, and that preserving a linguistic proficiency in the mother language can always provide personal, socio-economical, linguistic and cognitive advantages. Indeed, as shown by our studies, which were conducted on children speaking Italian as a second language and having a migration background, the linguistic and cognitive benefits typically associated with bilingualism were confirmed (including, in our studies, morphological competence, as in nonword pluralization, and executive functions, as in the Simon task).

The maintenance of the native language is thus to be supported, for a number of reasons. First, it can contribute to develop a positive self-concept, while preserving the native culture and roots. Renouncing to the home language could mean for parents to have difficulties communicating with their children, without language barriers. Second, being multilingual can provide better employment opportunities, allowing everyone to broaden their horizons. Finally, multilingualism can provide linguistic advantages, as gaining a higher sensitivity to the structure of the languages and also enhancing the learning of other languages, as well as cognitive advantages, such as a higher flexibility and a better control of sustained attention and executive functions.

3.2 Contrary to some usual prejudices: Encourage multilingualism in communicatively impaired children!

As discussed above, a major concern of parents, teachers and health professionals working with children that suffer from communicative impairments is that bilingualism may worsen their difficulties. For this reason, they often think that giving up bilingualism will allow children to develop stronger abilities in the chosen language, which usually coincides with the majority language, softening their impairments. However, results from our research suggest that this is not the case.

Giving up multilingualism will not solve their problems, since the difficulties that they experience are related to the presence of a specific disorder, and not to the number of languages they speak. As our data suggest, indeed, their difficulties would be similar, if they were monolinguals. On the contrary, giving up the mother tongue can induce negative effects, mainly related to emotional aspects and to communication issues within the family. Moreover, abandoning bilingualism would also imply renouncing to the cognitive and linguistic benefits which it typically confers.

3.3 Consider that the advantages provided by bilingualism also extend to impaired children!

Our results provide strong evidence suggesting that the advantages typically associated to bilingualism are not limited to typically developing children, but they crucially extend to linguistically impaired individuals as well. Specifically, our bilingual dyslexics have been found to outperform monolingual dyslexics, approaching and even outweighing the performance of monolingual controls in nonword pluralization and in implicit learning.

This constitutes an important indication for all the educators, speech therapists and teachers who think that bilingualism may have a negative influence on dyslexia and tend to provide families of dyslexic children with a negative advice with respect to the use of their home language, in order to avoid alleged negative consequences of bilingualism on dyslexic children. Our results suggest that this is generally not the case: on the contrary, it seems that in some cases bilingualism can be a positive, protective factor on dyslexia, especially in enhancing the subjects' morphological abilities. The conclusion emerging from these preliminary results is thus that bilingualism can be seen as an opportunity to catch, even in the case of communicative impairment and developmental language pathologies.

3.4 Consider nonword repetition to reduce the risk of false diagnoses!

As discussed above (section 1.1.), providing additional tools to aid the diagnosis of reading disorders in the bilinguals is an issue of major importance. In light of the existence of a solid causal relationship between phonological processing and reading achievements and the predictive power of phonological awareness and NWR, assessing the subjects' phonological abilities seems to provide a promising tool for the identification of reading disorders in bilinguals. There are indeed a number of conceptual and empirical advantages for focusing on phonology, starting from the fact that this area is less affected by bilingualism (if it is at all, as discussed above) in comparison to lexical and grammatical competence. Phonological abilities are also less culturally biased that other types of skills: if it is estimated that bilinguals take from five to seven years to achieve cognitive academic proficiency in their L2, surface phonological competences may be developed in a much shorter period, within two years (Cummins, 1978). This suggest that it could be possible to conduct testing in the majority language, without penalizations for bilinguals (Cisero & Royer, 1995) and using the same batteries of tasks employed for the native speakers (Guron & Lundberg, 2003). Frederickson & Frith (1998), for instance, administered the same battery of English phonological tests to English L2 poor readers and to normally developing bilinguals, reporting extensive deficits in the impaired children but normal performance in bilinguals, thus confirming that phonological measures could help in the identification of specific reading difficulties in bilinguals.

Within phonological tasks, our results (see section 2.1.3) indicate that NWR seems to be the most suitable one for the purpose of assisting the recognition of reading and language impairments in bilinguals, especially for its simplicity in comparison to other tests. Performing a rhyme detection task, indeed, could be much more difficult, since it would require a proper understanding of the task, including the knowledge of what constitutes a rhyme, a concept which may be mastered only after ages eight or nine by dyslexic children (Swan & Goswami, 1997). In addition, NWR is able to predict reading difficulties in languages with both transparent and opaque orthographies, whereas other more explicit phonological tasks, as rhyming, are less consistent predictors of reading disabilities (de Jong & van der Leij, 1999).

A further advantage of NWR over other phonological tasks lies in its independence from vocabulary: since bilinguals, as mentioned above, typically have poorer lexical abilities than monolinguals, NWR would be less vulnerable to negative effects of bilingualism and thus more appropriate than other tasks, as rhyme detection, blending and real-word segmentation, which relt more heavily on lexical competence.

As a final consideration, NWR has been reported to be quite independent from indexes of exposure to the L2, including quantity and length of exposure (Thordardottir & Brandeker, 2013; Vender et al., 2016), with the obvious advantage of allowing the use of the test even with children exposed only recently to the L2.

Nevertheless, one could object that a limitation of NWR lies in the mixed results reported by bilingual research and discussed above, related to the distance in terms of phonological complexity between the two languages. However, it must be noticed that there is wide consensus regarding the possibility to employ NWR tasks to discriminate impaired from unimpaired bilinguals. Several studies conducted on children with SLI have indeed found that typically developing bilinguals, even when showing a less optimal performance than monolinguals, are still more accurate than impaired children and that, crucially, the task could reliably distinguish children with a language impairment from children with a typical development, irrespective of bilingualism (Girbau & Schwartz, 2008; Thordardottir & Brandeker, 2013).

Although we firmly believe that more studies are needed to provide further support to this proposal, we envisage that analyzing NWR in (bilingual) children displaying difficulties in reading acquisition is worth recommending and possibly constitutes a viable strategy to avoid the growing risk of false diagnoses among L2 children.

4. Conclusion

In this report, we provided a brief summary of the studies that we conducted to analyze the performance of bilingual and monolingual children, with and without dyslexia, with respect to a set of linguistic and cognitive tasks. In section 2, we reported the results of the protocols assessing phonological abilities (nonword repetition; 2.1), morphological abilities (nonword pluralization; 2.2), and morphosyntactic abilities (clitic production; 2.3). We also discussed the preliminary results of a study assessing artificial grammar learning using a modified version of the Simon Task (2.4).

As argued above, all these studies suggest that bilingualism does not produce negative effects in dyslexic children, but that on the contrary it can provide linguistic and cognitive benefits. In section 3, we discussed the clinical implications of our results, trying to answer to the most frequent concerns of parents, educators and health professionals dealing with impaired children. We recommend that bilingualism and multilingualism be always supported, also in the presence of specific communicative disorders.

Finally, since we observed how challenging it can be to correctly identify reading impairments in sequential bilinguals, who might struggle in the acquisition of L2 literacy, we proposed that nonword repetition skills should be taken into account in the identification of dyslexia, integrating the test batteries normally used for a diagnosis of dyslexia. Studies have indeed revealed that nonword repetition can reliably identify dyslexic children, who are severely impaired in comparison to typically developing children, and that it can successfully aid in discriminating difficulties related to linguistic competence from those related to a specific impairment in bilinguals as well as in monolinguals.

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