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Language Production and Comprehension in Developmental Dyslexia and Specific Language Impairment: Evidence from Italian and Greek

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This thesis is dedicated to my father, Ioannis E. Zachos, for his contribution in the field of Dyslexia in Greece
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“I am indebted to my father for living,
but to my teacher for living well”
Alexander the Great, King of Macedonia (356-323 B.C.)

“A mio padre devo la vita, al mio maestro una vita
che vale la pena essere vissuta”
Alessandro Magno, Re di Macedonia (356-323 a.C.)

Contents

Chapter 1: Introduction

Developmental Dyslexia (henceforth, DD), the specific difficulty in the acquisition of reading and spelling, is associated with a range of verbal deficits that are the consequences of a core disruption in the phonological domain of language (Snowling, 2000). It is defined as a language-based reading disorder because of the undisputable connections between reading and intact language skills (see Catts and Kamhi, 2005; Snowling and Stackhouse, 2006 for a review). Dyslexia is the manifestation of a core deficit in phonology and in many cases dyslexic children's difficulties are apparent before their exposure to literacy. They are manifested as a delay in speech and language development. There are also cases in which dyslexia co-occurs with more serious deficits in language, also known as Specific Language Impairment. Specific language Impairment or Developmental Dysphasia is a developmental disorder characterized by significant limitations in language acquisition, in absence of mental retardation, additional neurological disorders or hearing impairments (Leonard, 1998). The early language deficits in developmental dyslexia, as well as the fact that many children with SLI manifest deficits in phonology, reading and reading-related skills, have motivated a series of theories, concerning with the overlap between these two disorders.

The behavioural overlap between the two disorders is well documented. In many cases, children with SLI meet the diagnostic criteria for dyslexia (McArthur et al., 2000; Bishop and Snowling, 2004). On the other hand, many dyslexic children have a history of language delay, but their deficits in language are still unclear (Robertson and Joanisse, 2010), since the majority of the researches in dyslexia has focused on the investigation of phonology, reading and reading related skills. Yet, the limited number of studies has shown that in many cases the performance of DD children is not age-appropriate.

To this effect, the present thesis investigates language production and comprehension in children with Developmental Dyslexia within a crosslinguistic framework of two historically related and morphologically rich languages, the ones of Greek and Italian, in structures that have been found to be particularly vulnerable for children with Specific Language Impairment, and in particular direct and indirect object clitics, definite articles and wh-questions (Zachou and Guasti, 2010). The aim of the current study is to highlight the different performance profiles of children with a diagnosis of dyslexia in both languages, focusing on the different error patterns observed in dyslexic and typically developing children. Moreover, the implementation of the experimental tasks in Greek-speaking children with SLI provides further insight for the overlapping, as well as the differentiating error patterns, despite the fact that the SLI children are of a wide range of chronological age and they do not match directly to the children of the Greek DD group.

The data of both DD groups are discussed in relation with previous existing studies in SLI in both languages, but not according to the different theories/models of the overlap between DD and SLI (for a review see Messaoud-Galusi and Marshall, 2010), since they are mostly based on phonological and metaphonological skills, something that is not investigated in the current study. Moreover, the fact that the SLI children are not matched on chronological age to the DD children, also does not permit a direct comparison.

Nevertheless, the primary aim of the current study is to provide the details of the individual profiles of DD children on a series of different tasks. The investigation of their performance can provide insight on which tasks, as well as which grammatical structures can be more sensitive for screening difficulties in language. Furthermore, the tasks in which no significant or no gross differences are observed between the DD and typically developing children indicate more reliable patterns for differentiation between DD and SLI.

The present thesis is divided into ten chapters. Chapter 1, includes the current introduction that is focused on the rationale and the presentation of this thesis.

Chapter 2 focuses on Developmental Dyslexia, its definition, an overview of the theories of developmental dyslexia with particular emphasis on the *Phonological Deficit Theory*, followed by an overview of the studies on language skills in DD as well as a review of studies on the early precursors of DD.

Chapter 3 provides a brief introduction to Specific language Impairment, a review on comparative studies between SLI and Developmental Dyslexia, the theories on the overlap between dyslexia and SLI and a presentation of previous findings in SLI of the grammatical structures under investigation.

Chapter 4 concerns with the detailed presentation of the experimental material in both languages, the experimental procedure and the presentation of the participant groups.

Chapter 5 concerns with the investigation of direct/accusative object clitics in Italian and Greek DD. First, the results obtained by the Italian DD group are presented, on both production and comprehension. After the presentation and the discussion of the Italian data, the results obtained by the Greek DD group on the production and comprehension of direct object clitics are presented. Finally, Chapter 5 ends with a comparative discussion between the Italian and Greek data.

Chapter 6 concerns the investigation of the production and comprehension of indirect object clitics in Italian and Greek DD. First, the results of the Italian DD group are presented on production and comprehension, followed by the discussion of the Italian data. After the discussion of the Italian data, the results obtained by the Greek DD group on the production and comprehension of indirect object clitics are presented, as well as the relevant discussion of the Greek data. The Chapter ends with a comparative discussion between the Italian and Greek data.

Chapter 7 concerns with the investigation of production and comprehension of definite articles in Italian and Greek DD. The first part focuses on the presentation of the data obtained by the Italian DD group on the production and the comprehension of definite articles (grammaticality judgment task of omissions), as well as the relevant discussion. The second part, concerns with the presentation of the Greek data, the results obtained on the production and comprehension task (grammaticality judgment task of omissions) and the relevant discussion. The third part includes the comparative discussion between Italian and Greek. Another part includes the comparisons between the production of direct object clitics and the homophonous definite articles. Finally, the last part is dedicated to the grammaticality judgment task of ungrammatical conditions of definite articles. Its first part focuses on the results obtained by the Italian DD group, and the relevant discussion. The second part concerns with the results obtained by the Greek DD group and the relevant discussion.

Chapter 8 is focused on the production of wh-questions in Italian and Greek DD. First, the results obtained by the Italian DD group are presented with a relevant discussion. Second, the data obtained by the Greek DD group are presented, followed by a relevant discussion, as well as a comparative discussion between the two languages. The Chapter ends with a summary of the results obtained by the Italian and Greek DD children across all tasks and the conclusions.

Chapter 9 is concerned with the findings on Greek SLI, the detailed presentation of the errors of SLI children and the predictions for the differentiation between DD and SLI. First, the data on the production and the comprehension of direct object clitics are presented. The section concludes with a discussion according to existing findings in Greek SLI, as well as with differentiating error patterns between SLI and DD. Next, the results on indirect object clitic production and comprehension are presented. After the presentation of the results on the indirect object clitics, the results on the grammaticality judgment tasks of definite articles are presented. First, we present the results obtained on the grammaticality judgment task of omissions, with particular emphasis on the presentation of the individual performance, as well as the detailed presentation of the errors. Then, the results obtained on the grammaticality judgment of ungrammatical conditions of definite articles, the details on the individual performance, as well as the presentation of the individual performance on both grammaticality judgment tasks of definite articles. The last section of the chapter is focused on the production of wh-questions, the presentation of the individual performance and the particular errors that were attested, as well as the discussion of the findings according to existing researches in Greek SLI.

Finally, Chapter 10 is focused on the comprehension of wh-questions in Italian and Greek DD, as well as in Greek SLI, through an experimental task that facilitates comprehension. First, the results obtained by the Italian DD are presented, the details of the individual performance and a relevant discussion, followed by the presentation of the results obtained by the Greek DD, the details on the individual performance and the discussion. The Chapter ends with the presentation of the results obtained by Greek SLI children.

Chapter 2: Language in Developmental Dyslexia

2.1. The definition of Developmental Dyslexia

The *International Dyslexia Association (Lyon, 1995; Lyon, Shaywitz and Shaywitz, 2003)*, has defined Developmental Dyslexia as a language-based reading disorder that is neurological in origin and:

"is characterized by difficulties with and/or accurate fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge".

It is estimated that DD affects an average of 3 to 10% of the school-aged population (Snowling, 2000) and it has been additionally found to have a genetic basis. Children with one affected parent are at 20-40% risk of developing dyslexia (Gilger et al. 1991) and additional evidence on the genetic basis is provided by twin studies. Monozygotic twins have a 68% concordance rate than dizygotic twins who have only an approximate of 39% (for a review, see Fisher and de Fries, 2002). The origins of DD are neurological (Leonard et al. 1993 among others) and there is additional evidence that dyslexic individuals manifest disruptions in areas of the left hemisphere involved in phonological processing (Paulesu et al., 1996; Shaywitz et al., 1998).

2.2. Theories of Developmental Dyslexia

Until recently, dyslexia, was considered to be the manifestation of some kind of disrupted visual processes, mainly due to the reversed errors during reading associated with this disorder (Orton, 1925). However, a limited number of studies that investigated these errors indicated that dyslexics actually do not make these reversal errors as a consequence of their visual perceptual problem (Liberman et al., 1971; Vellutino et al. 1973). Rather, these problems are attributed to these individuals' difficulties to establish firm-specified connections between the visually represented words with their correspondent phonological and lexical representation forms.

Hence, dyslexia is now viewed and reconsidered under the framework of a *"verbal deficit hypothesis"* (Vellutino, 1977), in which the role of phonology is crucial. Over the years, the subsequent researches, lead to the refinement of this view, also known as *the phonological deficit theory* (Vellutino et al. 2004, among others).

The complex and diverse neuropsychological profiles of dyslexics, however, have lead to the emergence of other theories as well, which however, do not exclude the existence of the deficits in phonology. We shall refer in brief to some of these theories, as the main the current thesis concerns with the investigation of language abilities in DD. The *phonological deficit theory* is discussed further in section 2.3.

We also present very briefly ***The Rapid Auditory Processing Theory*** (Tallal, 1980), as this shall be further discussed in Section 3.4.1. The specific theory postulates that the phonological deficits observed in dyslexia are the consequences of a basic auditory processing deficit, affecting the perception, discrimination and processing of rapidly changing sounds.

The visual theory (Eden et al., 1996; Lovegrove et al., 1980; Livingstone et al., 1991; Stein and Walsh, 1997, among others) posits that the difficulties that dyslexic individuals encounter in reading are the result of disruptions of the visual system. These difficulties can be manifested in the form of unstable binocular fixations, poor vergence and increased visual crowding (Cornelissen et al., 1993; Eden et al., 1996; Spinelli et al., 2002, among others). Anatomical and brain imaging studies (Livingstone et al., 1991; Eden et al., 1996) have detected selective disruptions in the magnocellular pathway, a division of the visual system.

The automaticity/cerebellar theory (Nicolson and Fawcett, 1990) holds that the deficits of dyslexic people are the consequence of a dysfunction of the cerebellum. The cerebellar dysfunction in dyslexic individuals has been confirmed by brain imaging studies (Nicolson et al., 1999; Brown et al., 2001 among others). The cerebellum is involved in motor control (and speech articulation) as well as in the automatization of overlearned tasks. A disruption in this specific region can result in poor articulation (hence in deficient phonology) and a difficulty in automatization will affect processes such as reading, which is based on the learning of phoneme-grapheme correspondence.

The magnocellular theory (Stein and Walsh, 1997; Stein, 2001) combines the aforementioned theories. The magnocellular disruption is not specific only to the visual system, because of the projections of the magnocellular system to parietal areas and the cerebellum. Hence, it extends to all modalities and can account for deficits found in visual perception, spatial attention and auditory problems.

2.3. The Phonological Deficit Theory of Developmental Dyslexia - Dyslexia as a manifestation of a core deficit in phonology

There is now strong consensus among researchers that dyslexia is the manifestation of a core deficit in the phonological domain of language (Ramus et al., 2003; Snowling, 1981; 2000, Vellutino, 1979; Vellutino et al. 2004). DD individuals are characterized by limitations in the representation, storage and manipulation of speech sounds (Ramus et al., 2003). These cognitive processes are fundamental for learning to read and write, since children must be able to discriminate between phonemes in order to combine them with their corresponding graphemes (phonological awareness and phonological coding). However, the problems of dyslexic individuals in literacy are only the key symptom of the consequences of this cognitive deficit (Fowler, 1991; Snowling, 2000). Phonological processing skills have been repeatedly found to be deficient in dyslexic readers and their performance on a range of tasks that tap the different levels of phonological processing suggests that they have poorly specified phonological representations (Ramus et al. 2003; Snowling, 2000; Vellutino, 1979; Vellutino et al. 2004). More specifically, relevant evidence comes from studies on phonological awareness, verbal short-term memory, naming and rapid naming.

2.3.1. Phonological Awareness

Phonological awareness is a metacognitive ability that shows the organization of the phonological system (Gombert, 1992). Children are said to have achieved phonemic awareness when they become able to decode words as sequences of discrete phonemes (Liberman et al., 1977), usually by the age of 5 to 6 years. Phonemic awareness has been found to be a critical determinant of reading ability (Swan and Goswami, 1997), and can be assessed through different measures[1], including phoneme segmentation (i.e. *What sounds do you hear in "hot"?*), phoneme deletion (i.e. *What would be left if you*

[1](from Harley, 2001, p. 209)

took /t/ out of stand?), phoneme reversal (i.e. *Say "as" with the first sound last and the last sound first*) and recognition of rhyme (i.e. *Does "sun" rhyme with "run"?*) among others.

As Snowling (2000) noted, these tasks show variation in their cognitive demands and these differences must be taken into account when the interpretation of relevant research results is concerned with. She also underlines that this variation accounts for differences across DD individuals, since they can fail some phonological awareness tasks but can succeed in others by making use of their orthographic knowledge. Nevertheless, numerous researches have demonstrated significant differences between dyslexic and normal readers (Bradley and Bryant, 1978; Windfuhr and Snowling, 2001 among others) and similar difficulties have also been found to characterize dyslexic adults (Pennington et al., 1990, Ramus et al. 2003).

2.3.2. Verbal Short-Term Memory

According to Baddeley and Hitch (1974), short-term, or working memory, consists of a set of three fundamental structures: the central executive (attentional system), the visuospatial sketch pad, where the storing of spatial information takes place and the phonological loop, which is involved in the processing of phonological information (Baddeley, 1986). The phonological loop functions as a phonological buffer of working memory; consequently, any disruption in this structure can immediately affect language processing. The most commonly known tests which are implemented in order to assess the efficiency level of STM usually include recalling of sequences of pseudowords or digits. Studies on dyslexic readers (Snowling et al. 1986; Siegel and Ryan, 1988; Snowling, 2000; Paulesu et al., 2001) have led to the conclusion that dyslexics manifest an inefficient capacity in storing phonological information, showing that they have impaired representations of the phonological forms of words. These limitations have been found to persist into adulthood (Paulesu et al., 1996) even when problems with reading are resolved.

2.3.3. Naming and Rapid Automatized Naming

The limitations in short term memory have a direct impact on long term memory (Bauer and Emhert, 1984; Byrne and Shea, 1979) and the findings suggest that dyslexic individuals are less efficient in the phonological coding for the storage of lexical information in long-term memory. Evidence comes from naming and rapid naming tasks.

Relevant exploratory investigations with different paradigms (confrontation naming and naming to definition) have been conducted. In confrontation naming tasks (subjects are presented with the picture of an object and are asked for its name) dyslexic children have been found to show more difficulties than controls and these difficulties have also been found to be related to word frequency and number of syllables (Katz, 1986). Difficulties in naming tasks have also been reported by Snowling et al. (1988) with 11 year-old dyslexic children, as compared to normal readers of the same chronological age and younger controls. DD children differed from their CA controls, but did not differ from the younger children in the naming task. The dyslexic children were further assessed on confrontation naming and on matching spoken words to pictures. On the receptive task, DD children did not differ from the controls. They were found to be impaired, however, on the naming task.

Thus, the findings suggest that DD children cannot retrieve the names of familiar objects. Moreover, a subsequent study by Nation, Marshall and Snowling (2001) ascertained the difficulties of DD children in naming and showed that their errors are mostly phonological. Hence, it appears that the memory representations of these words are not affected on the semantic level. The problem is specific to the phonological representations of the words. Evidence for impoverished phonological, rather than semantic representation has been also reported by Swan and Goswami (1997) and Snowling, Van Wagtendonk and Stafford (1998) reported the relevant observations on naming-to-definition tasks (the name of an object must be provided in response to its verbal description).

Deficits in *Rapid Automatized Naming (RAN)* have repeatedly been detected in dyslexic individuals. In RAN tasks, the testees are asked to name objects (highly familiar) and their performance is controlled on the basis of accuracy and speed. Dyslexics have been found to be slower in such tasks (Wolf, 1986) and such problems have been detected also in adults (Pennington et al., 1990). Deficits in rapid naming have been attributed to limitations in phonological processing (Snowling and Hulme, 1994), or alternatively to a disruption in timing mechanisms and automatization (Wolf and Bowers, 1999).

The deficits of DD individuals in naming, along with their poorly specified phonological representations, have led to the development of the ***Double Deficit Theory*** of DD (Wolf and Bowers, 1999; Wolf et al. 2002). According to this theory dyslexic children can exhibit limitations either in phonological skills or in naming speed, or exhibit a combined “double deficit” in both phonological and naming skills.

2.4. Non-phonological language skills in DD

The majority of the studies on developmental dyslexia has focused on the investigation of phonological and reading related skills. There is however, a number of studies that has focused on the study of non-phonological language abilities and in particular in the domains of syntax and morphology.

Certain studies (Byrne, 1981; Waltzman and Cairns, 2000), in line with Vellutino’s (1979) *“verbal deficit hypothesis”* of DD, postulate that dyslexic children’s difficulties in phonology, morphology and syntax are attributed to a developmental linguistic lag. On the other hand, under the theoretical account proposed by Shankweiler and Crain (1986) and Crain Shankweiler (1990), the difficulties of dyslexics in spoken sentence comprehension are attributed to their limitations in phonology, and more specifically to the processing limitations of verbal working memory.

2.4.1. Complex Syntactic Structures

In support of a linguistic lag are the results reported by Byrne (1981), who tested second grade dyslexic and typically developing children on the comprehension of late-maturing structures and in particular, adjectival and relative clauses. The first category included three kinds of adjectives, and in particular, subject, object and ambiguous in relevant sentences (*The bird is happy to bite/is tasty to bite/is nice to bite*), which despite the similarity in word order, they differ on the basis of the underlying grammatical relations. DD children did not show particular difficulties with the interpretation of S-type sentences. They differed, however, in the interpretation of object and ambiguous adjective types. Children were further tested on the comprehension of reversible and improbable relative clauses (i.e. *The cow that the monkey is scaring is yellow/the horse that the girl is kicking is brown*). The dyslexics performed almost equally to the controls in the case of reversible clauses, which were difficult for both groups. For the improbable sentences, however, a certain variability was attested within the dyslexic group. Byrne suggested that the specific difficulties are more attributable to a linguistic immaturity, since they appear to be dependent on extralinguistic knowledge.

Mann et al. (1984), tested the repetition and comprehension of subject and object embedded relative clauses. The mean age of the poor readers' group was 9;2 years. Dyslexic children were found to differ on both tasks. The difficulties in the sentence repetition task were attributed to the dyslexic children's failure to make effective use of phonetic representations and to limitations in memory mechanisms. This conclusion derived from the quantitative and not qualitative differences on the errors that were attested. In the case of comprehension, however, different error patterns were revealed and the authors suggested that the maturational lag must not be excluded either. They concluded, however, that the role of phonological representations in the memory mechanisms is crucial and that the deficient capacity to form phonetic representations may inhibit the development of syntactic competence.

An additional study corroborating the role of verbal memory on the repetition of relative clauses was conducted by Smith et al. (1989). The material was designed in order to reduce memory load. The sentences included two animate phrases and one inanimate noun phrase, e.g. *the lady who held an umbrella kissed the man* (SO, OS, OO). Conjoined (CC) clauses were also used, e.g. *the lady kissed the man and held an umbrella* and children were assessed on an object manipulation and a picture matching task. Dyslexics made more errors than the controls on the conjoined clauses, but the strategies that were observed in the manipulation task were not different, something which supports the processing limitation hypothesis. In the picture matching task, errors were attested as well, but both groups' overall performance resulted as highly rated.

Finally, similar findings on the role of working memory were also reported by Bar-Shalom et al (1993) on the production and comprehension of relative clauses, in 7-8 year old children. The findings on production, as concluded by the authors, showed that poor readers possessed knowledge of relative clauses and that their performance could not be interpreted on the basis of a syntactic lag. Moreover, they concluded that the particular difficulties with the comprehension of object relative clauses are more compatible with the processing limitation hypothesis and inline with the two aforementioned studies of Smith et al., (1989) and Mann et al. (1984).

Another structure that has been tested in children with DD is the one of passive sentences. Stein et al. (1984) investigated the comprehension of passive sentences and reported that despite the fact that dyslexic children exhibited more errors than the controls, their overall performance was good. A recent study in Italian by Reggiani (2009), however, in dyslexic children as compared to children of the same chronological age and younger children, showed different results. Dyslexic children were found to perform similarly to the young control group and the researcher attributed these difficulties to a linguistic delay. The comprehension of passive sentences has also been tested in dyslexic adults (Wiseheart et al., 2009), along with the comprehension of relative clauses and their performance was found to be related with both working memory and word-reading ability.

Another study in 10-11 year old Hebrew-speaking dyslexic children (Leikin and Assyag-Bouskila, 2004) focused on the issue of syntactic complexity. Sentences that varied on syntactic complexity (active, passive, conjoined, object-subject relative and subject-object relative) were investigated through different measures (syntactic judgement, picture matching task, sentence correction task). Dyslexic children were found to be less accurate and slower in all tasks and sentence complexity was a relatively independent aspect of sentence comprehension. The performance of dyslexic children across the tasks was attributed by the researchers to a processing deficit. Another recent study that investigated the role of working memory in the comprehension of sentences differing in syntactic complexity by Robertson and Joanisse (2010), shall be further reviewed in Chapter 3.

Finally, the interpretation of pronominal expressions has been tested by Waltzman and Cairns (2000) in poor and good readers of the third grade (age range 7;10 to 9;11). Children with reading difficulties were found to differ significantly from good readers in the interpretation of pronouns, suggesting difficulties with binding principles.

2.4.2. Inflectional Morphology and morphosyntax

Limitations of dyslexic individuals in inflectional morphology have also been reported by Joanisse et al. (2000) and more recently by Altmann et al. (2008). Joanisse et al. (2000) studied inflectional morphology in dyslexic children of third grade of primary school (aged 8-9) and more particularly, the formation of regular and irregular past tense forms of existing and novel verbs. DD children obtained low accuracy scores and the authors discuss this result as consistent with their deficits in phonology.

Altmann et al. (2008) investigated inflectional morphology in dyslexic children and young adults aged 8-22. Participants were asked to form sentences starting from stimuli with two nouns and one verb (e.g. candy-hidden-Mary) from three different categories: agent-patient verbs with regular morphology (control sentences), verbs that required an inanimate subject (theme-experiencer verbs in active sentences, e.g. the book *bored* Sarah) and irregular past participles ending in *–en*, which require the awareness of the syntactic requirements that are associated with this participle inflection. Dyslexic participants were found to produce significantly more dysfluent, incomplete and ungrammatical responses than the controls. They were also found to be particularly impaired in the use of the irregular past participle. The fluency difficulties did not show any difference across the participants of the dyslexic group. For the grammatical difficulties, a certain improvement was noticed by approximately high school age, but the authors suggested that this finding needs further investigation. Nonetheless, the results suggest that dyslexic individuals have difficulties with sentence formulation and that their grammatical development may be delayed.

Moreover, dyslexic children have been found to show difficulties in morphosyntax. Jimenez et al. (2004) tested Spanish-speaking dyslexic children on the comprehension of gender and number agreement as well as on grammatical structure and function words that were controlled for working memory effect. Dyslexic children were found to differ in the conditions that demanded phonological processing, namely gender and number agreement that were additionally controlled for working memory.

Rispens et al. (2004) found that Dutch children with dyslexia showed significant differences to subject-verb agreement violations when compared to normally developing children. Since the data of the dyslexic children were further compared to the data of children with Specific Language Impairment, the research shall be further reviewed in Chapter 3.

2.4.3. Summary

The majority of the researches on the linguistic abilities of dyslexic children concerns with the comprehension of syntactically complex sentences, whereas few studies have investigated their production abilities. The studies that we presented imply different approaches to the difficulties that dyslexic children experience in oral language. The first one posits that language difficulties are attributable to phonological limitations: deficient phonological processing affects non-phonological language skills (Bar-Shalom, Crain and Shankweiler, 1990; Crain and Shankweiler, 1990; Robertson and Joanisse, 2010 among others). The second one suggests that these difficulties are not exclusively related to phonology and that they more indicative of a linguistic delay (Byrne, 1981; Catts et al., 1999; Walzman and Cairns, 2000 among others).

Even if the language problems of dyslexic children are unclear, the existing researches suggest that dyslexic children’s language skills are not always age-appropriate. These problems, however, precede reading and they can be identified prior to exposure to literacy. The relevant researches are based on the investigation of phonological and non-phonological language skills in children with early speech or language delay, children at familial risk for dyslexia and finally, children with preschool language impairments. This last investigation, as we shall see in the following sections, has additionally motivated the hypothesis of whether dyslexia is a follow-up phenomenon of preschool language impairments and whether it is a disorder with which these impairments co-occur.

2.5. Early precursors of dyslexia – children at genetic risk for dyslexia and children with early language delay (ELD)

Dyslexia and language disorders have been found to be strongly correlated to familial predisposition as investigated through genetic studies. Children who have a first-degree relative with reading or language problems are 40% at risk as compared to children with non-affected relatives (Gilger et al., 1991). On the basis of familial, genetic predisposition a series of studies has focused on the investigation of phonological and non-phonological language skills, with the purpose to highlight the linguistic profiles of these children and tap specific difficulties that can be indicators of later reading difficulties.

Such investigations have also been motivated by previous researches in children with early language delay (ELD), which had shown that these children can either recover and accomplish normal language abilities by the age of 5-6 (Bishop and Edmuson, 1987) or, by contrast, have persistent language and/or reading impairments (Bashir, Wiig and Abrams, 1987).

However, this was not the case for all the children examined in these studies. There were also children who had achieved recovery by that age, but could be still at risk of developing subsequent difficulties in reading or language at a later stage. During preschool age, these children were tested on language production, grammatical complexity, pronunciation, MLU in morphemes and receptive language. At later stages, there were additionally tested on phonological skills and reading performance. At the early stages, ELD children were found to be severely impaired in syntactic and phonological tasks, as well as in tasks of lexical production. By the time these children reached the age of 60 months a noteworthy improvement was detected and, their language ability was almost normal. However, after three years, some of these children manifested severe limitations in reading.

The authors concluded that the selective impairments found among these children were related to deficits in syntax and phonology. They suggested that the causal relationship between early language delay and reading disabilities should be further researched and that the communicative environment (family) of such children should be observed as well.

In the field of investigation of early precursors of reading disabilities, Scarborough's (1990, 1991) and Scarborough and Dobrich's studies (1990) are considered to be “pioneering” (Snowling, 2000), since for once again they introduce the role of language to a disorder which is primarily related to impaired phonology. Scarborough conducted a follow-up study of 34 at-risk for dyslexia children (from 2 ½ until 8 years old). At the first stage of the assessment (2 ½) these children had short and less complex syntactic structures, but they did not demonstrate any deficiencies in lexical or speech discrimination tasks. At the age of 3, they were deficient in receptive vocabulary tasks, and at 5, the earlier deficits became more specified. They manifested poor phonological awareness skills, deficiencies in corresponding sounds to letters and sensitivity in object naming tasks. At the age of 8, more than 50% of the participants had been classified as dyslexics. It resulted that syntax and phonology are more reliable predictors of later difficulties in reading. However, measuring of phonological skills at the age of 5 was proved to be more revealing than the earlier assessment. Measurement of vocabulary skills was not indicative of a more general impairment until the age of 42 months. Finally, deficits in vocabulary are viewed as manifestations of *“earlier structural language deficiencies”* (p.1738), implying that language deficits can inhibit vocabulary growth.

At this point, we shall refer to specific points in a later article of the same author (Scarborough, 1991), concerning with the antecedents of reading disability. We consider referring to certain discussion points addressed in this study since they are of crucial importance and shall also be addressed in our further discussions. After a re-evaluation of the previous researches, and given the unique contribution of syntactic abilities to the reading outcomes of these children, several alternative hypotheses concerning the relations among “*developing syntactic, phonological, preliteracy, and reading abilities” (p.226)* are suggested by the findings.

First, the processing difficulties of dyslexic children may not be confined only to the phonological domain (for a review of the relevant studies, view Scarborough, 1990) but may involve broader structural language impairments or even more general symbolic rule learning difficulties. Moreover, syntactic limitations are not viewed as responsible for the reading problems of dyslexic children, but rather as predictions of later symptoms. That is, the so-called “precursors and outcomes” should be considered as successive, observable symptoms of the same condition and within this framework, syntactic problems are an early prediction of a later symptom labelled as reading problems.

The continuity of risk for dyslexia was also reported by a longitudinal study in Danish at risk children, by Elbro et al. (1998). Interestingly, at risk children who were later identified as literacy impaired, showed distinct deficits in measures of letter knowledge, phoneme awareness and verbal short-term memory. All language measures in kindergarten were significant predictors of dyslexia and three measures contributed independently to its prediction, namely letter naming, phoneme identification and distinctness of phonological representations.

Pennington and Lefly (2001) conducted a 3-year longitudinal study between children at high familiar and low familiar risk of dyslexia, before kindergarten to the end of second grade. During the testing years, children were assessed four times on the basis of phonological and literacy skills. In consistence with the familiarity of dyslexia, 34 per cent of the high risk children were eventually diagnosed as dyslexic, contrary to the 6 per cent of the children at low familiar risk. Moreover, the children who were diagnosed as dyslexic at the age of 5 showed a more variant performance on letter-name knowledge and their results were poorer than the ones of the low risk group. Letter-name knowledge was proved as a strong predictor. Finally, phoneme awareness and Rapid Serial Naming were proved to be more predictive than speech perception or verbal STM for later reading disability. An interesting finding is that impaired at risk children and unimpaired at risk children shared deficits in verbal STM and RAN, but only the at risk impaired children were found to have particular problems with the phoneme awareness tasks. The contribution of phonological awareness and Rapid Automatized Naming was further found to be predictive and related to reading ability also in a following research (Cardoso-Martins and Pennington, 2004).

Striking differences in letter knowledge had already been noted by Gallagher, Frith and Snowling (2000) in accordance with Vellutino et al.’s (1975) account for dyslexic children’s slower rate of verbal paired-associate learning. An additional indirect effect of this deficit would be on the *“word specific print sound associations”* which directly depend on verbal learning recourses. In this study, measures of metaphonological awareness were not included and speech and speech processing were found only to be marginally stronger predictors than semantic and syntactic skills. In Snowling, Muter and Carroll’s follow-up study (2007), 50 children were tested at 12-13 years on a battery of tests of language and literacy. From these children, 42 per cent were impaired in reading and spelling. The unimpaired at risk children despite the fact that they did not meet the criteria for literacy impairment, showed weak orthographic skills and non-fluent reading. The at risk impaired children, apart from their literacy impairment, were significantly worse on vocabulary, recall of sentences, phonological awareness and non word repetition. In sum, the literacy skills of these children did not show any evidence of catch-up in these skills.

Snowling, Gallagher and Frith (2003) investigated how the interaction of different language skills can determine the reading outcomes in children at genetic risk of dyslexia. For the purposes of this study, at risk children were followed from the age of 4 years until the age of 8 and were assessed at the ages of 4, 6 and 8 years in vocabulary, expressive language, rime awareness and phoneme awareness. It is worthy to note that 38 per cent of the at risk children had a history of language delay. At the age of 8, sixty six per cent of these children were found to have scores of one standard deviation below the ones of the age matched control group, confirming once again that there is an increased risk of poor reading and spelling abilities among these children. Interestingly, not all at risk children turned out to be dyslexic at the age of 8, and this has, at first glance, a purely genetic explanation. On a behavioural level, however, there are some very interesting points that need to be highlighted. The “non-affected at risk” children (that is, the ones that did not become poor readers), showed at age 4 language skills that did not differ from the ones of the control group, by contrast to the poor readers who showed a delayed language profile. At the age of 6, poor readers manifested apparent problems with phonemic awareness tasks, whereas at risk readers did not differ significantly from the control group, although they showed a trend to be slightly worse than controls. Such a difference was not found for oral language development among the at risk good readers and the control group. As far as letter knowledge and phonic skills are concerned, at risk normal readers were found to be as poor as the poor readers. These results suggest that the “at risk” normal readers, despite their difficulties in phonology and letter knowledge did not become poor readers at the age of 8, probably because they relied on their good oral language skills. The results suggest that children who have good vocabulary and wider language skills are able to compensate better.

The findings of the specific study are consistent with previous studies which have shown that children reach the age of reading instruction with diverse profiles of language and phonological abilities. Phonological abilities are crucial for the acquisition of reading, but the degree of how easily children will learn to read and how children with phonological problems will find and use compensatory strategies is determined by their language abilities.

The importance of phonological and speech processing skills has been found also in a longitudinal study of “at risk children” in Finnish (Lyytinen et al., 2001; 2004, Lyytinen, Eklund & Lyytinen, 2005). In these studies, children were followed from birth to school age and were assessed on a variety of tasks. At the age range of 12 to 30 months, the at risk children did not differ in vocabulary. At the age of 2 however, sentence length was the factor that differentiated the groups, and control group children were found to produce longer utterances (as indexed by the mean number of morphemes). Thus, difficulties with inflectional morphology were the first indicator of grammatical impairment found among these children. At the age of 3.5 years children were assessed in receptive and expressive vocabulary and in mastery of inflectional morphology. The at risk group performed lower than the control group on expressive but not on receptive language tasks. However, at the age of 5 a screening with the same tests revealed a significant difference on both receptive and expressive language tests between the at-risk group and the control group.

The additional interesting finding of these researches is the comparison between late talkers at a familiar risk of dyslexia and late talkers without familiar risk. From the at risk group, twenty later talkers were compared to fourteen late talkers without familiar risk until the age of 3.5 years. At risk late talkers by that age had not compensated and their linguistic lag persisted contrary to the late talkers of the other group, who, almost without exception by the age of 3.5, had reached the level of their age mates. To conclude, for Finnish children at high familiar risk of dyslexia (and children at high risk who had experienced speech onset delay), inflectional morphology appears as a stronger predictor than vocabulary. Moreover, at risk children with an additional history of speech delay are at higher risk for continuing impairments in language production.

As far as phonological awareness as a distinctive pattern among at-risk children is concerned, contrasting evidence comes from a longitudinal study in Dutch (Blomert and Willems, 2010). At risk children were tested on phonological awareness and only 14% (7 out of 48) of the at risk children showed a phonological deficit in kindergarten, whereas 44% of the total at-risk children developed a reading impairment in the first grade. In sum, the findings of this research, as discussed by the authors do not indicate that a deficit in phonological awareness can cause unspecified letter-speech sound associations, as it was not found to be predictive for the reading deficits experienced by the all these children. Despite the different findings on phoneme awareness as a predictor, the study confirms the continuity of dyslexia.

Chapter 3. Language Deficits in Specific Language Impairment and Developmental Dyslexia

3.1. Grammatical Deficits in Specific Language Impairment

Specific Language Impairment (henceforth, SLI), is a developmental disorder characterized by significant limitations in language acquisition, in absence of hearing impairment, frank neurological damage and within normal non-verbal IQ rate (Leonard, 1998; Stark and Tallal, 1981). Children with SLI lag significantly behind their typically developing peers in language production and comprehension and the profiles in this clinical population are characterized by particular heterogeneity (Leonard, 1998).

The prevalence of SLI is about 7% (Leonard, 1998) and it is more common in males than in females (3:1). Moreover, the specific disorder has been found to be related with familial predisposition and children with affected parents and siblings are more likely to manifest language learning problems (see Bishop, 1992 for a review).

The heterogeneity of SLI concerns both with the affected language domains, as well as with the severity of these deficits. Children with SLI can experience problems with all aspects of language: phonology, morphology, syntax, morhposyntax, semantics and pragmatics (see Leonard, 1998 for a review) and there is a considerable amount of work for the possible identification of different subtypes within the spectrum of this disorder.

The explanations for the causal origins of SLI are still a hotly debated issue. The theories concerning with the interpretation of the grammatical deficits in SLI follow two different accounts, frameworks. The first is ***the domain-general***, and within this framework, SLI children’s deficits result from impaired input processes and processing capacity (Bishop, 1997; Joanisse and Seidenberg, 1998; Leonard, 1998; Tallal et al., 1996 among others) or they are the consequences of deficient phonological short term memory (Gathercole and Baddeley, 1990; Archibald and Gathercole, 2006). Within this non-modular framework, Leonard’s (1998) ***Surface Hypothesis*** posits that an auditory-perceptual deficit in SLI, causes problems with the perception of morphemes of “low perceptual salience”, such as consonant inflections and weak syllable morphemes. Therefore, the comprehension and production of non-salient morphemes is affected because of their deficient perception (Leonard, 1998). Within the non-modular framework, Gathercole and Baddeley (1990) and Archibald and Gathercole (2006) attributed the limitations of SLI children in vocabulary and morphosyntax to a primary deficit in phonological short-term memory.

On the other hand, within ***the domain-specific*** framework (modular account), the deficits of SLI children are specific to the grammatical system (Gopnik, 1990; Clahsen, 1989, 1991; Rice and Wexler, 1996; van der Lely, 1998; 2005). Within the domain-specific framework, the ***Extended Optional Infitive Account*** (Rice and Wexler, 1996) holds that in children with SLI the feature of Tense and/or Agreement are unspecified. Consequently, SLI children's production is characterized by many unmarked forms over an extended period of time and is manifested as a significant delay in the acquisition of these features.

The ***Agreement Deficit Account*** (Clahsen, 1989, 1991; Clahsen, Bartke and Golner, 1997), postulates that children with SLI are deficient in establishing grammatical relations, i.e. case and agreement, between the different elements of a phrase and a clause. The research evidence on this theory mostly comes from German speaking SLI children, who were not found to encounter general morphological deficits.

Another hypothesis within the modular, domain-specific framework is the one of a ***Representational Deficit for Dependent Relationships***, also known as the RDDR hypothesis (van der Lely, 1998) which accounts for the syntactic deficits. The RDDR hypothesis is specific to the processing of complex syntactic structures that involve movement. More specifically, SLI children show significant deficits in the computation of grammatical operations specific to structural dependencies (i.e. binding) and movement (i.e. wh-questions). The theory was further developed into the ***Computational Grammatical Complexity Hypothesis*** (van der Lely, 2005; Marshall and van der Lely, 2007) that accounts for the phonological, morphological and syntactic problems observed in a specific group, subtype of SLI children (G-SLI, grammatical SLI children). The deficit is "computational" and "grammatical", since the core computational domains of language are affected and "complexity" because the deficit is specific in the formation of complex structural representations.

To sum up, the theories applied to the interpretation of the grammatical deficits observed in SLI children, follow two different frameworks. The modular, that is domain-specific attributes these problems in core deficits in grammar and the other, the non-modular, that is domain-general attributes these deficits in the deficient phonological processing that can also be specific to disruptions in verbal short-term memory. Despite the fact that SLI is the by-definition disorder that is related to impaired language acquisition and the grammatical deficits of SLI children have been extensively studied (view Leonard, 1998 for a review), the approaches to these deficits are more or less similar to the ones applied to interpret the language deficits of DD children. However, it is a fact that the significant limitations that characterize SLI children have not been detected to occur to the same extent in DD children.

3.2. Early language development in children at genetic risk of dyslexia and children with Specific Language Impairment (SLI)

As it has been reported in previous sections, dyslexic children have been found to manifest early language problems that extend beyond phonology and affect the domains of vocabulary, morphology and syntax. Moreover, in many cases these deficits are accompanied by an additional onset delay of early speech. An additional approach to these findings is their comparison with the early, but characteristic and pervasive language deficits detected among children with SLI. Even in this case, the majority of researches has focused on the investigation of early phonological abilities, whereas few studies have investigated non-phonological language abilities.

The main research concern of the studies focusing on phonology, is whether dyslexia and SLI are caused by the same underlying deficits in phonology and whether the diverse profiles can be classified on the basis of severity (with dyslexia as a lighter form of SLI) or both on the severity and quality. In the latter case, the overlap between the disorders is controlled by patterns of severity as well as qualitative differences).

Gerits (2003) investigated speech perception abilities, by using phoneme identification tasks. The study was based on two experiments: the first one included minimal pairs of words; both at risk and SLI children had significantly more errors than the children of the control group. The second experiment consisted of two different classes of speech sounds: stop consonants and vowels, in order to investigate whether speech perception is selectively or generally impaired. The results of the second experiment indicated that children at-risk and SLI children were not so effective in their categorization of speech sounds, comparing to normally developing children. According to these finding, Gerits suggests that the underlying cause of dyslexia and of SLI could be the perceptual deficits, and furthermore proposes that the two disorders are “two conditions on a phonological processing continuum”.

Van Alphen et al. (2004) studied early phonological and morphological abilities of a group of at risk children and a group of SLI children. First of all, the dyslexic group was found to exhibit a systematic and consistent developmental language delay and their general results were intermediate between the results of controls and the SLI. At the age of 3;6 the performance of at risk children on inflectional morphology tasks, in comparison to the SLI children showed qualitative, but not quantitative differences. That is, at risk children showed error patterns that are found among younger children, by contrast to SLI children who exhibited a different pattern of errors. As far as phonetics and phonology are concerned, we shall refer to the different stages of testing. At the age of 4 in the categorical perception of stop consonants, at risk children were significantly lower than the controls and did not differ from SLI children, indicating a speech recognition problem. At the age of 4; 6 at risk children were significantly worse than the controls but their performance was better than the SLI children's. At the age of 5, they were assessed on a task tapping the detection of phonemic mispronunciations. At risk children were again found to perform significantly worse than controls but better than the SLI. The latter results indicate a deficit of different degree in the analysis and representation of phonological word forms. Finally, at the age of 5 both groups performed significantly lower than the controls on a rhyme detection task, with the at risk children holding higher scores than the SLI. In sum, the results reported by this study show that at risk dyslexic children's language and phonological skills are delayed but not significantly impaired as in SLI.

de Bree (2007) studied speech production and phonic skills in infants at risk for dyslexia and young SLI children. The results of 2 and 3 year old infants on speech production revealed no particular differences between the at risk group and the control group. An additional investigation of 3 and 4 year old children at risk of dyslexia as compared to SLI, however, revealed different results. At risk children performed below the control group, but above the SLI group. Moreover, individual group performance showed that 31% of the at risk children performed similarly to the controls on percentages of correct consonants and 24% for mean length of utterance. The rest of at risk group children performed similarly to the SLI. The vast majority of SLI children, however, performed at the poor end of the spectrum. Quantitative analysis of the results showed that overall, at risk children were intermediate between the controls and the SLI. Similar findings were obtained in a non-word repetition task, where again, at risk children were found to be at an intermediate level.

Carrol and Myers (2010) investigated whether family history for dyslexia and speech and language difficulties can constitute separate factors for later literacy difficulties. For the purposes of the research, 46 children at familiar risk of dyslexia were compared to 36 children who were receiving speech therapy services. This group of children, however, included children who exhibited speech or phonological difficulties with or without additional language difficulties. Interestingly, 41,3 per cent of the at risk children had received speech and language therapy. Hence, the groups were further separated into children at family risk of dyslexia without speech and language therapy services (FRD only), children who were receiving speech and language therapy services (SLT only), and children who were both at family risk and were receiving speech and language therapy services (SLT and FRD). The results of the clinical groups were compared to the ones of 128 typically developing children. Children were tested on a variety of phonological, language and literacy tasks. Language skills were assessed on the basis of CELF and included sentence structure, word structure, expressive vocabulary and recalling of sentences. Children who had received or were receiving speech therapy performed significantly lower than all groups, irrespectively of whether they were at high risk of dyslexia, since no significant interactions were revealed between SLT and FRD children. Similar results were obtained for the speech measures, without any indication that the children at high risk show different strengths or weaknesses when compared to SLT children. In the phonological tasks, the combined groups obtained the lowest scores, possibly indicating a more severe phonological processing deficit.

The results on literacy tasks proved to be more particular. Performance below the average level for reading was found for 16% of the control group, 34,3% of the SLT children, 28% of the FRD children and 55,6% of the combined group. Main effects were revealed for SLT and FRD on reading, and no interaction between these two. Additional analyses indicated that the scores in reading dropped sharply in the FRD group, yet, FRD and SLT resulted as independent factors. No further interactions were revealed. For spelling, significant main effects were revealed as well, without any significant interactions between the two groups, indicating that even in the absence of SLT, children at familiar risk of dyslexia develop literacy difficulties.

The results of this research do not indicate that dyslexia is a specific form of SLI, since children at family risk of dyslexia do not show any kind of speech and language difficulties that differ from those detected in children with similar problems but no genetic background. Even if the risk was increased for the at risk children, they still exhibited a wide range of difficulties that cannot be specified according to, or by SLI patterns.

3.3. Comparative Studies between school aged children with Developmental Dyslexia and SLI

So far, we have reported researches comparing children at familiar risk of dyslexia and children with SLI, in most cases concerning with the early language profiles of these children. Apart from these researches, there is a limited number of other investigations in school aged children with dyslexia and SLI that is noteworthy to report and concern with phonological and non-phonological language skills.

The need for comparative researches among school aged children is actual, since not all children receive an early diagnosis of their preschool speech or language deficits and in many cases such problems are identified during primary school when these problems become apparent due to failure in literacy. The need for such researches however, serves an additional dual purpose. As we already reported, during preschool years, investigation of early speech and language difficulties can lead to the differential diagnosis between delayed and deviant grammatical development, contributing to early intervention enrollment. In school aged children, however, taking into consideration the additional cognitive load caused by school assignment obligations and children's difficulties to catch-up to these demands contrary to their peers, things can sometimes appear to be obscured. That is, there are many cases of behavioral overlap between the two disorders that is often difficult to provide a clear cut-off point between the symptoms.

Since phonological abilities have been found to be repeatedly impaired for both populations then probably reading competence and other phonological measures are not adequate in order to provide a clear distinction between the two disorders. Consequently, the issue of language comprehension and production appears to be rather promising. But again, as we shall see in this section, the researches are limited. For once again, and in order to provide a more clear differentiation between DD and SLI, further investigation is needed.

3.3.1. Phonological awareness, reading and phonological skills

As we have repeatedly reported, intact phonological skills play a crucial role in reading acquisition, and disruptions of the mechanisms involved in phonological processing are likely to affect this skill. Phonological processing is a term which covers separate but interactive processes involved in the representation and the manipulation of speech sounds and can be assessed through a variety of tasks. The most important tasks for the investigation of the specific abilities involved in reading are the ones of phonological awareness, RAN and non-word repetition (Snowling, 2000). Phonological awareness taps an individual's metaphonological skills, that is, the conscious manipulation of speech sounds (view section 2.3.1). RAN and non-word repetition on the other hand, are indicative of more general phonological skills, in particular of those which depend on the intact capacity of relevant cognitive mechanisms. RAN taps both phonological fluency and retrieval from long term memory, whereas non-word repetition taps an individual's phonological memory's capacity.

On the one hand, phonological awareness skills in dyslexia have repeatedly found to be impaired (view Snowling, 2000 for a review) and have been proved to be a reliable predictor of later reading difficulties in preschool aged children. We also reported findings of researches that report limited phonological awareness skills in children with language impairments (Catts and Kamhi, 1999; Snowling et al. 2000; Briscoe et al. 2001, Snowling et al. 2004). A more recent research by Fraser, Goswami and Conti-Ramsden (2010) also reports deficits in phonological awareness characterizing both children with dyslexia and SLI. More specifically they compared children with SLI, dyslexia and children with SLI with an additional diagnosis of dyslexia. All of the groups were found to have particular difficulties with the phonological tasks and the authors suggest that with respect to phonological skills, there is substantial overlap between the two disorders.

As far as non-word repetition is concerned, it has been proposed as a clinical marker for both disorders and has been found that such abilities are limited even in cases with reading/language impairments that have been treated (Bishop et al., 1996). In such tasks that are particularly sensitive for both disorders, dyslexics have been found to perform better than SLI children (Catts et al., 2005; Nithart et al. 2009; Rispens and Been, 2007), but still showing apparent deficits when compared to typically developing children. However, in cases where SLI is not manifested with an additional reading disability and consequently with no co-occuring phonological deficits, such differences have not been found (Kamhi and Catts, 1986; Catts et al. 2005). Such results have been reported by Conti- Ramsden and Durkin (2007) and Bishop et al. (2009).

In Dutch, de Bree et al. (2007) compared a group of dyslexic and SLI children on non-word repetition and found that both groups performed poorly, suggesting that pseudoword repetition is a clinical marker for both dyslexia and SLI. Moreover, non-word repetition ability was found to be associated with difficulties in both reading and language. An additional research in Dutch by de Bree et al. (2010) showed that non word repetition deficits can occur in SLI children irrespectively of reading disorders.

Rapid Automatized Naming (RAN) is a task that has repeatedly revealed deficits in dyslexic children and is also a reliable cognitive marker of dyslexia for transparent languages (Snowling, 2000; Brizzolara et al. 2006). Relevant comparative studies between SLI and Dyslexia on RAN have shown that dyslexia can be differentiated from SLI when SLI is not manifested with additional reading impairments (Bishop et al. 2009) and dyslexic children perform worse than SLI children. However, both SLI and dyslexic children perform lower than controls.

3.3.2. Non-phonological language skills

Joanisse (2004) compared the performance of dyslexic children aged 8-9 years old on an elicited production task of past tense forms with the performance of SLI children with dyslexia. The task included both existing and novel verbs and the results were investigated under the following hypothesis: *"Do phonological deficits in dyslexia lead to SLI-like past tense deficits?"* (p. 159). Indeed, the results of the dyslexic children were significantly lower than the control group but higher than the ones of SLI children. Again, for the dyslexic children an intermediate performance was found, but the results are indicative of a difficulty in both rule based forms (-ed suffix) and forms that require storage and retrieval (irregular verbs). The additional fact that both children with dyslexia and SLI showed limited generalization of the regular suffix –ed in novel verbs, is commented only in terms of deficient phonology.

Rispens (2004) investigated the sensitivity of violations of subject-verb agreement in Dutch dyslexic and SLI children. The grammaticality judgment task included three types of violations:

- Type 1: the verb was inflected for 1st person singular, instead of the third 3rd person singular (e.g. maak vs. maakt/ make (1st sing.) vs. makes in English)
- Type 2: the verb was inflected for the plural form (common inflection with the infinitive instead of the 3rd person singular (maken vs. maakt/make vs. makes)
- Type 3: The verb was inflected for the 3rd person singular instead of the 3rd plural form (e.g. maakt vs. maken/makes vs. make 3rd pers. plur.)

The results revealed that children with dyslexia and SLI were significantly worse than the controls, but dyslexic children significantly outperformed children with SLI. Moreover, both clinical groups showed a certain degree of variability among the three conditions. For the dyslexic group, 50% scored comparable to the normally developing children. By contrast, nine out of eleven SLI children's performance was chance-level.

Robertson and Joanisse (2010), tested dyslexic and SLI children on sentence comprehension tasks controlled by degrees of syntactic complexity and short term memory load. In particular, they tested simple SVO sentences, passives, subject and object relative clauses. When working memory load increased, sentence comprehension performance was found to decrease across groups, but the dyslexics were proved to be more sensitive on these alterations. By contrast, SLI children were found to have the lowest performance when the working memory load was minimized. These findings are particularly interesting, if we take into consideration that subtle sentence comprehension deficits in dyslexics are controlled more by memory limitations by contrast to the SLI children, who showed apparent grammatical limitations, something that was further corroborated by the qualitative analysis of their errors.

Cantiani (2011) studied the morphosyntactic abilities of Italian speaking children with DD and children with SLI and dyslexia on a variety of standardized and clinical tasks. In the case of standardized tasks, children were tested on semantic comprehension and grammatical comprehension. Dyslexic children did not differ significantly from the controls in both tasks, whereas significant differences were revealed for the SLI dyslexic children. A further implementation of a specific clinical battery assessing children's morphological and syntactic abilities resulted in very interesting findings. The particular task includes investigates also the formation of plural forms of existing and novel nouns. For existing nouns, dyslexic children did not differ significantly from controls, contrary to SLI who preformed significantly lower than the dyslexic and the controls. Interestingly, Dyslexic and SLI children did not differ in the plural formation of non-words. Another task tapped the morphological manipulations of non-words and significant differences across all groups were revealed. The additional task on the production of clitics and pronouns did not reveal any difference neither between the dyslexics and the controls nor the dyslexics and SLI. However, the SLI differed significantly from the control group. Even if there were no significant differences in certain cases between the dyslexics and the controls, there were dyslexic subjects that performed between -1SD and -2SD according to the general population norms of the test and this percentage was higher in the case of clitics production (31,25%) and word order comprehension (50%).

Cantiani (2011) provided additional data of Italian Dyslexic and SLI children on a grammaticality judgment task investigating subject-verb agreement violations. The conditions that were examined were the following:

- 1st type: the verb was marked for the 3rd plural person instead of the 3rd singular (i.e. La bambina bruna gioca/giocano* a palla – play/plays)
- 2nd type: the verb was marked for the 3rd singular instead of the 3rd plural person (i.e. le giraffe alte mangiano/mangia* nella savanna (eats/eat*)
- 3rd type: filler sentences with a violation of the auxiliary verb and the participle in the context of present perfect tense (i.e. Francesca è caduta/ha caduto* dalla sedia)

The analysis for the first two types of violations revealed significant differences between the SLI group and the control group, a marginally significant difference between the dyslexic group and the control group and no significant difference between the dyslexic and the SLI children. For the case of filler sentences, significant differences were revealed between the SLI and the controls, between the SLI and the dyslexic group, and no differences between the dyslexic group and the control group.

Talli (2010) compared the comprehension and production of morhposyntax in French and Greek children with developmental dyslexia and SLI. In French, she tested children of an age range of 8 to 9;11 years old and the results were indeed interesting. In the oral language comprehension task no significant difference was revealed between the dyslexic group and the SLI group and their results were significantly worse than the ones of typically developing children of similar chronological age. Expressive language skills were assessed through a sentence completion task, taken from a subtest of a French standardized test. Both clinical groups performed significantly worse than the CA control group and SLI children were found to perform significantly worse than dyslexic children. In Greek, the comprehension of morphosyntax was assessed, and DD children were found to be significantly worse than the CA control group, but their performance was higher than the one of the SLI children.

3.4. The theories on the Overlap between DD and SLI

The current section focuses on the studies and the relevant theories of whether Dyslexia and SLI are manifested on the same continuum of language disorders differing only on intensity, or, on whether they are two distinct disorders characterized by behavioral similarities. These theories arise from the investigation of phonological abilities in the two populations, since phonological abilities play a crucial role for speech, language and literacy development and the manifestation of the deficits as well as their intensity can define diverse or overlapping clinical profiles.

3.4.1. The severity hypothesis (Tallal and Piercy, 1973a, b; Tallal and Piercy, 1974; Tallal, 1980, Kamhi and Catts, 1986)

The series of studies by Tallal and her colleagues, focus on the fact that intact sensory reception is the basis for language processing and that any disruption in the quality or quantity of the incoming stimuli can have a direct impact on language development.

Therefore, the perception of auditory stimuli was investigated initially in language impaired and later in dyslexic children. Tallal and Piercy's (1973a, b) research was concerned with the discrimination, the indication of the order of presentation and the serial recall of non-speech tones that varied in frequency. Language impaired children were found to be significantly worse in the discrimination and the indication of the order of the tones, which had a short interstimulus interval.

A similar pattern of results was noted in the case of serial recall, which included the same tones in random order and with increasing strings of elements (from 2 to 5). The results showed that SLI children could not discriminate and as a consequence could not sequence, determine the temporal order of the stimuli. As far as the serial recall is concerned, SLI children were found to be significantly worse than controls and their difficulty was severely deteriorated in sequences above three elements even when the stimulus presentation time was increased. In subsequent experiments, the same subjects were tested with visual stimuli. No significant difference was found between the SLI and the control group and the results pinpointed to an auditory specific temporal processing deficit.

Furthermore, significant differences in temporal order judgment were also revealed when children were tested with verbal stimuli (stop consonant-vowel syllables). That is, the problem was proved again to be specific to a temporal integration of acoustically varying signals. Such impairments were found to be significantly correlated with speech perception and production deficits, receptive language deficits and reading decoding deficits. This was again attributed to the fact that intact sensory reception is the basis for language processing.

In following researches, the perception of rapidly changing sounds was additionally investigated in children with dyslexia. Dyslexics were found to differ significantly from typically developing children in processing rapidly presented auditory stimuli and this impairment was found to be highly correlated with the reading of nonsense words, an ability which is primarily based on the efficient analysis of the phonetic code. In particular, the degree of impairment in temporal processing defined the degree of difficulty in non-word reading.

According to the findings of these researches, dyslexics and language impaired children were found to perform significantly lower than the controls, but within the dyslexic group there were children who demonstrated similar, but less impaired pattern of performance than the SLI children.

The direction that arises from the aforementioned studies leads to the approach that dyslexia constitutes a lighter form of SLI. Under the perspective of this theory, there is no clear differentiation between the two populations and the more general definition of "*Language Learning Impaired children*" is proposed. An impaired basic perceptual processing on which higher cognitive functions are built, cannot but affect the phonological and linguistic profile of a child. Moreover, Stark and Tallal (1979) showed that such a difficulty is significantly correlated with speech perception and production deficits, receptive language deficits and again as we have already noted above, reading decoding deficits.

The earliest approach suggested that, in cases of severe and apparent speech processing deficits, in which oral language is affected, the disorder is manifested in the form of SLI. On the other hand, the same pattern of performance on temporal processing tasks can be found less severe in reading disabled children. That is, in the case of dyslexia, oral language problems are subtle, and manifested upon exposure to the demanding processes of reading and literacy. Hence, it is the severity of temporal processing that defines the phonological deficits; the additional factor of whether or not they are persistent is what causes the subsequent impairments in language and then in reading.

However, the fact that the more general definition of "*Language Learning Impaired children*" is used, provides an additional developmental continuum between the two disorders. More specifically, according to Tallal et al. (1997), children who demonstrate language impairments in preschool age, develop by consequence reading difficulties that are specific to phonology (dyslexia). This emerges also from their findings on the different profiles detected among the children of the dyslexic groups, in which some children were severely impaired.

To sum up, the theoretical direction emerging from auditory perceptual processing studies does not provide a by definition differentiation of the two disorders. Language symptoms are controlled by severity, and, at a later stage, a follow-up phenomenon, the one of specific reading difficulty is manifested.

Within this theoretical framework, Kamhi and Catts (1986), compared reading impaired children to language impaired children on phonological processing tasks (phonological awareness, word and sentence repetition) as well as on tasks that tapped lexical and morphological information. SLI children were found to perform significantly worse than DD children only on three tasks, and in particular, tasks that involved word and sentence repetition. The authors suggested the continuum between the two disorders, and the further discussion concerned the non-homogeneous profiles found among the groups. They concluded that the findings raise a question about the distinctiveness of school age language impaired and reading disabled children.

3.4.2. DD and SLI are two distinct disorders but similar at the behavioral level

Contrary to the theories of dyslexia and SLI as two points of a developmental continuum, are the approach and the relevant model proposed by Bishop and Snowling (2004), concerning the cognitive processes involved in reading. The authors acknowledge the behavioral similarities between the two disorders, but they suggest that "*it is helpful to retrain a distinction between relative restricted problems with literacy and difficulties that encompass production and comprehension of spoken language" (p. 858).*

The model that we shall review represents a two-dimensional aspect of the relationship between dyslexia and SLI.

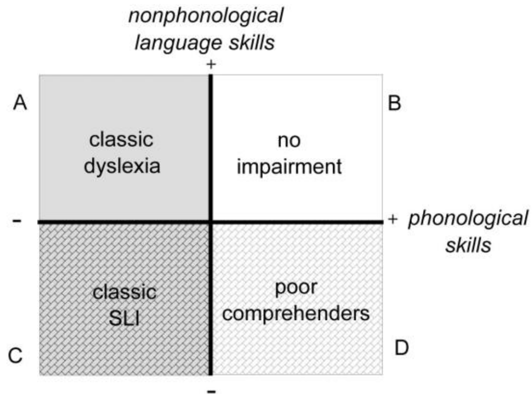


Figure 3.1: A two-dimensional model of the relationship between dyslexia and SLI (adapted from Bishop and Snowling (2004), *Psychological Bulletin,* 130, p.859*)*

The model represents DD and SLI as two distinct disorders that share commonalities on the behavioral level (*observed behavior*), but do not emerge from the same causal origins. The model is based on phonological and non phonological language skills, since their role in reading acquisition is crucial. In the case of dyslexic children's difficulties with reading, their problems are due to deficient phonological skills, which nonetheless are the foundation of decoding skills, whereas their comprehension and their oral language skills are not impaired. In SLI, phonological deficits cannot solely account for reading difficulties. First, it has been demonstrated that not all SLI children have problems with phonology. Additional studies have reported that children with non phonological language problems, in particular, syntax, semantics and pragmatics do experience problems with literacy and are usually defined as "poor comprehenders".

This is particularly interesting, since in the case of SLI, problems in reading can be present, irrespectively of phonological deficiencies. Their problems are attributable to the fact that they do not make use of their broader language skills in order to acquire reading and to succeed in reading comprehension (taking into consideration that successful reading is based on decoding, but the actual purpose of reading is assigning meaning to the decoded words within a specific context). Evidence comes from relevant studies that have shown the intact decoding abilities of "poor comprehenders" which outperform their semantic deficits. In contrast with dyslexics who, according to

Snowling (2006) are in this sense, the *"mirror image"* of poor comprehenders, characterized by phonological but not semantic deficits in reading.

3.4.3. The comorbidity theory and model (Catts et al. 2005)

The comorbidity theory postulates that dyslexia and SLI are distinct, but potentially comorbid developmental language disorders. The comorbidity is manifested when a phonological processing deficit is present in dyslexia and SLI, but not in cases of SLI in isolation from dyslexia. The following model representing the comorbidity between dyslexia and SLI according to these researchers is based on comparisons between dyslexic and SLI children on phonological awareness tasks and measures of phonological memory.

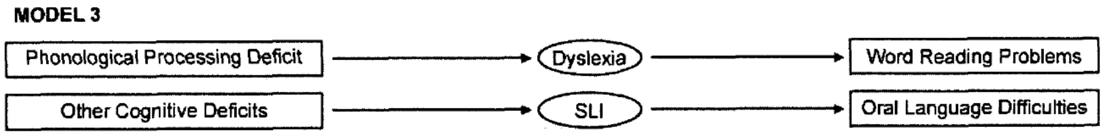


Figure 3.2: The comorbidity model proposed by Catts et al. (2005), adapted from Catts et al. (2005), Journal of Speech, Language and Hearing Reseach, 48, p.1380

With respect to this approach, dyslexia and SLI are two distinct disorders, characterized by different cognitive deficits and behavioral manifestations. As can be seen, the core deficit in dyslexia is a phonological processing deficit that causes these children's difficulties in reading. On the other hand, children with SLI are characterized by other deficits that cause problems in the development of oral language. Contrary to the model proposed by Bishop and Snowling (2004), in which the overlap results from both disorders manifesting a deficit in phonological processing, in the specific model the overlap is due to comorbidity. More specifically, despite the fact that the disorders are distinct they are related and can occur in the same individual. The authors conclude that if this model representing the relationship between dyslexia and SLI on the basis of comorbidity is correct, then one could expect to find greater-than-chance overlap between the two disorders. However, they also note that children with SLI without a reading difficulty resulting from phonological processing deficits and on the other hand children with dyslexia with no history of oral language difficulties should be observed as well.

Thus, the specific model does not propose neither deficits controlled by severity nor a core phonological deficit, since in cases of SLI children without phonological impairments, such a deficit does not appear to be a major factor.

3.4.4. The multiple deficit model of developmental disorders (Pennington, 2006)

This approach has been developed under the perspective that until now the prevailing cognitive model concerning with dyslexia, namely the phonological deficit theory, has been deterministic and focused only on a single cognitive cause, whereas the etiological model for dyslexia is probabilistic and multifactorial. In the specific article, the author investigates the comorbidity between dyslexia and ADHD (Attention Deficit Hyperactiviy Disorder) and between dyslexia and Speech Sound Disorder (SSD) that will be the main focus within the subject of the specific chapter.

Speech Sound Disorders can be subdivided into two major types: articulation disorders (also known as phonetic disorders) and phonemic disorders (also known as phonological disorders). Articulation disorders involve a difficulty in learning to produce physically the sounds of a language, whereas phonemic/phonological disorders concern with difficulty in learning the sound system of the language. Moreover, phonemic disorders often coexist with SLI.

I shall refer to the exact text of the author, since it constitutes a challenge for many findings and relevant theories: *"But these previous studies have rarely distinguished SSD from specific language impairment (SLI), which is defined by deficits in semantics and syntax. So it is less clear which subtypes (or components) of SSD per se presage which kind of later literacy problems"* (p.394).

According to this single cognitive model both disorders share a cognitive overlap (phonology), but support for shared etiology as well is provided by researches reporting co-familiarity (both disorders run in the same families) that can be explained by either genetic and environmental risk factors. Discussing further the severity hypothesis, he notes that due to the fact that phonology is complex, children with SSD without later dyslexia, could have a different kind of phonological deficit than those children with SSD who later develop dyslexia. That is, they could have a deficit in output phonology, opposed to input phonology or alternatively an altogether different cognitive deficit.

Furthermore, the severity hypothesis should be rejected if children with SSD who do not develop dyslexia later have a phonological deficit similar to the one found in SSD with later dyslexia or in dyslexia without previous SSD.

The overlap between the developmental disorders is far more complicated and cannot be merely explained on the basis of a single continuum where disorders can be differentiated by severity. As noted above, more factors contribute to development and the manifestation of different profiles found among developmental disorders is attributed to the multivariate interaction between these factors.

The model concerning with these factors is presented in Figure 3.3 and according to the author is similar to the complex disease model (Sing and Reilly,1993) in medicine and the qualitative genetic model in behavioral genetics (Plomin et al. 1997). The proposals of this approach are the following:

(1) The etiology is multifactorial, involving an interaction of multiple risk and protective factors (genetic or environmental)

(2) A consequence of this interaction is the altered development of cognitive functions and the production of the behavioral symptoms which characterize this disorder

(3) A single etiological factor cannot be sufficient for a disorder – more are necessary

(4) Complex behavioral disorders share etiologic and cognitive risk factors, thus comorbidity is something to be expected

(5) The liability distribution of a given disease is often continuous and quantitative (vs. discrete and categorical) resulting in an arbitrary threshold for having the disorder.

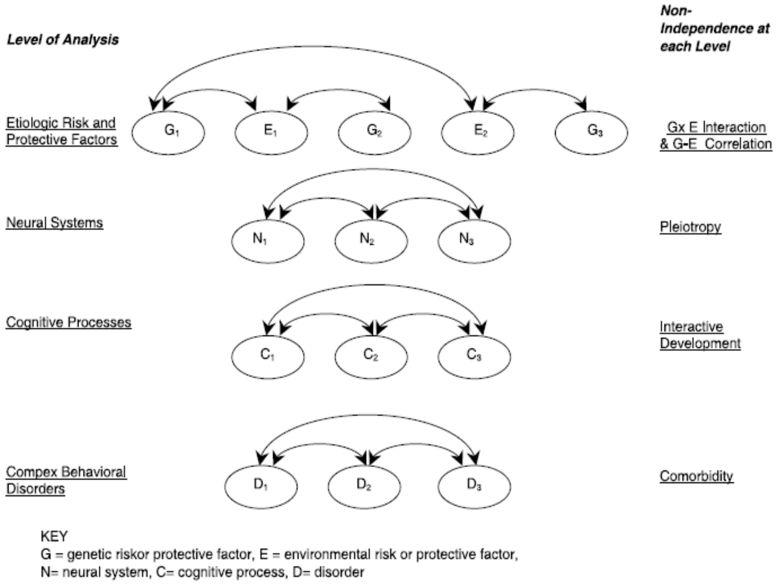


Figure 3.3: the multiple deficit model on the overlap between SLI and DD (reprinted from Pennington, (2006), *Cognition* 101, p. 404)

Thus, as far as SSD and dyslexia are concerned, each individual disorder would have its individual profile of risk factors (cognitive and etiological) with some of those risk factors being shared by the other disorder. And at this point is where comorbidity results.

3.5. Discussion

In the previous sections, we presented comparative studies between DD and SLI. More specifically, these studies concerned with the investigation of early language deficits in DD as compared to SLI, of researches on phonological abilities and finally comparative studies on non-phonological language abilities. Moreover, we presented the relevant models that apply into the explanation of the behavioral overlap between DD and SLI.

First, the investigation of early language deficits in DD provides evidence that language-related difficulties precede the reading problems of these children and on the other hand, these deficits are less severe and qualitatively different than the ones observed in SLI children. On the other hand, in older children with DD and SLI, the limited amount of researches reports that the difficulties are more severe in the case of

SLI and at some points, they are qualitatively different. In most cases, however, the performance of the DD children is not comparable to the one of typically developing children. DD children tend to perform less accurately than typically developing children, exhibiting non-age appropriate performance. In general, their performance is found to be intermediate, lower than the one of typically developing children and higher than the one of SLI children.

The different models applied to interpret the differences and similarities between DD and SLI are based on the phonological deficits that characterize both disorders. Certainly, the investigation of phonological skills can provide evidence for both overlapping and differentiating factors between the two disorders, but additional factors should be considered, as far the differentiation between the two disorders is only based on phonological measures. However, both disorders are characterized by heterogeneity (Bailey et al. 2004, Leonard, 1998). In addition, SLI can be manifested without DD (Bishop et al., 2009; Catts et al., 2005, Mc Arthur et al. 2000) and vice versa, that is, DD can be manifested with relatively intact non-phonological language abilities.

Therefore, it appears that an approach based on the interpretation of the deficits only on the basis of severity for differentiating DD from SLI on additional non-phonological measures, could probably not be completely plausible. This could account only in cases in which only quantitative differences are detected between the two groups and this pattern would be expected to occur across all tasks.

On the other hand, the models that focus on the distinction between the two disorders (Bishop and Snowling, 2004; Catts et al. 2005; Pennington, 2006) are more related to the needs of the current study, at least as far as the distinction between the two disorders is concerned, the patterns of comorbidity and the points in which the differentiation can be observed.

First of all, and in line with these models, we hold that DD and SLI are distinct disorders. However, taking into account previous research findings, we expect to find difficulties in language comprehension and production in children with DD, at many points similar to the ones that have been reported/observed for children with SLI.

Moreover, since the current study does not include measures of phonological abilities (that would permit a more accurate interpretation of the data according to the different models) and due to the additional fact that the data of the DD children are not directly compared to data of SLI children, an interpretation of the results according to the aforementioned models does not appear plausible.

Nevertheless, the evaluation of the results according to existing findings on SLI, can certainly assist into differentiating dyslexic children with additional difficulties in language and probably identify cases of undiagnosed language impairments.

In the next section, we present a brief overview of the studies in SLI that concern with the grammatical structures under investigation, with particular emphasis in Italian and Greek.

3.6. Grammatical Deficits in SLI: previous findings in object clitics, definite articles and wh-questions: implications for the current study

3.6.1. Object Clitics and Definite Articles

Direct object clitics have been found to be particularly vulnerable for SLI children, but the manifestation of the weaknesses has been found to differ across languages and to be related with both the chronological age of the children and to the severity of their deficits (Arosio et al., 2010; Bortolini and Leonard, 1996; Leonard et al., 1992; Leonard and Bortolini, 1998; Leonard and Caselli, 1997; Bortolini et al., 2006; Grüter, 2005; Jakubowitz et al., 1998; Mastropavlou, 2006; Paradis, et al., 2005/2006; Smith, 2008; Stavrakaki and Van der Lely, 2010; Tsimpli and Stavrakaki, 1999).

In Italian, which concerns us here, failure in clitic production has been proved to be a reliable clinical marker for SLI in preschool age (Bortolini et al., 2006) and the prominent error that has been reported for Italian SLI children, is the one of omissions. The omissions that characterize SLI children’s production have been mainly discussed on the basis of the prosodic properties of the direct object clitics (Leonard and Bortolini, 1998). Since Italian is a null subject language, clitics can additionally appear in sentence initial position and in these cases they are processed as a non-final weak syllable.

Certainly, the prosodic properties of direct object clitics can determine their production, but other factors must be considered as well, since object clitic production involves the syntax-discourse interface.

A recent study in Italian by Arosio et al. (2010) on a group of older SLI children (age range 6;4-8;7), reported different results. SLI children were found to have significant limitations in the production of direct object clitics, but the errors that were attested were different. In particular, no effects were revealed for omissions and SLI children were found to produce significantly more full NPs, instead of direct object clitics. Moreover, SLI children were tested on the production of reflexive clitics, which are also phonologically non-salient and they were not found to have particular difficulties. The authors attribute these findings to the grammatical and pragmatic limitations of SLI children. These findings confirm that the failure in the production of direct object clitics is not determined exclusively by prosodic factors. Nonetheless, the deficits appear to be persistent and the production of direct object clitics is a reliable marker of SLI even in school aged children.

In Greek, the findings on direct object clitics, as far as omissions and the persistence of the deficits are concerned are rather different. The existing data suggest that the production of direct object clitics depends both on the chronological age of the children, as well as on the severity of their deficits. Tsimpli and Stavrakaki (1999) on a single case study reported that direct object clitics were almost absent and the omissions in obligatory contexts were more than 95%. Mastropavlou (2006), in a study on elicited production in preschool children with SLI, found significant differences and high rates of omissions. In addition she reported the overgeneralization of the neuter clitic to the masculine and feminine singular clitics. Smith (2008), reported significant overall differences and particular difficulties with the plural direct object clitics. She also reported omissions and substitution errors. Stavrakaki and Van der Lely (2010) reported difficulties in the production and comprehension of direct object clitics in school aged SLI children. In the case of production, the most frequent error was the one of the production of a full NP, whereas in the case of comprehension the most frequent was the one of reversal of the thematic roles. In a more recent study by Manika et al. (2011), omissions were not found to characterize the performance of SLI children.

The findings in Italian and Greek, suggest a discrepancy as far as the omissions are concerned. The differences between the two languages have been explained on the different syntactic properties of the direct object clitics. More particularly, in Italian, direct object clitics agree with the past participle when the verb is in present perfect tense (i.e. Il bambino la ha salutata-the child-masc. **her-CLIT** has greeted-fem.sing.), whereas in Greek there is no participial agreement of the direct object clitic (Tsakali and Wexler, 2003; Manika et al., 2011). According to the UCC (Unique Checking Constraint, Wexler 1998, 2003), that prevents a D-feature on the DP from checking more than one D-feature, in languages as Italian and French, clitics must check their features against two functional categories,more precisely, the one with agreement with the object (AgrO) and one with the participle (AgrPart). On the other hand, in languages without participial agreement, clitics must check their features against only one category, the one of AgrO. Despite these differences, however, direct object clitics have been found to be problematic for Greek SLI children as well.

As far as the indirect clitic is concerned, in typical language acquisition in Italian, it emerges at a later stage than direct object clitics (Caprin and Guasti, 2009), but children omit indirect clitics less than directs. This finding has been attributed to the difference in the participial agreement, since indirect-dative clitics do not agree with the past participle.

In Greek, on the other hand, the only study on elicited production of indirect object clitics is the one by Smith (2008). She reported significant limitations in the production of the specific structure and lower performance than in direct object clitics. Moreover, the omissions for the indirect object clitics were more (28,8%) than the ones observed in direct object clitics (18,3%). The author attributed these findings to the later acquisition of genitive case (Stephany, 1997), as well as to the additional demands of ditransitive verbs.

As far as the study of articles in Italian SLI is concerned, Bottari et al. (1998) reported high percentages of omissions, something that has also been reported by Leonard et al. (1992). The difference, however, between these two studies is that in the study of Bottari et al. (1998), articles were found to be omitted more than clitics, whereas Leonard et al. (1992) reported better performance on the production and comprehension of articles. Moreover, particular difficulties have been reported with the masculine singular article *il* by Leonard et al. (1993).

Articles have also been found to be vulnerable in Greek SLI with high rates of omissions (Stavrakaki, 1999; Tsimpli and Mastropavlou, 2007), but better performance on definite articles than direct object clitics has been reported by Tsimpli (2001), Smith (2008) and recently by Chondrogianni, Marinis and Edwards (2010), who studied the online processing of omissions of articles and clitics in a group of school aged SLI children. They found that SLI children were sensitive to the omissions of indefinite articles and to the omissions of definite articles in subject positions, whereas they were not found to be sensitive to the sentences including clitic pronouns.

3.6.2. Wh-questions

The production and comprehension of wh-questions constitute particularly vulnerable domains for children with SLI (Stavrakaki, 2001, 2006; van der Lely and Battell, 2003; Deevy and Leonard, 2004; Marinis and van der Lely, 2007; Friedmann and Novogrodsky, 2011; van der Lely, Jones and Marshall, 2011). Moreover, SLI children have been found to encounter particular problems with the processing of object questions.

In Italian, Guasti (2012, to appear) reported significant limitations in the production of wh-questions by SLI children, and in particular for which subject and object questions. Furthermore, the same research in DD reports difficulties for *which* questions, which are however, observed, only in certain DD subjects. Finally, in the case of DD children, *who* questions were not found to be vulnerable.

With respect to the findings in Greek SLI, Stavrakaki (2001, 2006) has reported significant limitations in the formation of wh-questions with the more characteristic error the one of erroneous case assignment. Greek SLI children exhibited persistent deficits with object questions, and in particular for *which object* questions that were found to occur even in a later follow up study. As far as comprehension is concerned, Stavrakaki (2001) reported better performance on *which* than on *who* questions and attributed this finding to the referential *NP* that assisted SLI children into processing better *which* questions. Overall, however, their performance was found to be better on *subject* than *object* questions.

As far as the differences between the two languages are concerned, the evidence comes from the study of typical language acquisition. Despite the fact that in both languages the word order in subject and object questions is similar (*WhVNP*), in Italian the acquisition of wh-questions is remarkably delayed as compared to Greek (de Vinzenzi et al., 1999; Guasti et al., 2012; Stavrakaki, 2001), due to the lack of morphological case.

The different acquisition properties between the two languages as suggested by the existing researches, show that in Greek, *WhVNP* order is mastered very early, whereas in Italian, children make more use of alternative strategies and in particular for object questions (Guasti et al., 2012). The asymmetry between *WhVNP* subject and object questions in Italian has been reported by De Vincenzi et al. (1999) also in the comprehension of wh-questions, and this asymmetry appears to be fully resolved around the age of 10. By contrast, Stavrakaki (2001) with respect to data by typically developing children, reports high percentages in both production and comprehension during preschool age.

3.6.3 Implications for the current study

With respect to the previous findings in SLI and DD (Cantiani, 2011; Guasti, 2012 to appear; Stavrakaki and van der Lely, 2010, Talli, 2010) as well as to the particularities of the grammatical structures under investigation in each language, the the children of both DD groups are expected to show similar as well as different performance patterns.

First of all, Italian DD children are expected to encounter greater difficulties in the production and comprehension of direct object clitics, as compared to the Greek DD children, but even in the case of the Greek DD group, we do not expect to observe intact performance across all subjects. Reduced performance is expected for both DD groups in the production of indirect object clitics (as indicated also by the findings of Altmann et al., 2008 on complex sentence formation), yet no predictions can be made for their performance on the comprehension task, since this is the first study in both languages that investigates the comprehension of the specific structure.

Articles are expected to be processed better than object clitics, yet in both clitics and articles, errors specific to the phonological deficits of DD children are expected to be found.

Finally, difficulties in the production of wh-questions are expected in both languages. Italian DD children are expected to show more impaired performance and in both languages reduced performance of the children of the DD groups is expected in object questions.

Chapter 4: Experimental material and method

4.1. Direct Object Clitics: experimental material and procedure

4.1.1. Production of direct object clitics

In order to assess children's ability to produce direct object clitics, an elicitation task was designed including both singular and plural forms of direct object clitic pronouns in both languages. The elicitation procedure was different than the one used in previous researches (Jakubowicz et al. 1998; Mastropavlou 2006; Bortolini et al. 2006; Smith, 2008; Stavrakaki and van der Lely, 2010). Similarly to these studies, subjects were presented with pictures depicting animals performing transitive actions. In most of the previous researches, however, subjects were only asked to respond to the probe question: *"What is X doing to Y?"*, without any additional feedback on the depicted action. In the current study, however, the experimental design was based on the one used in the study by Arosio et al. (2010), in which the probe paradigms consisted of both the description of the transitive action and the relevant question, as in the following examples for both Italian **(IT)** and Greek **(GR)**:

(IT) –Probe: Il gatto lava **il cane**
The cat wash-3rdSPr the dog-**masc. sing**.
The cat is washing the dog

Cosa fa il gatto **al cane ?**
What is the cat doing to the dog ?

Target Answer: **lo** lava
him-CLIT wash-3rdSPr.
(He) is washing him

(GR)- Probe: I γata pleni **ton skilo**.
The cat-fem.sing. wash-3rdSPr. the dog-**masc. sing**.

Ti kani i γata s***ton skilo*** ?
What is the cat doing to the dog?

Target Answer: **ton** pleni
him-CLIT wash-3rdSPr.
(She) is washing him

The elicitation task consisted of 24 tokens, 6 for each item. The direct object clitics that were investigated in both languages can be found in Table 4.1. In sentences targeting singular clitics the verb was marked for the 3rd singular person, whereas for the plural clitics the verb was additionally marked for 3rd plural person. In particular, for each item there were 3 tokens with the verb marked for 3rd person singular (involving one agent and two patients) and 3 tokens with the verb marked for 3rd person plural (involving two agents and two patients), as the following examples:

(IT) Target Response: **le inseguono**
them-**CLIT-**fem.plur. chase-3rdPlPr.
(They) are chasing them

(GR) -Target Response: **tis kinigoun**
them –**CLIT-**fem.plur. follow-3rdPlPr.
(They) are chasing them

All the pictures and experimental sentences were common in Greek and Italian. Hence, a careful selection of nouns-direct objects that would elicit the clitics was realized. The nouns for the object noun phrase that were selected were of the same gender in Italian and Greek and each noun appeared only once as a target object.

4.1.2. Comprehension of Direct Object Clitics-Grammaticality Judgment Task

In order to assess children's ability to detect omissions of direct object clitics, a grammaticality judgment task was designed by the experimenter. The experiment included the pictures and the probe sentences and questions of the production task. Two cartoon characters, one male (prerecorded voice of a male Native Italian and respectively Greek speaker) and one female (pre-recorded voice of a female Native Italian and respectively Greek speaker) provided two alternative responses. More particularly, the one character provided a response which included the clitic whereas the other character provided a response in which the direct object clitic was omitted. Examples are provided for both Italian and Greek experiments as follows:

(IT) –Probe: Il gatto lava **il cane**
The cat wash-3rdSPr the dog-**masc. sing**.
The cat is washing the dog

Cosa fa il gatto **al cane ?**
What is the cat doing to the dog ?

Female Cartoon Character: **lo** lava
him-CLIT wash-3rdSPr.
(He) is washing him

Male Cartoon Character: *lava
wash-3rdSPr.
(He) is washing

(GR)- Probe: I γata pleni **ton skilo**.
The cat-fem.sing. wash-3rdSPr. the dog-**masc. sing**.

Ti kani i γata ***ston skilo*** ?
What is the cat doing to the dog?

Female Cartoon Character: **ton** pleni
him-CLIT wash-3rdSPr.
(She) is washing him

The items were presented in a pseudorandomized order and the cartoon characters appeared in different ways on the screen. In particular, as soon as the pre-recorded question *"What is X is doing to Y"* was heard, the one character appeared on the lower part of the screen with direction from left to right and provided the one answer, whereas the other appeared with direction from right to left and provided the other answer. The characters appeared in pseudorandomized order, i.e. the same character did not always appear from the same side[2].

Children were tested individually in the Speech Therapy Centres or in the schools. A digital voice recorder was used in order to register children's responses for further control of the production data by the author and two Native speakers of Italian.

Table 4.1: Experimental Items in Accusative/Direct Object Clitics in Greek and Italian

Direct Object Clitics	Greek		Italian	
Masculine Singular	**ton**	6	**lo**	6
Feminine Singular	**tin**	6	**la**	6
Masculine Plural	**tus**	6	**li**	6
Feminine Plural	**tis**	6	**le**	6
Total	**24**		**24**	

Table 4.2: Verbs used in the production task of direct object clitics in Greek and Italian (infinitival forms)

Verb	Greek	Italian
capture	pjano	catturare
catch	pjano	prendere
chase	kiniγo	inseguire
comb	chtenizo	pettinare
follow	akoloutho	seguire
kiss	filo	baciare
pet	chaiδevo	accarezzare
pull	travo	tirare
push	sprohno	spingere
smell	mirizo	annusare
tie up	dheno	legare
wash	pleno	lavare
wet/splash	vreho	bagnare

4.2. Indirect Object Clitics: Experimental Material and Procedure

4.2.1. Production of indirect object clitics

For the purposes of this experiment a picture based elicitation task was designed by the experimenter for both languages and concerned only with singular indirect object

[2] Picture samples for the direct object clitics tasks can be found in Appendix I.

clitics. The elicitation procedure was similar to the one of the direct object clitics task, that is, a computer based stimuli display (through PowerPoint presentation) with a prerecorded voice (female Native Italian Speaker and female Native Greek speaker) describing the transitive action and asking "*What is X is doing to Y*". We present examples for both languages, for both masculine and feminine singular.

<u>Examples for Masculine Singular:</u>

(IT) – **Probe:** Il lupo lancia la palla all' orso.
The wolf- masc.sing. is throwing the ball to the bear-masc. sing.

Cosa fa il lupo all' orso ?
What is doing the wolf to the bear ?

Target Answer: **gli** lancia la palla
him -clit.masc.dat.sing. is throwing the ball
(He) is throwing him the ball

or alternatively a Target response could be one including a clitic cluster:

gliela lancia
him-indclit **her-**dirclit (the ball) is throwing
(He) is throwing him the ball

(GR) –**Probe:** O likos petai ti bala ston arkudho.
The wolf masc.sing. is throwing the ball to the bear masc. sing.

Ti kani o likos ston arkudho?
What is doing the wolf to the bear ?

Target Answer: **tou** petai ti bala
him **-clit.**masc.gen.sing. is throwing the ball
(He) is throwing him the ball

or alternatively, a Target response could be one including a clitic cluster:

tou tin petai
him-indclit **her-**dirclit (the ball) is throwing
(He) is throwing him the ball

Examples for Feminine Singular:

(IT) –Probe: La capra lancia la palla alla mucca.
The goat-fem.sing. is throwing the ball to the cow-fem. sing.

Cosa fa la capra alla mucca ?
What is the goat doing to the cow ?

Target Answer: **le/gli** lancia la palla
her –**clit.**fem/masc..dat.sing. is throwing the ball
(She) is throwing her the ball

or alternatively a Target response could be one including a clitic cluster:

gliela lancia
her-CLITind **her-**CLITdir (the ball) is throwing
(She) is throwing her the ball

(GR) Probe– I katsika petai ti bala stin ajelada.
The goat fem.sing. is throwing the ball to the cow fem. sing.

Ti kani i katsika stin ajelada ?
What is the goat doing to the cow?

Target Answer: **tis** petai ti bala
her –CLIT**.**fem.gen.sing. is throwing the ball
(She) is throwing her the ball

or alternatively a Target response could be one including a clitic cluster:

tis tin petai
her-indclit **her-**dirclit (the ball) is throwing
(He) is throwing her the ball

The experiment consisted of 12 tokens, 6 for each item. The verbs that were selected for this experiment were all ditransitive. The indirect object clitics and the verbs of the experimental sentences for both languages can be found in Tables 4.3 and 4.4 respectively:

Table 4.3: Experimental Items in Indirect Object Clitics in Greek and Italian

Indirect Object Clitic	**Greek (genitive case)**	**Italian (dative case)**
Masculine Singular	tou (6)	gli (6)
Feminine Singular	tis (6)	le/gli (6)
Total	12	12

Table 4.4: Verbs used in the production task of indirect object clitics in Greek and Italian (infinitival forms)

Verb	**Greek**	**Italian**
narrate/tell	leo	raccontare
show	δichno	mostrare
bring	ferno	portare
serve	serviro	servire
throw (1)	peto	lanciare
throw (2)	richno	tirare
give	δino	dare
give as a gift	charizo	regalare

The procedure was similar to the one of the direct object clitics production task. In the current task, however, the training including four pictures, two for each item.

4.2.2. Comprehension of Indirect Object Clitics

The current experiment investigates children's comprehension ability of indirect object clitics. For this purpose, a picture pointing selection task was designed by the experimenter and included the target images of the production task, common for both languages and concerned only with singular indirect object clitics. Children were presented a computer based stimuli display (through PowerPoint presentation, with a prerecorded voice (female Native Italian Speaker and female Native Greek speaker) that provided the sentence under investigation. In this case, children had to select between four images (one correct and three syntactic distractors). The recorded sentence was presented simultaneously with the image in order to avoid a possible impact on short term memory.

We present examples for both languages, for both masculine and feminine singular:

Examples for Masculine Singular

(IT) – In questa storia c' è un orso e il lupo ***gli*** lancia la palla

In this story there is a bear-masc.sing. and the wolf-masc.sing. him –**CLIT**dat.masc. is throwing the ball.

(GR) – Se afti tin istoria ine enas arkudos ke o likos ***tou*** petai ti bala

In this story there is a bear-nom.masc.sing. and the wolf-nom.masc.sing him **CLIT.**gen.masc. is throwing the ball.

Examples for the Feminine Singular Indirect Clitic :

(IT) - In questa storia c' è una mucca e la capra ***le*** lancia la palla

In this story there is a cow fem.sing. and the goat-fem.sing. **her-CLIT**.-dat.fem.sing. is throwing the ball

(GR) – Se afti tin istoria ine mia ajelada ke i katsika ***tis*** petai ti bala

In this story there is a cow-fem.sing. and the goat-fem.sing. **her –CLIT.-** gen.fem.sing. is throwing the ball

Let us now refer to the different images that tap different responses, taking into consideration the last example on the feminine indirect clitic. A correct response would be the one in which the goat throws the ball to the cow. Another image (syntactic distracter 1) depicted the transitive action with reversed thematic roles (i.e. the cow is throwing the ball to the goat). Another one (syntactic distracter 2) tapped the omission of the indirect clitic (i.e. the goat is throwing the ball). The next syntactic distracter tapped children's ability to comprehend the probe sentence (i.e. the cow is throwing the ball).

The experiment consisted of 12 experimental sentences, 6 for each item. The sentences were identical with the ones of the indirect clitic production task and were presented in a pseudorandomized order and the training included two tokens, one for each item (masculine-feminine).

4.3. Definite Articles: Experimental Material and Procedure

4.3.1. Production of definite articles

We investigated children's ability to produce definite articles using a picture based elicitation task throughout a PowerPoint presentation following the procedure by Jakubowicz et al. (1998) and Smith (2008). Many of the pictures were common with the ones of the Direct Object Clitics tasks. A prerecorded voice (female Native Italian Speaker and female Native Greek speaker respectively) asked questions concerning the agent (Subject NP-nominative case for Greek) or the patient of the action (Object NP-accusative case for Greek). We present examples for both Subject and Object NP in both Italian and Greek:

Subject NP- Nominative Case for Greek

(IT) Probe question: Chi è che bagna la scimmia ?
Who is wetting the monkey?

Target Answer : **la** volpe
The nom.fem. sing. fox
The fox

(GR) Probe question: Pjos vrehi ti maimu ?
Who nom. is wetting the monkey acc.fem.sing. ?
Who is wetting the monkey?

Target Answer : **i** alepu
The nom.fem.sing. fox
The fox

Object NP-Accusative Case for Greek

(IT) Probe question: Chi è che la volpe bagna ?
Who is that the fox is wetting ?
Who is the fox wetting ?

Target Answer: **la** scimmia
the fem.sing. monkey

(GR) Question: Pjon vrehi i alepu ?
Who-acc. is wetting the nom.fem. sing. fox
Who is the fox wetting ?

Target Answer: **Ti** maimu
the acc.fem.sing. monkey

The experiment consisted of 48 tokens, 6 for each item. The pictures that were used were common for both languages, thus all depicted characters were of the same gender in Italian and Greek. Samples of pictures for the indirect object clitics tasks can be found in Appendix II. All the responses were recorded for further control and were analyzed by Italian and Greek Native speakers respectively.

Table 4.5: Experimental items of the Article Production Task in Greek and Italian

Definite Article	**Subject NP-**		**Object NP**	
	Greek Nominative Case	**Italian**	**Greek-Accusative Case**	**Italian**
Masculine Singular	**o** (6)	**il** (6)	**ton** (6)	**il** (6)
Feminine Singular	**i** (6)	**la** (6)	**tin** (6)	**la** (6)
Masculine Plural	**i** (6)	**i** (6)	**tus** (6)	**i** (6)
Feminine Plural	**i** (6)	**le** (6)	**tis** (6)	**le** (6)
Total for each task (48)	**24**	**24**	**24**	**24**

4.3.2. Comprehension of Definite Articles-Grammaticality Judgment Task of Omissions

The comprehension of definite articles was tested through a grammaticality judgment task. The task included sentences in which the definite articles were omitted, both in subject and object DPs. The task was administered through a PowerPoint presentation. Children were presented with pictures that depicted animals performing transitive actions. A prerecorded voice (female Native Italian and female Greek speaker respectively) described the action taking place and children were asked to judge the correctness of the sentence as well as to provide an appropriate correction in case of an erroneous sentence.

The task included 48 tokens, 6 for each item. The presentation of the items was pseudo randomized and the sentences tapping omissions of definite articles were part of a larger task which included also other sentences with grammatical errors on definite articles. Thus, the entire task on articles which included both sentences tapping omissions and other ungrammatical omissions, consisted of 96 items and was divided into two subtests. The first included the experimental items on masculine singular and feminine plural articles and the second included the experimental items on feminine singular and masculine plural articles. An instructional training preceded the experiment during which children were guided in order to detect as well as to correct the errors.

Examples are provided for both Italian and Greek for both subject and object NPs in the following examples:

Omissions of Definite Articles- Subject NP

(IT) - *Foche guardano la giraffa (instead of ***Le foche***)

Seals-fem.plur. look-3rd Sing Pres. the giraffe-fem.sing.

*****Seals are looking at the giraffe

Target response: No, ***le foche*** *(guardano la giraffa)*

No, the-fem.plr. seals (are looking at the giraffe)

(GR) –*Fokjes kitazoun tin kamilopardhali (instead of ***i fokjes***)

Seals-fem.plur. look-3rd Sing Pres. the giraffe-acc.fem.sing.

*****Seals are looking at the giraffe

Target response: Ohi, ***i fokjes*** *(kitazun tin kamilopardhali)*

No, the-plur. seals (are looking at the giraffe)

<u>Omissions of Definite Articles- Object NP</u>

(IT) -*La capra guarda **foche** (instead of ***le foche***)

The goat-fem.sing. look-3rd Sing Pres. seals-fem.plur.

*****The goat is looking at seals

Target response: No, *(la giraffa guarda)* ***le foche***

No, *(the giraffe is looking at)* ***the seals***

(GR) –*I katsika kitazi **fokjes** (instead of ***tis fokjes***)

The goat-fem.sing. look-3rd Sing Pres. seals-fem.plur.

*****The goat is looking at seals

Target response: No, ***le foche*** *(guardano la giraffa)*

No, the-fem.plr. seals (are looking at the giraffe)

The responses were recorded for further control by the experimenter and two Native speakers of Italian.

<u>4.3.3. Ungrammatical Conditions of Definite Articles</u>

In the task of ungrammatical conditions, different paradigms were used in Italian and Greek. In the case of Italian, since articles are not morphologically marked for case, the definite article was substituted with the proposition ***in*** combined with the definite article, a form also known as *articulated prepositions,* while in the case of Greek, nominative case was substituted with accusative and vice versa. However, in Greek this occurred only for the article (localised) and not for the whole DP. In particular, the case of the noun was maintained and the only thing that was modified was the case of the article. This allows for a direct investigation of the role of the case of articles, especially if we consider previous findings on deficient case assignment in Greek SLI (Stavrakaki, 2001; Mastropavlou, 2006) in simple and complex sentences, as well as deficits in DetN agreement (Mastropavlou, 2006).

The following table includes all the conditions, for masculine and feminine in singular and plural, for both languages and relevant examples follow:

Table 4.6: Experimental items in Greek and Italian in the Grammaticality Judgment of Ungrammatical Conditions of Definite Articles

DP	Erroneous vs Correct Form-Italian	Erroneous vs Correct Form-Greek
Masculine Singular (S)	**nel** inst. of **il**	**ton** inst. of **o**
Masculine Singular (O)	**nel** inst. of **il**	**o** inst. of **ton**
Feminine Singular (S)	**nella** inst. of **la**	**tin** inst. of **i**
Feminine Singular (O)	**nella** inst. of **la**	**i** inst. of **tin**
Masculine Plural (S)	**nei** inst. of **i**	**tous** inst. of **i**
Masculine Plural (O)	**nei** inst. of **i**	**i** inst. of **tous**
Feminine Plural (S)	**nelle** inst. of **le**	**tis** inst. of i
Feminine Plural (O)	**nelle** inst. of **le**	**i** inst. of **tis**

Ungrammatical Conditions – Subject NP-Masculine Singular Nouns

(IT)- *Nel riccio sveglia il gatto (instead of ***il riccio***)
in the-masc.sing. hedgehock-masc.sing. wake up-3rdSingPr the-masc.sing. cat-masc.sing.

(GR)-*Ton skantzochir**os** ksipna ti ghata (instead of ***o skatzochiros***)
the-*acc.masc.sing*. hedgehock-*nom.masc.sing*. wake up-3rdSingPr the-*acc.fem.sing*. cat-*acc.fem.sing.*

In the case of Italian, the preposition ***nel*** substitutes the definite article. This is not merely a grammatical error, since neither the article nor the noun are morphologically marked for case, but also a semantic and pragmatic error, since this results into a PP. The PP ***nel riccio*** is otherwise grammatical, since there is no violation between the preposition and the noun. However it is grammatically and semantically inappropriate in the specific context. The selection of the specific violation was inevitable, since other alternative options (i.e. *i* or *la*) would result in a violation on number or gender and this would examine something totally different.

It is apparent that in the case of Greek, first the final –n of the masculine singular accusative article was maintained for all nouns (even for nouns in which this was not necessary), so as not to result in the neuter article *to*, something that would have altered the purpose of the investigation. If we had used the form *to*, then the article would be erroneously marked for gender and not for case (the article ***to*** is used equally for both nominative and accusative case in neuter singular nouns). Moreover, the fact that the nominative case inflection was maintained for the noun leads to an immediate disambiguation and the erroneous pattern concerns exclusively the article. If both the article and noun had been altered (i.e. * *to skatzohiro*), this would have lead to a neutralization of the whole DP and the results obtained could not be indicative of difficulties with the article per se.

<u>Ungrammatical Conditions – Object NP-Masculine Singular nouns</u>

(IT)-*Il gatto sveglia **nel** riccio (instead of ***il riccio***)
The cat-*masc.sing*. wake up-*3rdSingPr* **in the-masc.sing.** *hedgehock-masc.sing.*

(GR)-*I ghata ksipnai **o** skatzochiro (instead of **ton skatzochiro**)
The cat-*nom.fem.sing*. wake up-*3rdSingPr* the-*nom.masc.sing***.** hedgehock-*acc.masc.sing.*

Again, in the case of Object DP in Italian, the use of *nel* is both grammatically and semantically inappropriate. An alternative substitution with the preposition ***a*** (i.e.* *al riccio*) would have an impact on the properties of the verb, since it would make appear a monotransitive verb into a ditransitive and probably cause additional problems. Nonetheless, the plural form *nei* and *nelle* is more comparable to the plural of indefinite articles *dei* and *delle* and this could additionally examine both the status of indefinite and definite articles as well as add a phonological element (*nei-dei, nelle-delle*), somehow comparable to the one in the accusative singular article in Greek *(to(n) vs. o – ti(n) vs. i)*.

Therefore, in Greek, at least for the case of accusative singular, the substitution with the nominative case examines additional phonological components.

Erroneous sentences with feminine nouns in Greek

As we already discussed, for the case of masculine singular nouns, the disambiguation is facilitated on the basis of the accusative case of the article and the nominative case of the noun. This does not occur for the feminine nouns, as the article is differently marked for case, whereas the noun is commonly inflected for nominative and accusative case. Consider the examples below:

Ungrammatical Conditions – Subject NP- Feminine Singular Nouns

(GR) – *Tin ajelaδa sprochni tin katsika **(**instead of ***i ajela*δa**)

The-acc.sing.fem. cow-fem.sing. push-3rdSingPr the- acc.sing.fem goat-fem.sing.

Ungrammatical Conditions – Object NP- Feminine Singular Nouns

(GR) - ***I katsika sprochni **i ajelaδa (instead of ***tin ajelaδa)***

The-nom.sing.fem. cow-fem.sing. push-3rdSingPr the- nom.sing.fem goat-fem.sing.

Ungrammatical Conditions – Subject NP- Feminine Plural Nouns

(GR) –*Tis maγises vrechoun ton kirio

The-acc.plur.fem. witch-fem.plur. slash-3rdPlurPr the- acc.sing.masc. gentleman-acc.sing.masc.

Ungrammatical Conditions – Object NP- Feminine Plural Nouns

(GR) –*O kirios vrechi **i** maγises

The-nom.sing.masc. gentleman-nom.sing.masc.

It is apparent for the aforementioned cases of feminine nouns that the disambiguation is based exclusively on the syntactic properties of the DP (in particular when both DPs are of feminine gender) and these conditions are more complicated.

Certainly, the simultaneous presentation of the pictures depicting the transitive actions in such sentences is more than necessary, as for Greek there are additional limitations.

For example, a sentence like the one targeting the feminine singular subject NP in the aforementioned examples, without the picture can easily be corrected with the addition of a direct object clitic and the correction of the DP in nominative case as follows:

Erroneous Sentence: *Tin *ajelaδa sprochni* **tin** *katsika*
The-acc.sing.fem. cow-fem.sing. push-3rdSingPr the- acc.sing.fem goat-fem.sing.

Possible Correction: Tin *ajelaδa* ***ti(n)*** *sprochni* ***i*** *katsika*
The-acc.sing.fem. cow-fem.sing. her-ACC.CLIT. push-3rdSingPr the- nom.sing.fem goat-fem.sing.

Clearly, this would be the case of a correction with a *Clitic Left Dislocation*, something that could also be possible for masculine nouns if both the determiner's and the noun's case had been altered in accusative case. Therefore, the use of pictures for the current sentences is more than necessary for this additional reason[3].

4.4. Production of wh-questions-Experimental Material and Procedure

In order to investigate children's ability to produce subject and object wh-questions, an experiment similar to the one of Guasti, Branchini and Arosio (2012) was designed by the experimenter. Assessment was realized through a PowerPoint presentation[4] which included images with transitive actions. Depending on the type of the question, subject or object, the agent or the patient of the action was hidden respectively, so as to motivate the child to produce the relevant sentence.

A pre-recorded voice (female Native Italian Speaker and a female Native Greek speaker respectively) described the action that was clearly depicted and asked the child to pose the question to a puppet that was placed next to the portable computer. The puppet (which was manipulated by the experimenter) had to guess the hidden character. After

[3] Samples of pictures for all the tasks of definite articles can be found in Appendix III.
[4] Samples of pictures can be found in Appendix IV.

the production of the sentence and the revelation of the hidden character the child had to judge the puppet's guess.

The experiment consisted of 24 items balanced for type (subject-object) and wh-element (who-which NP). In particular it included 6 *who*-subject questions, 6 *who*-object questions, 6 *which*-subject questions and 6 *which*-object questions.

We provide detailed examples for the experimental material and procedure on both subject and object *who* and *which* questions in both Italian and Greek, as follows:

***Who* Subject Questions**

(IT): Qualcuno tira i draghi.
Someone pull-3rdsing. the dragons-masc.plur.
Someone is pulling the dragons.

Lui sa chi. Domandagli chi.
He knows who. Ask him who.

Target: Chi tira i draghi?
Who pull-3rdSing the dragons-masc.plur.?
Who is pulling the dragons?

(GR): Kapjos travai tous drakous.
Someone pull-3rd Sing the dragons -acc.masc.plur.
Someone is pulling the dragons.

Aftos kseri pjos. Rota ton pjos.
He knows who-nom.masc.sing. Ask him who-nom.masc.sing.
He knows who. Ask him who.

Target : Pjos travai tous drakous ?
Who-nom.masc.sing. pull-3rd.sing. the dragons-acc.masc.plur.
Who is pulling the dragons?

***Who*-Object Questions**

(IT): I draghi tirano qualcuno.

The dragons-masc.plur. pull-3rdPlur. someone.

The dragons are pulling someone.

Lui sa chi. Domandagli chi.

He knows who. Ask him who.

Target: Chi tirano i draghi?

Who pull-3rd Plur.-the dragons-masc.plur.

Who are the dragons pulling?

(GR): I draki travoun kapjon.

The dragons-nom.masc.plur. pull-3rdPlur. someone-acc.masc.sing.

The dragons are pulling someone.

Aftos kseri pjon. Rota ton pjon.

He knows who-acc.masc.sing. Ask him who-masc.acc.sing.

He knows who. Ask him who.

Target : Pjon travoun i draki?

Who-acc.masc.sing. pull-3rd Plur. the dragons- nom.masc.plur.

Who are the dragons pulling?

As can be seen from the above examples on *who* questions, the experimental items consisted of reversible structures that, according to the picture and the thematic roles, were presented both as subjects and object questions; i.e. characters were presented both as agents and patients. Moreover, considering the particularities of *wh* –question formation in Italian (as already discussed), all six *who*-subject questions included a singular verb and all six *who*-object questions included a plural verb. Consequently, the items in Greek were formed as in Italian.

As far as *which-NP* questions are concerned, the same rationale and design were followed. However, in order to elicit a *which-NP* question, two pictures were used. The first one depicted the characters participating in the story and the second one with the hidden character was used for the elicitation of the question. Again, given the particularities of wh-question formation in Italian, the items were additionally counterbalanced in the following way: three of the six *which-NP* questions included a singular verb and three of the six included a plural verb. Examples for which questions are provided below:

<u>Which-Subject Questions- Singular NP</u>

(IT): 1st picture

Ci sono un asino grigio, un asino marrone e due coccodrilli.

There are a donkey grey-masc.sing., a donkey brown-masc.sing. and two crocodiles-masc.plur.

(GR): Edho ine enas grizos ghaidharos, enas kafetis ghaidharos ke dhio krokodhili.

Here there are a grey donkey-nom.masc.sing., a brown donkey-nom.masc.sing. and two crocodiles-nom.masc.plur.

There are a grey donkey, a brown donkey and two crocodiles.

(IT): 2nd picture

Uno degli asini lava i coccodrilli.

One of the donkeys-masc.plur. wash-3rd Sing. the crocodiles-masc.plur.

Lui sa quale. Domandagli quale asino.

He knows which-sing. Ask him which-sing. donkey-masc.sing.

He knows which. Ask him which donkey.

Target: Quale asino lava i coccodrilli ?

Which-sing donkey-masc.sing. wash-3rd.Sing. the-masc.plur. crocodiles-masc.plur.

Which donkey is washing the crocodiles ?

(GR) 2nd Picture

Enas apo tous ghaidarous pleni tous krokodhilous.

One-nom.masc. of the-acc-masc-plur. donkeys-acc.masc.plur. wash-3rd sing. the-acc.masc.plur. crocodiles-acc.masc.plur.

Aftos kseri pjos. Rota ton pjos ghaidharos.

He knows who/which-nom.. Ask him who-nom. masc. donkey-nom.masc.sing.

Ask him which donkey.

Target: Pjos ghaidaros pleni tous krokodhilous?

Who-nom donkey-nom.masc.sing. wash-3rdSing. the crocodiles-acc.masc.plur.

Which donkey is washing the crocodiles ?

<u>Which-Object Questions-Singular NP</u>

The 1st picture was the same as the 1st one in the previous example for which-Subject questions.

(IT) 2nd Picture

I coccodrilli lavano uno degli asini.

The crocodiles-masc.plur. wash-3rd plur. one of the donkeys-masc.plur.

Lui sa quale. Domandagli quale asino.

He knows which-sing. Ask him which-sing. donkey-masc.sing.

He knows which. Ask him which donkey.

Target: Quale asino lavano i coccodrilli ?

Which-sing. donkey-masc.sing. wash-3rd Plur. the crocodiles-masc.plur?

Which donkey are the crocodiles washing ?

(GR) 2nd Picture

I krokodhili plenoun enan apo tous ghaidharous.

The crocodiles-nom. masc.plur. wash-3rd plur. one of the donkeys-acc.masc.plur.

Aftos kseri pjon. Rota ton pjon ghaidharo.

He knows who-acc. Ask him who-acc. ghaidharo-acc.masc.sing.

He knows who/which. Ask him which donkey.

Target: Pjon ghaidharo plenoun i krokodhili ?
Who-acc donkey-acc.masc.sing. wash-3rd Plur. the crocodiles-nom.masc.sing.
Which donkey are the crocodiles washing ?

Which Subject and Object Questions-Plural NP

Since the above examples were rather detailed, we present just the target question for both Italian and Greek.

Which Subject Questions

(IT) – Quali signori tirano il mago ?
Which-plur. gentlemen pull-3rd Plur. the wizard-masc.sing. ?
Which gentlemen are pulling the wizard ?

(GR) – Pji kirii travun to magho ?
Who-nom.masc.plur. gentlemen-nom.masc.plur. pull-3rdPlur. the wizard-acc.masc.sing
Which gentlemen are pulling the wizard ?

Which Object Questions

(IT) – Quali signori tira il mago ?
Which-plur. gentlemen pull-3rdSing. the wizard-masc.sing.
Which gentlemen is the wizard pulling ?

(GR) – Pjus kirious travai o maghos ?
Who-acc.masc.plur. gentlemen-acc.masc.plur. pull-3rdSing. the wizard-nom.masc.sing.
Which gentlemen is the wizard pulling ?

The verbs as well as the number of the experimental items for the different paradigms that were used in both languages can be found in Table 4.7 and Table 4.8.

Table 4.7: Verbs used in the wh-question production task in Greek and Italian

Verb	Greek	Italian
bite	δagono	mordere
pet	chaidevo	accarezzare
catch	pjano	prendere
chase	kinigo	inseguire
look	kitazo	guardare
pull	travo	tirare
scare	tromazo	spaventare
wake up	ksipno	svegliare
wash	pleno	lavare
wet/splash	vrecho	bagnare

Before proceeding to the main experiment, children received an instructional training. A different training procedure than the one in Guasti et al's (2012) study was followed. Guasti et al. (2012) used two trials with a *what* question, since the purposes of the specific study were different than the present one's. In particular, Guasti et al's (2012) study investigated the different strategies that children and adults use for the production of local *who* and *which* questions in Italian. Therefore, a relevant training with *what* questions met perfectly the needs and the finality of the task. We aimed to investigate more closely the production of *WhVNP* structures, since the existing studies report a remarkable asymmetry between Italian and Greek (De Vincenzi et al. 1999; Stavrakaki, 2001; Guasti et al. 2012) on both production and comprehension. Considering that *who subject* questions are not particularly problematic, a relevant trial was not included in the training part. Thus, the training consisted of three trials (*who object, which subject, which object*). The guidance was very specific, as children were encouraged to produce these questions by starting with *who* or *which* respectively.

All the responses were transcribed by the experimenter and were audio recorded for further control. The recordings of the Italian DG were further controlled by two Native speakers of Italian, whereas the ones of the CG were controlled only by one native Italian speaker.

Table 4.8: Production of wh-questions-experimental sentences in Italian and Greek

Sentence Type-Number of Relevant Items	Italian	Greek
Who-Subject (6)	Introduced by **chi** – singular verb i.e .Chi lava… who washes-3rdsingPr	Introduced by **Pjos-nom.** singular verb i.e. Pjos pleni… who-nom.masc.sing. washes….
Who-Object (6)	Introduced by **chi** – plural verb i.e. Chi lavano …. Who wash-3rdplurPr	Introduced by **Pjon-acc.** plural verb i.e. Pjon plenoun…. Who-acc.masc.sing. wash- 3rdplurPr….
Which Subject (6) : • 3 sentences with singular masculine NP • 3 sentences with plural masculine NP	i.e. **Quale**-which sing. Asino-masc.sing. which –sing. Donkey- masc.sing. i.e. **Quali-which plur.** Signori-masc.plur. which gentlemen	i.e. **Pjos who-nom.** ghaidharos- donkey-nom. masc.sing. which donkey i.e. **Pji-who nom. masc.plur.** kirii-nom.masc.plur. travoun-pull3rdPlurPr which gentlemen
Which Object (6) • 3 sentences with singular masculine NP • 3 sentences with plural masculine NP	i.e. **Quale**-which sing. Asino-masc.sing. which donkey i.e. **Quali**-which plur. Signori- masc.plur…. which gentlemen**…**	i.e. **Pjon-who.acc.masc.sing.** ghaidharo-acc.masc.sing. which donkey i.e. **Pjus-acc.masc.plur.** kirious- acc.masc.plur. .. which gentlemen
Total of Sentences	**24**	**24**

4.5. Participant Groups

4.5.1. Italian Group of Dyslexic Children

10 monolingual Italian children (3 females) with DD (henceforth, DG, or ITDG), age range 8;2-10;3 (M=9 SD=7,65), without a diagnosis of SLI were referred for participation in the study by experienced clinicians. The children had at least -2SD on standardized reading tests, nonverbal IQ >85 [only children who did not have a recent assessment on the WISC-III were measured on the Raven Coloured Progressive Matrices (2008)] and a mean score of 96,8 (SD: 9,67) on the Italian version of TROG-2 (Bishop, 2009)[5]. The scores on the standardized tests were provided to the experimenter by the Speech Therapy Centres. The children completed the tests within a period of two months. The chronological age is indicative of the first testing session.

4.5.2. Italian Control Group

10 monolingual Italian children (henceforth, CG or ITCG) referred by the teachers as non-reading impaired, of an age range 7;8-10, (M=8;10, SD=9,19) were matched to the children of the DG on chronological age. All children had a nonverbal IQ >85 as measured on the Raven Coloured Matrices (2008) and a mean score of 117,1 (SD=4,7) on the Italian version of TROG-2 (Bishop, 2009)[6].

4.5.3. Greek Dyslexic Group

9 monolingual Greek children (3 females) with DD (henceforth, DG , or GRDG), of age range 8;2-11;5 (M=9;9, SD=12,46), without a diagnosis of SLI were referred by experienced clinicians. The children had been assessed by Public and Private Centres. All children had a nonverbal IQ >85 as measure on the Raven Coloured Progressive Matrices (2008) and in the case of the older children on the Raven Standard Progressive Matrices (2008). Their language abilities were tested on a translated (by the

[5] The individual z-scores on nonverbal IQ and on TROG-2, can be found in Appendix V.
[6] The individual z-scores on nonverbal IQ and on TROG-2, can be found in Appendix V.

experimenter) version of the Italian TROG-2. However, since there are no norms for the Greek population, the Italian norms were used[7].

4.5.4. Greek CA Control group

9 monolingual Greek children, (henceforth, CG or GRCG), age range 8;3-11;6 (M=9;93, SD=12,63) referred by the teachers as non-reading impaired were matched to the children of the DG on chronological age. All children had a nonverbal IQ >85 (as measured on the Raven Coloured Progressive and Standard Progressive Matrices). Their language abilities were tested on a translated (by the experimenter) version of the Italian TROG-2[8].

4.5.6. Greek younger control group

9 monolingual Greek children, (henceforth, CG2 or younger control group), age range 5;2-7;4 (M=5;10, SD=10,3) were compared to the DG on the comprehension of direct and indirect object clitics. Eight children were recruited from the control group used in the SLI research and one more child was additionally tested. All children had a nonverbal IQ >85, as measured on the Raven's Coloured Progressive Matrices (2008) [9].

4.6. Statistical Analysis

The statistical analysis of the raw data was conducted with R (R Development Core Team, 2011) using logistic regression, with mixed models for fixed and random factors (Baayen, 2008). The model included group as a fixed factor, subject and item as random factors and type of response as the dependent variable.

Additional analyses, when necessary, were conducted with SPSS, version 18.

[7] The relevant raw scores (number of blocks for each child) and the individual z-scores on non-verbal IQ can be found in Appendix VI.

[8] The relevant raw scores (number of blocks for each child) and the individual z-scores on non-verbal IQ can be found in Appendix VI.

[9] Their individual scores on verbal measures can be found in Appendix VI.

Chapter 5. Production and Comprehension of Direct Object Clitics by Italian and Greek Children with Developmental Dyslexia

5.1. Production of Direct Object Clitics in Italian Dyslexic and Typically Developing Children

5.1.1. Classification of Responses

The analyses were conducted on a total of 480 (240 responses by each participant group). As *Target* response was counted a sentence that included a direct object clitic correctly marked for gender and number. The other responses were classified as follows:

-**Clitic**: included all sentences in which clitics were produced, irrespectively of errors on gender or case (i.e. indirect)

-**Omission**: when the argument was omitted

-**Indirect**: when the direct object clitic was erroneously substituted by the indirect object clitic *gli*

-**Gender**: when the clitic was erroneously marked for gender

-**NP**: for cases of production of a full NP instead of a clitic

-**Other**: responses that could not be classified among the aforementioned ones

5.1.2. Results

5.1.2a. Target responses

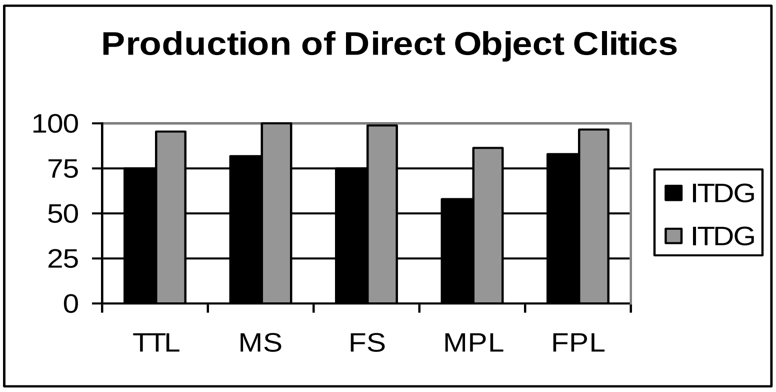
The accuracy scores on *Target* responses and the summary of the fixed effects can be found in *Table 5.1* and in *Figure 5.1*. The model on *Target* responses turned out to be significant ($x^2(1) = 15.938$, $p<0{,}001$) and revealed a significant group effect. The next model on gender did not turn out to be significant ($x^2(1)= 1.5457$, $p=0.2138$). A similar analysis with number, similarly did not turn out to be significant ($x^2(1)= 2.2785$, $p=0.1312$) either.

To sum up, DG children were found to produce significantly less *Target* responses than the CG and this performance was not found to be determined either by gender or number, suggesting that there is no specific clitic type that can appear particularly vulnerable.

Table 5.1: Raw percentages of Target Responses on the direct object clitics production task and fixed effects: Italian DG and CG

Target Responses	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculine Plural (MPL)	Feminine Plural (FPL)
DG	**74,58** (15,76)	**81,66** (16,57)	**75** (16,19)	**58,33** (36,21)	**83,33** (22,22)
CG	**95,42** (4,58)	**100** (.00)	**98,33** (5,27)	**86,67** (15,31)	**96,67** (7,02)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***	
Target (Intercept)	1.3828	0.3518	3.930	< .001	
groupCG	2.2800	0.5128	4.447	< .001	
Gender (Intercept)	1.6803	0.4231	3.972	< .001	
Group CG	2.2775	0.5122	4.447	< .001	
Gender Masculine	-0.6110	0.4736	-1.290	0.197	
Number (Intercept)	1.0112	0.4077	2.480	0.0131	
Group CG	2.2793	0.5126	4.447	< .001	
Number Singular	0.7356	0.4713	1.561	0.1185	

Figure 5.1: Accurate Performance-Target Responses of the Italian DG and CG on the Production of Direct Object Clitics



5.1.2b. Clitic Response

The raw percentages and the summary of the fixed effects can be found in Table 5.2. The statistical model turned out to be significant ($x^2(1) = 6.2385$, $p = 0.0125$), but without any further group effects, something clearly attributable to the few instances of responses that did not include a clitic.

Table 5.2: Raw percentages of Clitic responses on the direct object clitics production task and fixed effects: Italian DG and CG

Clitic Responses	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculine Plural (MPL)	Feminine Plural (FPL)
DG	**88,75** (15,96)	**88,33** (17,65)	**85** (18,34)	**91,67** (14,67)	**90** (22,5)
CG	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)
Clitic	**Estimate**	**SE**	**Z**	***p***	
(Intercept)	3.489	0.831	4.199	<.001	
groupCG	18.541	3922.6	0.005	0.996	

5.1.2c. Erroneous Responses

Table 5.3 presents the raw percentages and standard deviations of erroneous items produced by both the DG and the CG group. The model on *Omissions* did not turn out to be significant ($x^2(1) = 2.2989$, $p = 0.1295$). Similar results were obtained for *Gender Errors* ($x^2(1) = 0$, $p = 1$), for the *indirect gli*[10] ($x^2(1) = 0.3424$, $p = 0.5584$), for the *NP* ($x^2(1) = 1.3879$, $p = 0.2388$) as well as for *Other* ($x^2(1) = 0.1764$, $p = 0.6745$).

To sum up, Italian DG children were found to differ significantly on the production of direct object clitics. The errors that were attested were variable and no significant effects were revealed.

[10]This error was observed only for masculine plural items (25% of the relevant sentences). Whenever the indirect clitic was produced this was without any ditransitive verb construction (i.e. there were no instances of *gli dà un bacio* instead of *la bacia*). Thus, it was produced in full phonetic substitution of the direct *li* , i.e. *gli* annusa, instead of *li* annusa.

Table 5.3: Mean percentages of Erroneous responses on the direct object clitics production task and fixed effects-Italian DG and CG

Errors	**Omissions**	**Gender errors**	**Indirect *gli***	**NP**	**Other**
DG	**6,67** (12,29)	**6,67** (6,57)	**6,25** (7,66)	**4,17** (7,85)	**1,25** (2,01)
CG	**0** (.00)	**1,67** (2,91)	**2,5** (2,91)	**0** (.00)	**0,42** (1,32)

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Omissions (Intercept)	-3.458	1.456	-2.375	0.0175
groupCG	-17.532	12301.3	-0.001	0.9989
Gender Errors (Intercept)	-30.00	15.59	-1.924	0.0544
groupCG	20.78	24.92	0.834	0.4044
Indirect *gli* (Intercept)	-4.3581	1.6120	-2.704	0.00686
groupCG	0.6064	2.1391	0.284	0.77682
NP (Intercept)	-3.2375	0.9867	-3.281	0.00103
groupCG	-16.94	7246.45	-0.002	0.99814
Other errors (Intercept)	-3.0126	0.6476	-4.652	<.001
groupCG	0.5693	1.3560	0.420	0.675

5.2. Comprehension of Direct Object Clitics by Italian Dyslexic and Typically Developing Children

5.2.1. Accuracy Scores (Clitic Responses)

As a correct response was counted the one with the clitic. The accuracy scores on the clitic comprehension task can be found on Table 5.4 and in Figure 5.2. The model on accurate responses turned out to be significant ($x^2(1) = 4.6606$, $p = 0.03086$) and revealed additionally significant group effects. The model on gender also turned out to be significant ($x^2(1) = 4.3375$, $p = 0.03728$) and revealed a significant effect for the masculine gender. An additional model on the possible effects of number did not turn out to be significant ($x^2(1) = 0.0354$, $p = 0.8509$).

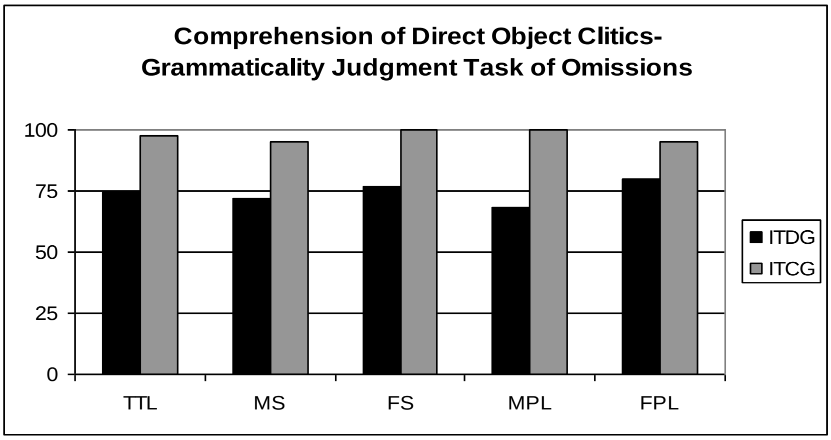
To sum up, Italian DG children were found to differ significantly from the children of the CG, and the difference was found to be additionally significant for the clitics of the masculine gender.

Table 5.4: Raw Percentages of Accuracy Scores-Clitic responses on the Direct Object Clitic Comprehension Task-Italian DD and TD children and summary of fixed effects

Accurate-clitic responses	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	**Masculine Plural (MPL)**	**Feminine Plural (FPL)**
DG	**74,17** (33,89)	**71,67** (39,32)	**76,66** (33,52)	**68,33** (40,40)	**80** (34,96)
CG	**97,07** (6,55)	**93,33** (16,01)	**100** (.00)	**100** (.00)	**95** (11,25)

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Target (Intercept)	2.4495	0.9502	2.578	0.00994
groupCG	3.3612	1.6048	2.095	0.03622
Gender/Target (Intercept)	2.9108	0.9985	2.915	0.00355
groupCG	3.4349	1.6431	2.091	0.03657
Gender-Masculine	-0.8000	0.3931	-2.035	0.04184
Number/Target (Intercept)	2.48540	0.96952	2.563	0.0104
groupCG	3.36184	1.60510	2.095	0.0362
Number-singular	-0.07074	0.37750	-0.187	0.8514

Figure 5.2: Accurate Performance on the Comprehension of Direct Object Clitics (Grammaticality Judgment Task of Omissions)-Italian DG and CG



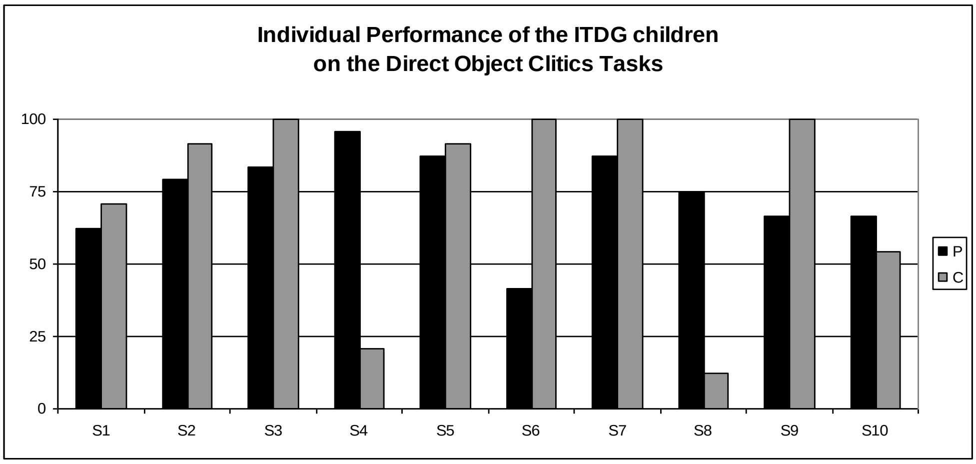
5.3. Individual Performance of the children of the Italian DG on the Direct Object Clitics tasks - comparisons between production and comprehension

5.3.1. Individual Performance

The individual performance of the children of the DG was further investigated. Individual z-scores were also calculated on the basis of the mean raw scores of the CG on each task (22,9 or 95,42% in the production task, 23,2 or 97,7% in the comprehension task). Figure 5.3 illustrates the correct performance of each child of the

DG on the production (*Target Responses*) and comprehension (*Clitic Responses*) of direct object clitics.

Figure 5.3: Individual Performance of the children of the Italian DG on the Production (P) and Comprehension (C) of Direct Object Clitics



As can be observed, the performance of the DG children is characterized by considerable variation. In the production task, only three out of ten children (S4, S5 and S7) were not found to have particular problems[11]. The performance of the remaining children was particularly low and significantly below the mean of the CG.

In the comprehension task, three different performance profiles can be identified. Six out of ten children were not found to differ significantly from the mean of the CG children, as their performance was almost/or at ceiling. However, four children (S1, S4, S8 and S10) were significantly lower than the mean of the CG[12]. These were children who selected more the omission response and children who selected almost exclusively the omission response.

To conclude, the performance of the children of the DG is characterised by particular variation and in many cases DG children do not exhibit the same profile across the two tasks.

[11] S5 and S7 z-scores were low, but still, equal to the lowest accuracy score observed in the CG (87,5%, 21/24).
[12] In the CG the lowest accuracy score in the comprehension task was 19/24 (79,1%) suggesting that selection of a maximum of five omission responses is allowed.

5.3.2. Comparisons between comprehension and production

An additional series of analyses investigating the differences between the two tasks was implemented. The analyses were conducted on the *Target* responses of the clitic production task and the accurate responses on the clitic comprehension task. We preferred including the *Target*, rather than the *Clitic* responses[13] of the production task, because the category *Clitic* in the production task is not indicative of a correct performance as it is in the case of the grammaticality judgment task, since it includes both target and non-target clitic responses.

The model comparing the two groups on the overall accurate responses turned out to be significant ($x^2(1) = 17.238$, $p<.001$) and CG children were found to perform significantly higher than DG children.

The addition of *gender* as a factor also resulted into significant differences. The model turned out to be significant ($x^2(1) = 4.1517$, $p = 0.04159$) and revealed additional significant differences for the masculine gender. This is a finding clearly attributed to the significant differences in the comprehension task. In the production task, no similar effect had been revealed. Furthermore, the model on *number* turned out to be significant, but without any additional significant differences ($x^2(1) = 4.1517$, $p = 0.04159$).

Finally, the model investigating effects of type of task did not turn out to be significant ($x^2(1) = 0.0955$, $p = 0.7572$) and consequently did not reveal any further significant effects. The summary of the fixed effects can be found in Table 5.5.

[13]However, before proceeding into the results of the multiple regression analyses, we consider reporting the results obtained by a non-parametric (Wilcoxon) test between the total percentages of non-target *Clitic* responses on the production task and the total of clitic responses on the comprehension task by the DG. The test did not turn out to be significant (Z=-0,981, *p*=0,326 two tailed).

Table 5.5: Summary of the statistical results (fixed effects) of the comparison between the Production and Comprehension of Direct Object Clitics

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Target (Intercept)	1.2890	0.3129	4.120	<.001
groupCG	2.3638	0.4850	4.874	<.001
Gender/Target (Intercept)	1.5693	0.3380	4.643	<.001
groupCG	2.3627	0.4844	4.878	<.001
Gender-Masculine	-0.5627	0.2623	-2.145	0.0320
Number/Target (Intercept)	1.1151	0.3374	3.305	<.001
groupCG	2.3635	0.4847	4.876	<.001
Number-singular	0.3453	0.2765	1.249	0.211
Production vs. Comprehension (Intercept)	1.32112	0.32964	4.008	<.001
groupCG	2.36432	0.48507	4.874	<.001
production	-0.06378	0.20411	-0.312	0.755

To sum up, the overall performance of Italian DG children was found to be equally low across the two direct object clitics tasks and the masculine gender resulted as more vulnerable.

5.3.3. Discussion - Italian data

The present tasks investigated Italian DG children's abilities to produce and comprehend direct object clitics. The results can be summarized as follows:

- In the production task, significant differences were revealed between the DG and the CG on *Target* responses, but not on the number of clitics.
- Omissions were not found as the prominent error: gender errors and phonetic substitutions of the masculine plural clitic with the indirect *gli* were observed
- Seven out of ten children exhibited significantly low performance as compared to the mean performance of the children of the CG.
- In the comprehension task, significant differences were revealed between the two groups and these differences were also found to be significant for the clitics of the masculine gender
- Four out of ten children were significantly below the mean of the control group and three different performance profiles were observed
- Despite the individual variation of the children of the DG, no significant overall differences were revealed between the production and the comprehension task.

Italian DG children were found to differ significantly from their typically developing peers on the production of direct object clitics, a finding which suggests that language production in DD can be non-age appropriate and shows the reliability of the specific grammatical structure for screening difficulties in language production (Bortolini et al. 2006; Guasti, 2012 to appear among others).

The results are in agreement with recent studies in Italian DD (Cantiani, 2011; Guasti, 2012 to appear) that reported limited production skills in many cases of dyslexic individuals and, more particularly, in the manipulation of object clitics. Moreover, the present findings are consistent with the studies by Arosio et al. (2010) and Guasti (2012 to appear) on the non-significant effects of omissions in the production of direct object clitics. Despite the fact that previous research in Italian has demonstrated high rates of omissions in obligatory contexts in pre-school SLI children aged around 5 (Bortolini et al., 2006), such pattern was not replicated in school aged children with SLI (Arosio et al., 2010). The fact however, that in our study, certain children's production was in some instances characterized by argument omissions, a pattern that was not observed in any of the CG children, should not be ignored.

The next interesting finding is the production of the indirect object clitic *"gli"* instead of the direct object clitic *"li"*. This error pattern was observed only for the masculine plural clitics (25% of the relevant items). It was produced in full phonetic substitution of the direct *li* , i.e. **gli* annusa, instead of *li* annusa. Moreover, it was found to occur almost exclusively for a specific item in which the target noun was *i conigli*:

Probe: *"Il gatto annusa i coni**gli**. Cosa fa il gatto ai coni**gli**?"*
Response*: ****gli*** *annusa*

This pattern was observed in CG children as well, and for some children this was their only error. Apparently, in this specific sentence there is a context bias, but this cannot account for the rest of the sentences in which it was produced. Another issue concerning the production of the indirect *gli* is the fact that it is homophonous with the definite article (*lo*-*gli*). As already noted, the nouns that were used in order to elicit the direct object clitics were nouns preceded by the definite articles *il* and *i*. Could it be possible that the exposure to the production of the clitics "*lo, la, le"* caused a bias towards the production of the indirect *gli* ? This possibility should not be excluded.

Furthermore, even if its production was also observed in sentences in which the following verb begun with an *s* cluster (i.e. **gli* spingono, instead of *li* spingono), this was not applied as a default (i.e. **gli* cattura, instead of *li* cattura). It appears that the production of the indirect *gli* can vary from selective to exclusive. However, the exclusive production of the indirect *gli* was found only in certain subjects of the DG, whereas in the CG only sporadic and selective production of this pattern was observed.

The next error which was investigated was the one of erroneous gender. This was an error attested both in the DG and the CG. Even if there was no difference between the number of omissions and gender errors in the DG, gender errors were observed in more children. Finally, the production of full NPs was also attested, but contrary to the findings by Arosio et al. (2010) and Guasti (2012 to appear), we did not find a significant effect for this error. In fact, none of the errors resulted into significant group effects. A further investigation of each child's production data indicates that not all children tend to produce the same errors and that apart from two subjects whose errors were restricted to omissions, the rest of the subjects produced a variety of errors.

Individual variation was also observed in the comprehension task and again, significant differences were revealed between the DG and the CG. Based on each child's individual performance, we identified three different profiles. In particular, six children performed similarly to the CG, two children tended to select more omission responses and two children selected almost exclusively the omission response.

The first profile includes six children who performed similarly to their typically developing peers, showing exclusive or almost exclusive selection of the clitic response.

The second profile is indicative of a bias towards selecting more omission responses than the children of the CG and more precisely, more than five omission responses. The statistical analyses revealed that the selection of the omission response was significantly more frequent for the masculine gender. We should note again that for the relevant sentences, only nouns that are preceded by the definite articles *il/i* were used. In this way, the clitic was not primed by its homophonous definite article in the probe sentence. This could presumably account for the selection of the omission response, since in all other cases the phonologically identical definite article was included in the probe sentence. Therefore, for the case of selection of omission responses for the masculine gender, a phonological explanation is more plausible.

The third profile with the almost exclusive selection of the omission response is indeed noteworthy and cannot be interpreted on the basis of the phonological properties of direct object clitics. This finding is rather to be attributed to deficient metalinguistic skills and is consistent with the findings by Joanisse (2004) and Cantiani (2011) who report weaknesses in meta-morphological tasks. Hence, the selection of omission responses is determined both by phonological and metalinguistic factors.

5.4. Production of Direct Object Clitics by Greek Dyslexic and Typically Developing Children

5.4.1. Classification of Responses

We obtained 216 responses from each participant group, thus the analyses were conducted on a total of 432 responses. As a *Target* response was counted the one in which a direct object clitic was produced correctly marked for gender and number. The other responses were classified as follows:

-**Clitic**: included all sentences in which clitics were produced, irrespectively of errors on gender or phonetic errors
-**Omission**: when the argument was omitted
-**NP**: for cases of production of a full NP instead of a clitic
-**Gender**: when the clitic was erroneously marked for gender
-**Phonetic error:** when phonological errors occurred *(i.e. tu instead of tus)*

5.4.2. Results

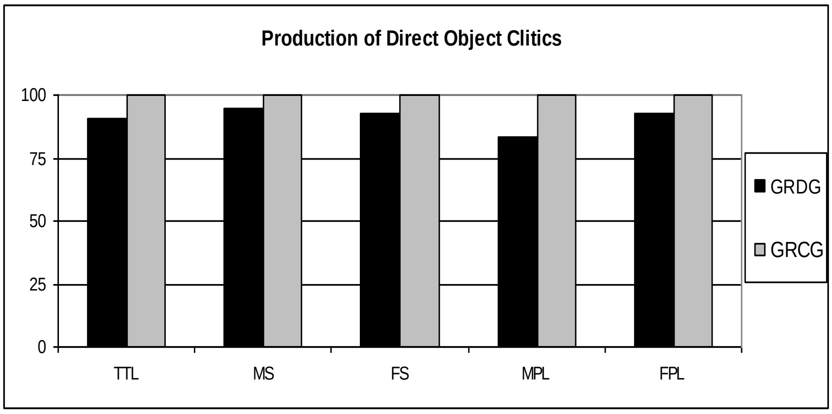
5.4.2a. Target responses

The accuracy scores of each group on *Target* and the summary of fixed effects can be found in Table 5.6 and in Figure 5.4. DG children had lower accuracy scores than the children of the CG, whose performance was ceiling. The model on *Target* responses turned out to be significant ($x^2(1) = 17{,}180$, $p<.001$), but failed to show any further significant group effects.

Table 5.6: Raw percentages of Target responses on the direct object clitics production task and fixed effects-Greek DG and CG

Target Responses	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculin e Plural (MPL)	Feminine Plural (FPL)
DG	**90,74** (8,00)	**94,44** (11,78)	**92,59** (14,7)	**83,33** (11,78)	**92,59** (8,78)
CG	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***	
Target (Intercept)	3.1060	0.4777	6.502	<.001	
groupCG	18.2835	2218.8720	0.008	0.993	

Figure 5.4: Accurate Performance-Target responses on the Direct Object Clitics Production Task-Greek DG and CG



5.4.2b. Clitic and Erroneous Responses

The next analysis concerned with the number of clitics which were produced by both participant groups. The model did not turn out to be significant ($x^2(1) = 1{,}7253$, p=0,189). The mean percentages for both groups and the summary of the statistical results can be found in Table 5.7.

Table 5.7: Raw percentages of Clitic responses on the direct object clitics production task and fixed effects: Greek DG and CG

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	**Masculine Plural (MPL)**	**Feminine Plural (FPL)**
DG -clitic	**94,44** (8,59)	**94,44** (11,78)	**92,59** (14,7)	**94,44** (11,78)	**96,3** (7,35)
CG-clitic	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***	
Target (Intercept)	6.229	1.482	4.204	<.001	
groupCG	17.733	8111.119	0.002	0.998	

To sum up, Greek DG children were not found to differ significantly from their typically developing peers neither on *Target* nor on *Clitic* responses. Despite the non-significant differences, the percentages of the DG were lower than the ones of the CG and different errors were observed. We present the mean percentages of these errors on Table 5.8.

Table 5.8: Raw percentages of Erroneous Responses on the direct object clitics production task -Greek DG and CG

Errors	**Omissions**	**Gender errors**	**Phonetic Error**	**NP**
DG	**4,16** (8,33)	**1,85** (3,02)	**1,85** (2,19)	**1,39** (4,16)
CG	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)

As Table 5.8 shows, omissions were not absent in the production of some children of the DG. Although the percentage is low, the chronological age of the children does not allow such errors. The other category of errors that we should also comment on, is the one of phonetic errors that were very rarely observed for the masculine plural clitic. In Greek, the phonological error for the masculine plural consisted of the deletion of the final –s (i.e. *tou* instead of *tous*). This reduction results into the production of the indirect masculine singular clitic. It is noteworthy that this error was observed only for the masculine plural.

Finally, sporadic errors on gender were also observed, as well as some instances of production of a full NP instead of a direct object clitic. However, these are errors that can also be observed in typically developing children and can be random. Nevertheless, this depends on the age of the children.

Since the performance of the CG was ceiling, z-scores were not calculated. Instead, we present the errors for S2, S3, S8 and S9, as in the rest of the subjects there was only one gender error and four phonetic errors on the masculine plural.

5.9: Errors produced by certain children of the Greek DG in the direct object clitics production task

Subject	CA	Number of errors	Error Type (/total errors per child)
S2	11;05	4	Omissions (4/4)
S3	9;10	5	NPs (3/5 errors), Gender (1/5), Phonetic (1/5)
S8	9;11	2	Gender (2/2)
S9	8;02	5	Omissions (5/5)

A noteworthy finding is the presence of omissions in the production of S2, even at this advanced age. Omissions were also present in the production of S9. Nonetheless, this suggests that omissions should not be ignored if they are observed in school-aged children, since they could be indicative of problems in language.

To sum up, Greek DG children were not found to differ from the children of the CG on the production of direct object clitics, but omissions were attested in the production of two children.

5.5. Comprehension of Direct Object Clitics by Greek Dyslexic and Typically Developing Children

5.5.1. Accuracy responses

A total of 216 responses from each participant group was obtained and the analyses were conducted on a total of 432 responses. The accuracy scores of each group and the summary of the fixed effects can be found in Table 5.10. As expected, the statistical model did not turn out to be significant ($x^2(1) = 0.0054$, $p = 0.9416$) since the selection of omission responses was rare.

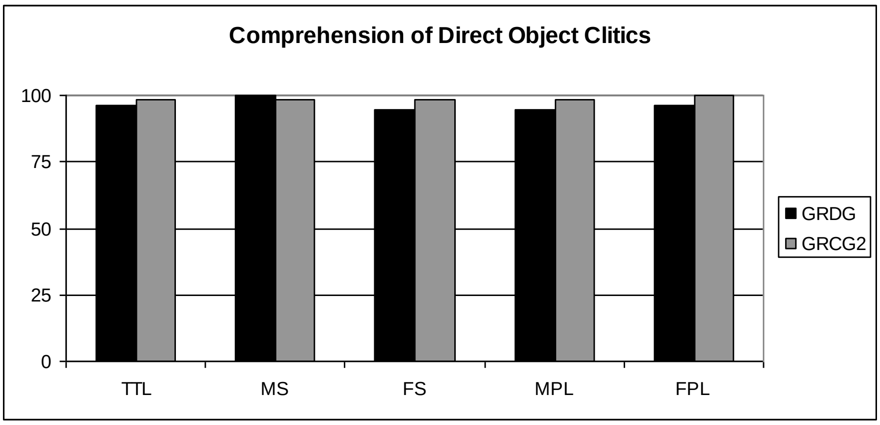
To sum up, Greek DG children were not found to have particular problems with the comprehension of direct object clitics.

Table 5.10: Raw Percentages of Clitic responses on the Direct Object Clitic Comprehension Task and fixed effects-Greek DG and CG2

Accurate responses	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculine Plural (MPL)	Feminine Plural (FPL)
DG	**96,3** (7,35)	**100** (.00)	**94,44** (11,78)	**94,44** (11,78)	**96,3** (7,35)
CG2	**98,61** (2,94)	**98,14** (5,55)	**98,14** (5,55)	**98,14** (5,55)	**100** (.00)

Fixed Effects	Estimate	SE	Z	p
Target (Intercept)	15.5099	4.7791	3.245	0.00117
groupCG	0.1872	5.4345	0.034	0.97252

Figure 5.5: Accurate Performance on the Direct Object Clitics Comprehension Task-Greek DG and CG2

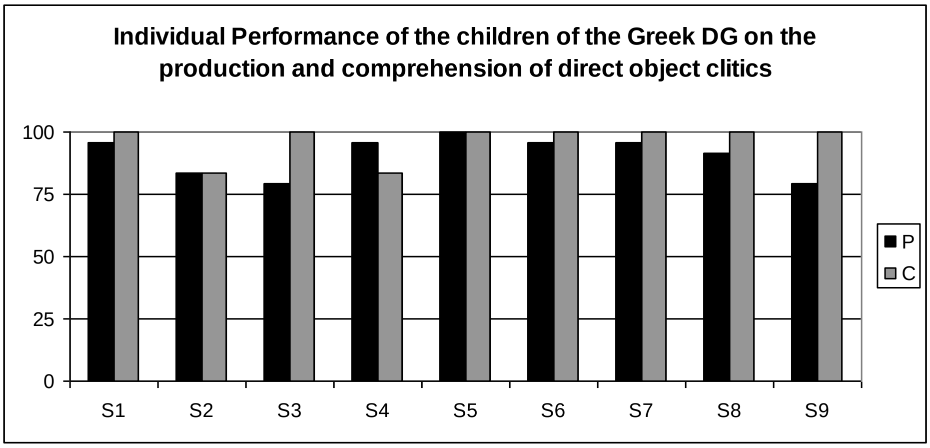


5.6. Individual Performance of the children of the Greek DG on the direct object clitics tasks –comparisons between production and comprehension

5.6.1. Individual Performance

The individual accuracy scores of the children of the Greek DG on the direct object clitics production and comprehension task is presented in Figure 5.6.

Figure 5.6: Individual Performance of the children of the Greek DG on the production (P) and comprehension (C) of direct object clitics



As can be seen, in the case of the DG there are not any noteworthy differences on the individual performance and these results contrast the ones that were observed in Italian. It is apparent that the Greek DG children do not show the same weaknesses, and no different performance profiles can be observed.

In the comprehension task, the lowest accuracy score in the Greek DG was 83,33% (S2 and S4). Even if this is not indicative of particular difficulties, the z-score of these children showed that they differed significantly from the mean of the control group. In the CG2 the maximum amount of errors was 2. Taking into consideration that in the current task the data of the DG are compared with those of younger TD children, then it appears that probably after a certain age no more than one or two errors should occur.

5.6.2. Comparison between production and comprehension

Since the control groups were different, the comparison concerned only the performance of the DG. A paired t-test between the *Target* responses on the production task and the accurate-clitic responses in the comprehension task did not turn out to be significant (t = -1,6, df = 8, p = 0,074 one-tailed), showing that there was no difference between the tasks for the Greek DG. Indeed, in the case of the Greek DG, at least for the direct object clitics, no particular variability was noticed, contrary to the Italian data. In Greek, there were some instances of errors, but between the DG and the control groups no significant differences were observed.

5.6.3. Discussion-Greek data

The results obtained by the Greek DG can be summarized as follows:

- DG children were not found to differ significantly from the CG on the production of direct object clitics, but only one DG child showed ceiling performance
- Despite the non-significant differences, omissions, gender and phonetic errors were observed.
- In the comprehension task, no significant differences between the DG and the CG2 were revealed

The children of the DG were not found to differ significantly from their typically developing peers on the production of direct object clitics. Despite the non-significant differences, there were instances of errors in the DG. The errors which were found to characterize the production of two children of the DG group, namely S2 (CA: 11;5) and S9 (CA: 8;2), were the ones of omissions. This finding should be taken seriously in consideration, since previous research has showed that Greek typically developing children do not omit clitics even at a very early age (Tsakali and Wexler, 2003). Therefore, in the current group, the omissions of direct object clitics are highly indicative of language problems.

The rest of the errors that were found, were mainly gender and phonetic errors. Phonetic errors have been reported by Smith (2008) for both singular and plural direct object clitics in Greek SLI children. In the current study, DG children produced such errors sporadically. Finally, there were very few instances of gender errors which concerned only with the plural clitics, but again this is an error that can be found occasionally even in TD children.

To sum up, contrary to the Italian DG children, Greek DG children were not found to differ significantly on the production of direct object clitics, but even the few errors that were observed, differentiated certain children. The findings suggest that the research must be replicated with DD children of younger age, since only one child of the DG showed at ceiling performance and omissions were observed even in the production of the oldest child of the group. To conclude, the results of the Greek DG show that direct object clitics are not completely intact and probably can appear vulnerable for some dyslexic children.

The DG's performance on the comprehension task of direct object clitics was not found to differ significantly from the one of younger typically developing children. If this difference were significant, then this would indicate significant limitations for the DG children. By contrast, none of the DG children showed reduced performance neither exhibited any particular difficulties with the task.

5.7. Discussion –Italian and Greek data

In the previous sections, we presented the results on the production and comprehension of direct object clitics obtained by Italian and Greek dyslexic children. The findings between the two languages appear at many points contrasting. These contrasting findings concern both the production and the comprehension task.

In the production task of direct object clitics, Italian DG children were found to differ significantly from their typically developing peers. Within the DG group, six out of nine children were found to be significantly below the mean of the CG, showing that direct object clitics in DD is vulnerable and confirming previous findings in Italian (Cantiani, 2011; Guasti, 2012 to appear) for non-age appropriate performance on language production tasks. The DG group produced a variety of errors, but none of them resulted in significant group effects. Contrary to the findings in Italian, Greek DG children were not found to differ from their typically developing peers However, even in the case of the Greek DG there were some instances of errors which differentiated DG children from the CG, but were not many enough to provide significant differences.

The difference between the two DG groups on direct object clitic production is clearly attributed to the different properties of this grammatical structure in the two languages (Tsakali and Wexler, 2003). Second, the fact that the children of the Greek DG were older can also account for these findings.

As far as the errors are concerned, omissions were not found to result in significant group effects in any of the two groups. This finding certainly has a developmental explanation and is in agreement with recent studies in Italian (Guasti, 2012, to appear) and Greek (Stavrakaki and van der Lely, 2010). The fact, however, that in both DG groups omissions were found to occur, must not be ignored, since this error was not observed at any instance in the control groups and it clearly differentiated some DG children.

The next error which was common in both languages, was the one of phonetic errors for the masculine plural, which were found more for the Italian DG. In Italian, this error consisted of the substitution of the direct object clitic *li* with the indirect object clitic *gli*, whereas in Greek there were some rare instances of deletion of the final –s of the direct object clitic *tus*. Moreover, in Italian, this error was also observed in the CG, whereas in Greek it was only observed in the DG. However, there is a possibility that this error could occur for other clitics except from the masculine plural. In Italian this error was an exclusive phonetic substitution (without ditransitive verb constructions), and it is possible that it can generalize to the feminine plural clitic, but more as a gender error (*li*-*gli*-le). In Greek, phonetic errors for the feminine plural clitic would involve again the deletion of the final –s of the clitic.

Hence, it appears that clitic production in the present groups of DD reveals deviant profiles and the additional detailed analysis of errors can predict other possible patterns for differentiating DD children. We observed that the attested errors in many cases reflect the impact of phonological deficits in these children's production. Moreover, in some cases, only these errors, even if limited or unique, could be probably enough to differentiate a dyslexic child.

As far as the comprehension of direct object clitics is concerned, again, there were discrepant findings between the two languages. In Italian, significant differences were revealed between the DG and the CG. DG children showed different performance profiles according to the selection of omission responses. One of these different profiles was the one of the almost exclusive selection of the omission response. The results in Italian revealed both phonological and metalinguistic limitations in the comprehension of direct object clitics. Contrary to these findings, in Greek, we compared the DG children's data with the ones of younger typically developing children and still, no significant differences were revealed.

The variability that was observed in the Italian DG group was not found in the Greek DG group. In the Greek DG group, only two children exhibited more omission responses, that is, only four items. Apparently, a part of these differences is attributable to the different acquisition properties of the direct object clitics between the two languages. Can the current findings on comprehension be interpreted only according to this difference? Certainly, direct object clitics are more difficult for Italian DG children according to existing findings (Cantiani, 2011; Guasti, 2012 to appear), but the cases in which almost exclusive selection of the omission response was observed, are clearly attributed to deficient meta-linguistic skills. This has also been reported by Cantiani (2011) who reports deficits in the formation of non-existing nouns and verbs in Italian children with DD. Therefore, for the current results of Italian and Greek dyslexic and typically developing children, certainly, the major differences can be explained in terms of the different acquisition properties between the two languages, but these specific profiles must be taken into consideration, since these deficits have not been found to occur only when direct object clitics are investigated.

To recapitulate, the results on production and comprehension of direct object clitics showed that this grammatical structure can be vulnerable in children with DD, but the major difficulties reported in the current tasks concern mainly with Italian. In Greek, the research should be replicated, since the limited but characteristic errors suggest that in younger dyslexic children additional errors could be found.

Chapter 6: Production and comprehension of Indirect Object Clitics by Italian and Greek children with Developmental Dyslexia

6.1. Production of Indirect Object Clitics by Italian Dyslexic and Typically Developing Children

6.1.1. Classification of Responses

The analyses were conducted on a total of 240 responses (120 by each participant group). As a *Target* response was counted the one in which an indirect clitic was produced marked correctly for gender (*gli* was counted as correct for both masculine and feminine and *le* only for the feminine). An additional demand for a *Target* response was that the sentences had to be complete and include the direct object as well, in the form of an NP or alternatively, of a direct clitic (clitic cluster).

Other responses were classified as follows:

-**Clitic**: included all sentences in which clitics were produced, correct and erroneous, irrespectively of phonetic or gender errors

-**Omission of the indirect clitic**: when the indirect clitic was omitted

-**Omission of direct object**: when the direct object was omitted

-**Phonetic**: included instances of phonological simplification of the indirect clitic (i.e. *li* instead of *gli*)

-**Other**: responses that could not be classified among the aforementioned ones

6.1.2. Results

6.1.2a. Target responses

The accuracy scores can be found in Table 6.1. As can be observed, DG children produced fewer *Target* responses comparing to their typically developing peers. In this case, however, contrary to the findings on direct object clitics, no particular difference is observed between the masculine and feminine clitic. The statistical analyses verified these observations.

The model turned out to be significant ($x^2(1) = 9.625$, $p = 0.001919$) and revealed a significant effect of group for *Target* structures. CG children were found to produce significantly more *Target* responses than the DG children. The next analysis on *Target* responses investigated the possible effects of gender. As expected, the model did not turn out to be significant ($x^2(1) = 0.4176$, $p = 0.5182$) and did not reveal any significant effects.

Table 6.1: Raw percentages of Target responses on the Indirect Object Clitics Production Task and fixed effects-Italian DG and CG

Indirect Object Clitics Accuracy	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	
DG -target	**77,5** (21,17)	**76,66** (26,29)	**78,33** (20,86)	
CG-target	**96,67** (5,82)	**95** (8,05)	**98,33** (5,27)	
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Target (Intercept)	1.4763	0.3918	3.768	0.000165
groupCG	2.2978	0.7665	2.998	0.002718
Gender (Intercept)	1.6216	0.4569	3.549	< .001
Group CG	2.3037	0.7682	2.999	0.002709
Gender Masculine	-0.2789	0.4340	-0.643	0.520433

To sum up, Italian DG children were found to produce significantly less *Target* responses than their typically developing peers and gender did not result as a significant factor for Target responses.

6.1.2b. Clitic Responses

The next analysis was conducted on the number of the clitics which were produced. The mean percentages and the summary of the fixed effects can be found in Table 6.2. The statistical analysis corroborated these observations ($x^2(1) = 0.5312$, $p = 0.4661$).

Table 6.2: Raw percentages of Clitic responses and summary of fixed effects on the Indirect Object Clitic Production Task-Italian DG and CG

Clitic Responses	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	
DG -clitic	**96,67** (5,82)	**96,67** (7,02)	**96,67** (7,02)	
CG-clitic	**99,16** (2,63)	**100** (.00)	**98,33** (5,27)	
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
(Intercept)	4.667	0.965	4.836	<.001
groupCG	1.080	1.791	0.603	0.546

To sum up, similarly to the direct object clitic production task, DG children were found to differ significantly from their typically developing peers on *Target* responses, but did not differ on the amount of clitics which they produced.

6.1.2c. Erroneous responses

Table 6.3 illustrates the raw percentages and standard deviations of erroneous responses obtained by both groups as well as the summary of the statistical results.

Table 6.3: Raw percentages of Erroneous responses on the Indirect Object Clitic Production Task and fixed effects-Italian DG and CG

Group	Indirect clitic Omission	Direct Object Omission	Phonetic Errors	Other
DG	**3,33** (5,82)	**4,17** (13,17)	**11,66** (17,21)	**2,5** (4,02)
CG	**0,83** (2,63)	**0** (.00)	**0** (.00)	**1,66** (3,51)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Omissions				
(Intercept)	-2.120	0.611	-3.470	0.00052
groupCG	1.022	1.306	0.782	0.43422
Phonetic Errors				
(Intercept)	0.1155	2.0985	0.055	0.956
Group CG	-17.5663	3078.5983	-0.006	0.995

As it can be observed in Table 6.3, the highest error percentage for the DG was the one of phonetic errors, namely, the phonological simplification of *gli* to *li*, which was not observed in the CG at any instance. Another error which was observed in the DG and involved the erroneous production of only one child, was the omission of the direct object (i.e. **gli dà*) resulting in an incomplete sentence. Probably, this reflects a difficulty in producing clitic clusters, since a difficulty in producing the indirect clitic per se would result or in an indirect clitic omission or in the production of a PP (i.e. *dà i fiori alla gallina).*

The common errors which were observed in the DG and the CG were the omissions of the indirect clitic, which were rare for both groups. The rare production of gender errors on the masculine clitic (*le* instead of *gli*) was also attested and were included in the category *Other*.

Since the number of items and the errors were limited, the statistical analysis on group effects of errors concerned the omissions of indirect object clitics and the phonetic errors. The first model on the omission of indirect clitics did not turn out to be significant ($x^2(1) = 0.5466$, $p = 0.4597$) neither showed any significant group effects. Similar findings were obtained for the phonetic errors, as the model did not turn out to be significant ($x^2(1) = 2.1904$, $p = 0.1389$), neither showed any significant group effects.

6.2. Comprehension of indirect object clitics by Italian Dyslexic and Typically Developing Children

6.2.1. Accuracy Scores

We obtained 240 responses, 120 by each participant group. The accuracy scores (raw percentages and standard deviations) for each group can be found in Table 6.4. As Table 6.4 shows, there is no noteworthy difference between the DG and the CG on the indirect clitics comprehension task and this was further corroborated by the statistical result. The model turned out to be significant ($x^2(1) = 5,613$, $p = 0.01783$), but did not show any significant group effects. This was something to be expected, since there were very few errors in the DG.

Table 6.4: Raw percentages of Accurate responses on the Indirect Object Clitics Comprehension Task-Italian DG and CG

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	
DG -target	**96,67** (4,3)	**96,67** (7,02)	**96,67** (7,02)	
CG-target	**100** (.00)	**100** (.00)	**100** (.00)	
Accuracy	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.3673	0.5086	6.621	<.001
GroupTD	18.1988	4399.7414	0.004	0.997

6.2.2. Erroneous responses

The percentages and standard deviations of erroneous responses are presented in Table 6.5. As can be observed, the only error which was attested in the DG was the one of the reversed thematic roles. Since there were very few instances of these errors (4 erroneous items), no statistical analysis was conducted.

Nonetheless, it appears that DG children do not exhibit any particular difficulties with the comprehension of indirect object clitics.

Table 6.5: Raw percentages of Erroneous responses on the Indirect Object Clitics Comprehension Task-Italian DG and CG

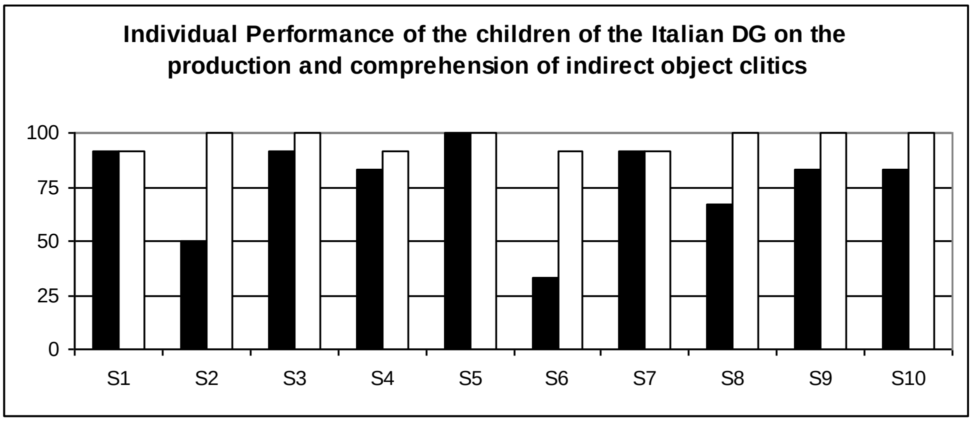
Group	**Reversed thematic roles**	**Indirect clitic omission**	**Incomprehension of the probe sentence**
DG	**3,33** (4,3)	**0** (.00)	**0** (.00)
CG	**0** (.00)	**0** (.00)	**0** (.00)

6.3. Individual performance of the children of the Italian DG on the indirect object clitics tasks-comparison between production and comprehension

6.3.1. Individual Performance

The individual performance of the children of the DG on the production and comprehension of indirect object clitics can be observed in Figure 6.1.

Figure 6.1: Individual Performance of the children of the Italian DG on the Production (P) and comprehension (C) of indirect object clitics



In the production task, only one child of the DG obtained ceiling performance. The performance of the DG children was characterized by particular variation. Six out of ten children of the DG were found to be significantly below the mean of the CG that was almost excellent (mean accuracy score 11,6 out of 12 or 99,16%). The z-scores indicated that S2, S6 and S8, S9 and S10 were significantly below the mean of the CG and different errors were observed. The systematic error of S6 was the omission of the direct object. On the other hand, S2, S6, S8, S9 and S10 produced phonetic errors (*li* instead of *gli*). Omissions were very rare and also substitution of the masculine clitic with the feminine indirect clitic *le* was observed.

In the CG there was only one instance of omission of the indirect clitic and the rest of the errors consisted of the substitution of the masculine clitic with the feminine indirect clitic *le*. The lowest raw accuracy score in the CG was 10/12, that is, 83,33%, indicating that probably only a limited number of errors is allowed.

Nonetheless, these findings concern only with the singular number. Since we did not include the plural number we cannot provide further evidence for possible differences between the DG and the CG, at least on the number of correct responses. The differentiating error patterns, however, that were observed only in the DG were the phonetic simplifications and the omission of the direct object.

In the comprehension task, DG children did not exhibit particular difficulties. In the current task, apart from the erroneous response on the reversed thematic roles that was rarely observed, we had the opportunity to investigate the omission of the indirect clitic. There was no single instance of selection of this type of response, something which demonstrates adequate comprehension abilities and shows no qualitative differences from the control group, since in the CG there were very rare instances of self correction after the selection of the reversed thematic role response. Moreover, there was no instance of selection of the third type of syntactic distracter which taps cases of incomprehension of the stimulus sentence.

DG children showed almost intact comprehension abilities on the indirect object clitics comprehension task, a finding which contrasts their performance on the indirect object clitic production task and was further corroborated by the statistical analysis.

6.3.2. Comparisons between comprehension and production

We compared the *Target* responses on the indirect clitics production task with the *Accurate* responses on the indirect object clitics comprehension task. The first model turned out to be significant ($x^2(1) = 12.320$, p=0.0004482), showing significant differences on *Target* responses between the two groups. However, since no significant differences were revealed for the comprehension task, this difference is clearly attributable to the production task. As expected, the model on the type of task turned out to be significant ($x^2(1) = 27.890$, $p < .001$) and revealed a significant effect of group and a significant effect of task type, showing that production is significantly lower than comprehension for the DG. The summary of the statistical results can be found in Table 6.6.

Table 6.6: Summary of the statistical analysis-fixed effects on Target Responses between the Indirect Clitic Production and Comprehension Task

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Target Responses				
(Intercept)	2.0832	0.3012	6.917	<.001
groupCG	2.2184	0.6628	3.347	<.001
Task				
(Intercept)	3.7748	0.5999	6.292	<.001
Group CG	2.3685	0.7039	3.365	<.001
TaskPROD	-2.3887	0.5754	-4.151	<.001

To recapitulate, DG children were found to have significantly lower performance in the production of indirect object clitics as compared to comprehension, a pattern which was not detected in the CG.

6.3.3. Discussion-Italian data

The current tasks concerned with the investigation of indirect object clitic production and comprehension in Italian dyslexic and typically developing children. The main findings can be summarized as follows:

- DG children were found to produce significantly less *Target* responses than their typically developing peers
- The errors which were observed were various and not standard across subjects

- Omissions were not found to elicit significant group effects and were sporadically observed in both groups, similarly to sporadic gender errors for the masculine indirect clitic
- The errors which were observed only in the DG were the phonetic simplification of the indirect clitic (*li* instead of *gli*) and the omission of the direct object which was noticed exclusively in one subject of the DG
- No significant differences were revealed in the comprehension task
- Significant differences were revealed between production and comprehension

DG children were found to differ significantly from their typically developing peers in the production of *Target* responses on the indirect object clitics tasks. However, just like in the case of direct object clitics, they were not found to produce fewer clitics than their typically developing peers. This was further demonstrated by the absence of production of PPs as well as from the very limited instances of omissions.

The dominant error found in the DG was the one of phonetic simplifications of the indirect clitic which resulted in the production of *li*, a form homophonous to the direct object clitic. This was an error which was not observed in the CG and despite the fact that no group effects were found, it actually differentiated the production of some subjects of the DG. In the direct object clitics production task, certain children overgeneralized the indirect clitic: they were using the indirect *gli* instead of the direct *li*. However, only two subjects exhibited phonetic errors in both tasks (S3 and S9). Thus, it appears that these substitutions are not standard and can occur randomly. In addition, this implies that clitics are generally vulnerable for DG children and that these findings should be further investigated.

Another noteworthy issue is the performance of S6, who (in the indirect object clitics task) repeatedly omitted the direct object. As we already discussed, this could reflect more a difficulty in producing clitic clusters; if this child were not able to form sentences including an indirect clitic, then a PP would have been produced instead. However, we considered referring to this finding since even if our DG is small, still we can identify different profiles that can differentiate DG from CG children.

Finally, we consider discussing another issue in comparison with the direct object clitics production task. Even if in the current task significant differences were revealed, the performance of most DG children was better than on the direct object clitics task. First, this could be attributed to the difference on the participial agreement between the direct and indirect clitics. Evidence for this asymmetry comes from a study on typical language acquisition in Italian (Caprin and Guasti, 2009). Although dative clitics emerge at a later stage, they are omitted less systematically than accusative clitics. Moreover, if we take into consideration the findings of the present study, the role of clitic gender should be probably reconsidered. Gender errors were found more frequently for the direct object clitics than for the indirect. This was to be expected, since for the indirect object clitics, *gli* can be used for both masculine and feminine, something which is not the case for the direct ones. Nonetheless, further investigation is needed, but this possibility should be considered as well.

Furthermore, DG children were not found to differ from their typically developing peers in the comprehension of indirect object clitics, contrary to the findings on production and in addition, contrary to the findings on the comprehension of direct object clitics. However, this last observation could be probably attributed to the difference between the two comprehension tasks. We cannot know what results we would have obtained if we had designed a similar task for the indirect clitics as well.

To recapitulate, DG children were found to differ significantly from their typically developing peers on the production of indirect object clitics, whereas comprehension was found to be relatively intact. Further investigation is needed on comprehension, including different experimental designs and of course, the plural number which was not included in the present experiment.

6.4. Production of Indirect Object Clitics by Greek Dyslexic and Typically Developing Children

6.4.1. Classification of Responses

We obtained 216 responses from both groups. We counted as a *Target* response the one in which an indirect clitic was produced marked correctly for gender and number in sentences that were complete and included the direct object as well, in the form of an NP or alternatively of a direct clitic (clitic cluster). In the case of Greek, however, in which gender distinction is strict for the indirect clitic, gender errors were included in a distinct category.

Other responses were classified as follows:

-**Clitic**: included all sentences in which clitics were produced, irrespectively of errors on gender or case (i.e. direct)

-**Omission**: when the indirect clitic was omitted

-PP: when a prepositional phrase was produced (*i.e. petai ti bala stin ajelada* -throws the ball to the cow)

-**Gender error:** when the indirect clitic was erroneously marked for gender

-**Other**: responses that could not be classified among the aforementioned ones (i.e. omission of direct object, production of a genitive possessive clitic).

6.4.2. Results

6.4.2a. Target Responses

The accuracy scores on *Target* responses and the summary of fixed effects (Table 6.7) show a sharp difference between the overall performance of DG and the CG on *Target* responses. In the case of the DG there is also a small difference between the masculine and the feminine indirect clitic. The statistical model on *Target* responses turned out to be significant ($x^2(1) = 4.1978$, $p = 0.04048$) and revealed additional significant effects of group. DG children were found to produce significantly less *Target* structures than their typically developing peers.

The next analysis concerned with the possible effects of gender on *Target* responses. The model did not turn out to be significant (x^2 $(1) = 1.6564$, $p = 0.1981$) neither revealed any significant effects.

Table 6.7: Raw percentages of Target responses on the Indirect Object Clitic Production Task and fixed effects-Greek DG and CG

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	
DG -target	**70,37** (35,13)	**74,07** (31,30)	**66,67** (41,66)	
CG-target	**97,22** (4,16)	**98,14** (5,55)	**96,3** (7,35)	
Target Responses	**Estimate**	**SE**	**Z**	***p***
Target (Intercept)	4.998	1.204	4.151	<.001
groupCG	-3.090	1.485	-2.081	0.0375
(Intercept)	4.7026	1.2230	3.845	0.000121
Group CG	-3.1174	1.4966	-2.083	0.037248
Gender Masculine	0.6830	0.5347	1.277	0.201458

6.4.2b. Clitic Responses

The percentages of clitics which were produced can be found in Table 6.8.

Table 6.8: Raw percentages of Clitic Responses on the Indirect Object Clitic Production Task and fixed effects--Greek DG and CG children

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	
DG -clitic	**80,55** (30,33)	**79,62** (27,36)	**81,5** (34,8)	
CG-clitic	**100** (.00)	**100** (.00)	**100** (.00)	
Clitic Responses	**Estimate**	**SE**	**Z**	***p***
Clitic (Intercept)	21.33	4122.33	0.005	0.996
groupCG	-18.44	4122.33	-0.004	0.996

The model turned out to be significant (x^2 (1) = 6,0502 p = 0.0139) but failed to reveal any significant group effects. To sum up, Greek DG children, were found to differ significantly on the production of *Target* responses but did not differ on the number of clitics that they produced.

6.4.2c. Erroneous responses

The percentages of erroneous responses of the DG and the CG can be found in Table 6.9.

Table 6.9: Raw percentages of Erroneous responses on the Indirect Object Clitic Production Task and fixed effects-Greek DG and CG children

Erroneous responses	**Indirect clitic Omission**	**PP**	**Gender errors**	**Other**
DG	**12,03** (30,07)	**1,85** (5,55)	**3,7** (8,44)	**9,25** (15,27)
CG	**0** (.00)	**0** (.00)	**2,77** (4,16)	**0** (.00)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Indirect Clitic				
(Intercept)	-17.43	3520.64	-0.005	0.996
groupCG	17.52	3520.64	0.005	0.996
Other				
(Intercept)	17.98	9162.69	-0.002	0.998
Group CG	16.32	9162.69	0.002	0.999

The statistical analysis was conducted for the categories of the *Indirect Clitic Omission* and *Other,* since the number of the rest of the errors was limited. The model on *Indirect Clitic Omission* did not turn out to be significant (x^2 (1) = 3.3131, p = 0.06873). Similar results were obtained for the category *Other* (x^2 (1) = 0.5296, p = 0.4668).

6.5. Comprehension of indirect object clitics by Greek Dyslexic and Typically developing children

6.5.1. Accuracy Scores

The accuracy scores for both groups are presented in Table 6.10. The model on *Accurate* responses did not turn out to be significant (x^2 (1) = 1.4444, p = 0.2294) neither revealed any significant differences.

Table 6.10: Raw percentages of Accurate responses on the Indirect Object Clitics Comprehension Task and fixed effects-Greek DG and CG2

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**	
DG -target	**92,6** (5,00)	**92,6** (8,78)	**92,6** (8,78)	
CG2-target	**96,3** (6,05)	**100** (.00)	**92,6** (12,11)	
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.3046	0.5271	6.270	<.001
groupCG	-0.7360	0.6392	-1.151	0.250

6.5.2. Erroneous Responses

The mean percentages and standard deviations of the erroneous responses are presented in Table 6.11 for the DG and CG2. As Table 6.11 illustrates, the dominant error in the DG was the one of reversed thematic roles, whereas there was only one instance in each group of selection of the indirect clitic omission response. Finally, there was no instance of selection of the third syntactic distracter that would have implied incomprehension of the probe sentence. However, again we should note that even if no significant differences were revealed on Target structures, erroneous responses should be taken into consideration since the current comparison is between the DG and the younger CG.

Table 6.11: Raw percentages of erroneous responses on the Indirect Object Clitics Comprehension Task- Greek DG and CG2

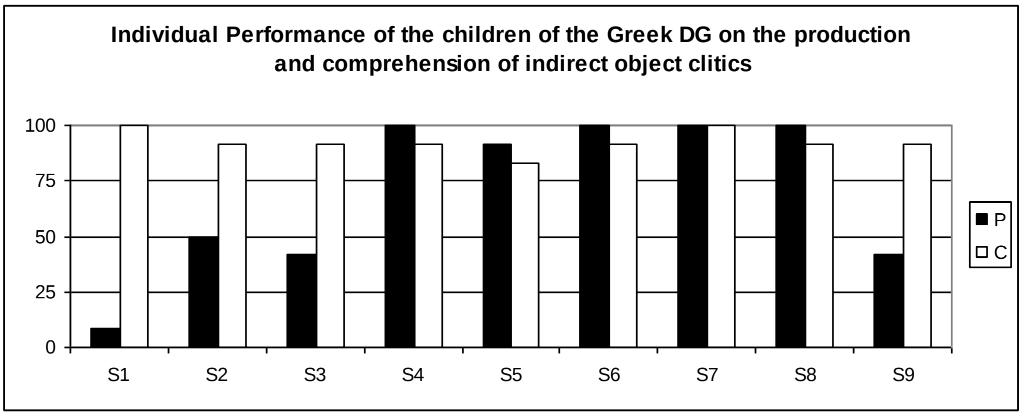
Group	**Reversed thematic roles**	**Indirect clitic omission**	**Incomprehension of the probe sentence**
DG	**6,5** (5,55)	**0,92** (2,77)	**0** (.00)
CG2	**2,77** (4,16)	**0,92** (2,77)	**0** (.00)

6.5.3. Individual performance of the children of the Greek DG on the indirect object clitics tasks -comparison between production and comprehension

6.5.3.1. Individual Performance

The individual performance of the children of the Greek DG on the production and comprehension of indirect object clitics is presented in Figure 6.2:

Figure 6.2: Individual Performance of the Greek DG children on the Production (P) and Comprehension (C) of indirect object clitics



It is apparent that just like in the case of the Italian data, the performance of the DG is variable across the tasks. In the production task, S1, S2, S3 and S9 appear to have particular difficulties with the production of *Target* structures and their z-scores were significantly below the mean of the CG.

S1's production was exclusively characterized by omissions of the indirect clitic, a profile which appears rather deficient with respect to the chronological age of the child. S2's production on the other hand was characterized by omissions and gender errors especially for the feminine singular clitic. S3's production was characterized by a variety of errors, including the production of a PP, as well as the production of the indirect object clitic and the PP (**tis dhini ena mpouketo stin kota- her*-gen.obj.clit. *gives a bouquet to the hen*). Finally, S9's production was characterized by omissions of the indirect clitic as well as omissions of the direct object.

Therefore, four out of nine children were found to be significantly lower than the mean of the CG. The mean accurate performance of the CG on *Target* structures was 11,67 out of 12 (97,22) and errors were rarely observed. Again, this performance concerned only with the singular clitics. The errors that were observed in the CG were only gender errors.

In the comprehension task, only one subject (S5) was found to be significantly below the mean of the CG (11,556 or 96,3). The maximum amount of errors in the CG was 2. Furthermore, if we consider the fact that the CG2 was composed by younger children, then the probably more than one errors are not allowed after a certain age, something that was also observed in the Italian DG.

6.5.3.2. Comparison between production and comprehension

A non-parametric test (Wilcoxon) test between production and comprehension did not turn out to be significant ($Z=-1,227$, $p=0,260$ two tailed).

Even if no significant differences were revealed, not all DG children were successful were successful in the production task, and probably if plural number had been included the results would have been different. Nonethelees, this is something that remains to be investigated.

6.5.3.3. Discussion-Greek data

Through the present tasks, we investigated Greek dyslexic children's abilities to produce and comprehend indirect object clitics, something that in Greek has been investigated in children with SLI (Smith, 2008). The findings can be summarized as follows:

- DG children were found to perform significantly lower on the production of *Target* responses than their typically developing peers
- Even though omissions were not found to elicit significant group effects, they were observed exclusively in the DG
- The errors which were observed in the DG were various, but the only common error between the DG and the CG was the one of gender.
- No significant differences were found in the comprehension task, but errors were attested.

Dyslexic children were found to produce significantly fewer *Target* structures than the CG, but were not found to produce significantly fewer clitics. The different errors did not result in any significant group effects. Even if the dominant error was the one of omissions, this was found exclusively in one child (S1) and was observed sporadically in the rest of the subjects. Other errors occurred as well, such as the PP and various other errors that were included in the category *Other*.

Even if the DG was composed by nine subjects, the errors were variable and distinguished qualitatively the children of the DG. The quality and the amount of errors show that there can be DG children who lag significantly behind their typically developing peers on indirect object clitics production. We already noted the production of the indirect clitic with the PP, which is ungrammatical in Greek. Even if these instances were rare, they differentiate DG from CG children. Therefore, it appears that if such errors are revealed, they definitely indicate particular difficulties. Finally, the omission of the direct object was also observed, as in Italian, and, most probably, it reveals a difficulty in the formation of clitic clusters. Alternatively, it can reveal difficulties with the formation of complex sentences, taking into consideration the additional demands of ditransitive verbs.

The results on production are in agreement with the study of Smith (2008), both on the overall correct performance between the clinical group and the control group, as well as on the lower performance on the indirect object clitics than on the direct clitics. However, with respect to the quality of the errors, there are considerable differences between the two studies, which are certainly to be attributed to the age difference between the subjects, as well as to the difference between the experimental tasks. Despite the differences, the present findings confirm these difficulties.

In the comprehension task, only one child of the dyslexic group exhibited significantly lower performance as compared to the mean of the CG group. Interestingly, ceiling performance was obtained only by two DG children and contrary to the Italian DG no significant difference was revealed between the production and the comprehension task.

Contrary to the findings on direct object clitics, where the errors were non-age appropriate, but sporadic, in the indirect object clitics task some participants showed failure in producing relevant structures. Some instances of errors occurred also in the comprehension task, but there was a clear discrepancy between production and comprehension, mainly for the subjects who showed reduced performance on the production task. Even if the accuracy scores in the comprehension task were higher, the performance of certain DG was not intact.

To sum up, the investigation of production of indirect object clitics appears more promising than the investigation of direct object clitics, at least after a certain age, for screening difficulties in language. Moreover, the investigation of the plural indirect clitic could provide additional evidence, both for production and for comprehension.

6.6. Discussion – Italian and Greek data

The specific section focuses on the discussion of the findings in the two languages, the common and different patterns which were revealed, the limitations as well as the further implications that derive from the present study.

I shall first discuss the findings in the production task, since significant differences between the children of the DG groups and their typically developing peers were revealed in both languages. DG children in both Italian and Greek were found to differ significantly from their typically developing peers on the production of indirect object clitics. Moreover, in both languages despite the significant differences on *Target* structures, DG children were not found to produce significantly less clitics than their typically developing peers.

This last finding can be interpreted further by the quality of errors. In the Italian DG, omissions were very rare. Moreover, the dominant error that was found was the phonetic simplification of the indirect clitic *gli*-*li*, clearly attributable to difficulties in phonology. In Greek, on the other hand, such errors were not attested, but these errors would be more likely to occur in the case of the plural form of the indirect clitic (Smith, 2008) that was not included in the present experiment. Contrary to Italian, in Greek, the highest percentage of errors was the one of omissions, without however significant effects. Omissions in Greek were observed exclusively as an error in the production of one child (S1) and were optional for the rest of the subjects who demonstrated weaknesses. This difference between the two languages could be presumably attributed to the fact that in Italian, *gli* can be used equally for masculine and feminine gender and therefore, gender does not influence the production of indirect clitics to the same extent. In Greek, on the other hand, at least for the singular number, there is a strict distinction between masculine and feminine as well as the additional demand of genitive case.

Although we cannot attribute with certainty the omissions found in the Greek DG group, the contribution of gender should be taken into consideration.

On the other hand, what must be primarily considered, exclusively for Greek, is the genitive case of the clitic. Genitive case is the last to be acquired (Stephany, 1997) and Smith's research (2008) showed that omissions of the indirect clitic characterize the production of typically developing children contrary to the absence of omissions in direct object clitics. Therefore, both gender and case should be considered for the specific errors errors in Greek.

As far as the rest of the errors are concerned, I shall first discuss the common ones between the two languages. A common error that was found in the production of two children (one in each DG group) was the one of the omission of the direct object. This was the case of S6 of the Italian DG and of S9 of the Greek DG. This error is most likely to occur due to difficulties in the formation of clitic clusters that are commonly used in both languages. If this is the case, then these limitations are clearly attributed to their deficient phonological skills (Snowling, 2000). Alternatively, it could also reflect a difficulty in the formation of complex sentences, despite the sufficient training that was provided. The specific error was not found in any instance in the control groups, and probably should be considered as indicative of difficulties. This finding is in line with a previous study in DD (Altmann et al., 2008) that has demonstrated deficits in the formation of complex sentences.

Another common error that was found between the two DG groups, was the one of gender. In the case of Italian this consisted of the production of *le* for the masculine singular. In Italian, as already noted, gender errors cannot occur for the feminine singular, since in everyday language *gli* is used equally for both genders. Gender errors were common in the Italian DG and CG, therefore, this error pattern is to be expected even in typically developing children. In Greek, all gender errors for the DG were observed in the case of the feminine clitic (*tou* instead of *tis*) and occurred even in the oldest children of the group. Again, this error was rarely observed in the CG. Therefore, for these specific errors, quantitative differences are more likely to be noted between DD and TD children.

Finally, I shall refer to the errors which were not common between the two DG groups. The only other error that was observed in the Italian DG was only one instance of production of the feminine singular direct clitic (*la* instead of the indirect clitic). No other errors were observed in the Italian DG.

In Greek, however, there were other errors as well. First, it was the production of the PP, which could be classified as an equivalent to an NP response for the direct object clitics production. That is, it not a grammatically inappropriate response, but a pragmatically inappropriate response. Other inappropriate responses for the Greek DG included the production of the indirect clitic with a PP (i.e. *_**tis**_ *dinei ena mpouketo louloudja* _**stin**_ *kota*), the production of a genitive possessive clitic instead of an indirect clitic (i.e. *dhini mia bala* _**tou**_) or the production of an NP in genitive case (*i.e. pigheni to faghito tou lagou).*

The first error, with the indirect clitic and the PP is ungrammatical and clearly reflects an inadequate representation of the syntactic role of the indirect clitic. Probably this could also reflect a certain influence by the probe sentence in which the PP is in which the PP is also included in the probe no similar errors were attested. Therefore, the problem is specific to the indirect clitics. These errors (even if limited) must be taken into consideration, since they are indicative of a deviant linguistic profile. Even if in the present group of Italian DG children we did not find such an error, the equivalent error in Italian would be the following: *i.e. *gli porta il cibo al coniglio*, without an intermediate pause.

The rest of the errors, namely the one with the genitive NP and the one with the genitive possessive clitic, are not ungrammatical, but cannot be accepted either, since the preverbal indirect clitic has not been produced. A correct sentence for this instance would be the following: *tou dinhei mia bala tou* – him CLITgen. gives a ball of his.-he gives him his ball. Again, problems in more complex structures are reflected.

The last error, however, with the genitive NP is somehow unclear. First, it can be considered as a correct sentence that includes a ditransitive verb with a direct (*to faghito)* and an indirect object (*tou laghou)*, but cannot be classified as a target response. Second, the genitive NP could indicate possession and could mean *of the rabbit*, but again an indirect clitic is needed. The third possibility reflects a difficulty in producing structures with clitic doubling and therefore in that case, the preverbal indirect clitic has been omitted. Hence, it is difficult to provide a clear explanation about this sentence. Nonetheless, if we combine this error with the one of the indirect clitic with the PP, this leads more to interpreting it as a difficulty with clitic doubling, since these errors were produced by the same child (S3).

Finally, another instance of an error occurred, namely of a lexical substitution of the verb *dini (gives)* with the verb *dichni (shows)* that was noticed in the case of S2.

Although the clitic was produced correctly, we considered not accepting this response as correct, since the verb had already been primed twice in the probe sentence and question and the child is of an advanced age.

To sum up, the detailed presentation of the errors in the production of indirect object clitics for the DG in both languages, showed that DG children can produce a variety of errors. Even if the number of errors were limited, they should not be ignored as they were not found to occur in the control groups. Despite the fact that in most cases the errors between the languages were different, it appears that there are DG children who can have particular difficulties with the production of indirect object clitics.

As far as comprehension is concerned, in both languages no significant differences were found between the DG and the CG. The task examined additional erroneous responses, as the ones of reversed thematic roles, the omission of the indirect clitic and finally the incomprehension of the probe sentence. Despite the non-significant differences, there were instances of errors for the DG in both languages. These errors concerned exclusively with the selection of the reversed thematic roles, apart from one case in the Greek DG, the one of a selection of an omission response. The findings on the comprehension task are in agreement with the recent study of Stavrakaki and van der Lely (2010) on the comprehension of direct object clitics in Greek SLI, as far as the error patterns are concerned and with Talli's (2010) study on the comprehension of direct object clitics in Greek children with DD. However, even if there are similarities with these studies, the crucial difference is that in the present study we did not find any significant group differences. The reason for this, at least as far as the Greek data are concerned, could be the difference in the probe sentence. In particular, the probe sentences of the current task, the target noun was primed (i.e. In this story there is a ***fox***, and the hen is throwing **herCLIT** the eggs) something which was not the case in the aforementioned studies (*i.e.* the elephant **himCLIT** is pushing). Consequently, since a recent study in DD (Talli, 2010) reports difficulties in the comprehension of direct object clitics on a sentence-picture matching task and considering the significant difficulties in the production of indirect object clitics, we can probably assume that we would have found more apparent difficulties if our probe sentences were different and of course if we had included items of the plural number. After all, errors were detected even in the current task, but again, the groups are composed by few subjects and more data are needed in order to generalize our findings, at least as far as comprehension is concerned. Nonetheless, the current data indicate that even comprehension skills are not completely intact since not all subject achieved at ceiling scores.

The comparison between comprehension and production did not reveal significant differences in the case of the Greek DG, something apparently attributable the fact that not all DG children showed limited production skills. In Italian, significant differences were revealed between production and comprehension. The results suggest that the production task appears more promising for revealing difficulties with indirect object clitics, at least in DG children.

To sum up, in both languages, the production of indirect object clitics was found to be problematic for certain children of the DD groups. In Greek, indirect object clitics were found to be weaker than direct ones, clearly attributed to the later acquisition of the genitive case. In Italian, despite the significant differences in production, omissions were rare. In both languages instances of particular errors reflected difficulties with more complex clitic structures, suggesting further investigation of the various grammatical phenomena. Nonetheless, DD children's overall performance suggests non-age appropriate profiles and the need for additional testing as far as diagnostic purposes are concerned. The comprehension of indirect clitics should be further investigated with additional and different experimental designs, since the current study showed minimal but not significant differences.

6.7. Conclusions

The findings of the current study on direct and indirect object clitics production and comprehension in Italian and Greek DD, are in agreement with previous studies in Italian and Greek SLI (Arosio et al., 2010; Guasti, 2012 to appear; Smith, 2008; Stavrakaki and Van der Lely, 2010), studies in Italian and Greek DD (Cantiani, 2011; Guasti, 2011; Talli, 2010), as well as other crosslinguistic studies in DD (Altmann et al., 2008; Jimènez et al., 2004; Joanisse, 2004; Rispens, 2004, Waltzman and Cairns, 2000, among others) that report limitations in phonological, metamorphological, morphosyntactic skills and syntactic skills.

Chapter 7: Production and comprehension of definite articles by Italian and Greek Children with Developmental Dyslexia

7.1. Production of Definite Articles by Italian Dyslexic and Typically Developing children

7.1.1. Classification of responses

A total of 960 responses was obtained by both groups (480 by each participant group). As a *Target* response was counted the one in which a definite article was produced correctly marked for gender and number. The rest of the responses were classified as follows:

-**Indefinite Article**: when an indefinite article was produced instead of the definite (these were grammatical responses)

-**Article**: when an article was produced (definite or indefinite) and irrespectively of phonological or substitution errors (i.e. *lo* instead of *il*, *i* instead of *il*)

-**Omission**: when the article was omitted

-**Phonological Error**: when there was a phonological error

-**Other**: responses that could not be classified among the aforementioned ones

7.1.2. Results

7.1.2a. Target responses

The raw percentages and standard deviations of *Target* responses for the DG and the CG are presented in Table 7.1 and Figure 7.1. As can be observed, the performance of the DG appears comparable to the one of the CG, except from the masculine singular article. Indeed, for this category there were cases of omissions and phonological errors. Moreover, it appears that the specific article influences the overall performance of the DG. The DG group's performance appears reduced as compared to the one of the CG, but generally, not deficient.

Indeed, the statistical analyses which were conducted verified these observations. The model for *Target* responses resulted significant ($x^2(1) = 7.679$, $p = 0.005587$) and revealed a significant group effect, showing that the children of the CG produce significantly more target structures than the DG children. The subsequent analysis focused on the investigation of *gender*. The model turned out to be significant ($x^2(1) = 9.9239$, $p = 0.001631$) and revealed significant group effects for the articles of masculine gender.

The last analysis on *Target* structures concerned with the investigation of *number* and the model showed a significant effect for the singular number ($x^2(1) = 5.3486$, $p = 0.02074$). The last analysis concerned the possible effects of the NP position (subject vs. object), but the model did not turn out to be significant ($x^2(1) = 0.0216$, $p = 0.8831$) and did not reveal any additional significant effects.

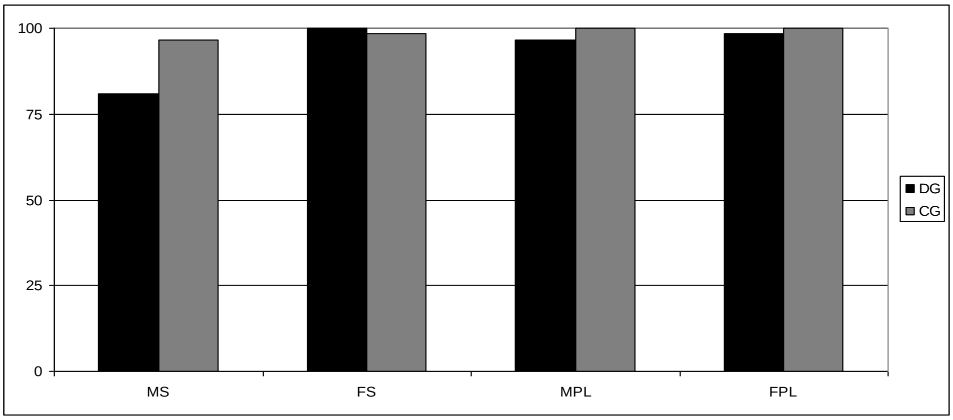
To sum up, Italian DG children were found to produce significantly less *Target* responses on the production of definite articles and this difference was found to have additional significant group effects for the masculine singular definite article.

Table 7.1: Raw percentages on Target responses on the Definite Article Production Task and fixed effects-Italian DG and CG

Target Responses	**Total**	**Masculine Singular**		**Feminine Singular**		**Masculine Plural**		**Feminine Plural**	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
DG	**93,95** (5,68)	**78,33** (5,58)	**83,33** (22,2)	**100** (.00)	**100** (.00)	**96,67** (7,02)	**96,67** (7,02)	**96,67** (7,02)	**100** (.00)
CG	**98,75** (1,76)	**95** (8,05)	**98,33** (5,27)	**98,33** (5,27)	**98,33** (5,27)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)

	Estimate	**SE**	**Z**	***p***
Target				
(Intercept)	4.4432	0.5291	8.398	< .001
groupCG	1.9774	0.7350	2.690	0.00714
(Intercept)	5.6039	0.8304	6.748	< .001
Group CG	1.9867	0.7310	2.718	0.00657
Gender Masc.	-2.3557	0.8550	-2.755	0.00587
(Intercept)	5.2015	0.7319	7.107	< .001
Group CG	1.9757	0.7304	2.705	0.00683
Number Sing.	-1.7240	0.7782	-2.216	0.02672

Figure 7.1: Target responses (collapsed percentages) on the Definite Article Production Task-Italian DG and CG



7.1.2b. Article

The following table (Table 7.2) illustrates the raw percentages (collapsed percentages of subject and object DPs) of articles which were produced for the DG and the CG.

Table 7.2: Raw percentages of Article responses on the Definite Article Production Task and fixed effects- Italian DG and CG

Group	**Total**	**Masculine Singular**	**Feminine Singular**	**Masculine Plural**	**Feminine Plural**
DG	**96,46** (4,39)	**87,5** (14,3)	**100** (.00)	**98,33** (3,51)	**100** (.00)
CG	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)
Article	**Estimate**	**SE**	**Z**		***p***
(Intercept)	11.561	2.584	4.474		< .001
groupCG	18.261	2865.397	0.006		0.995

The next analysis concerned with the number of articles which were produced. The model turned out to be significant ($x^2(1) = 9.5909$, $p = 0.001955$) but did not reveal any significant group effects.

Thus, similarly to the findings on direct object clitics, DD children were found to produce significantly fewer *Target* responses, but they were not found to produce significantly fewer articles than their typically developing peers.

7.1.2c. Indefinite Articles

As can be seen in Table 7.3, the production of indefinite articles was rather limited and no statistical tests were computed.

Table 7.3: mean percentages of indefinite articles

Indefinite Articles	DG	CG
(/total items)	**0,83** (1,45)	**0,46** (138)

7.1.2d. Erroneous Responses

Table 7.4 illustrates the mean percentages of erroneous responses for the DG. As can be seen, there were instances of omissions which occurred mostly for the masculine singular article (10,83% of the masculine singular items) and for the specific article also phonological errors occurred (3,35% of the masculine singular items). The error analysis was conducted only on omissions, as the other errors were very limited. The model turned out to be significant ($x^2(1) = 5{,}5731$, $p = 0{,}01824$) but did not reveal any significant group effects.

Table 7.4: Mean percentages of Erroneous responses on the Production of Definite articles and fixed effects-Italian DG and CG children

Errors	Omissions	Phonological Errors	Other	
DG	**3,12** (4,07)	**0,833** (1,45)	**1,25** (1,45)	
CG	**0** (.00)	**0** (.00)	**0** (.00)	
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Omissions				
(Intercept)	-0.7934	0.9949	-0.797	0.425
Group	-18.6352	3605.7866	-0.005	0.996

7.2. Comprehension of Definite Articles - Grammaticality Judgment Task of Omissions -Italian Dyslexic and Typically Developing Children

7.2.1. Classification of responses

The analyses were conducted on a total of 960 responses for both groups (480 for each participant group). As a *Target* response was counted the one in which an appropriate correction with a definite article was provided, marked correctly for gender and number. The rest of the responses were classified as follows:

-Omission of article: when the sentence in which the definite article was omitted was judged as correct

-Other NP: when the child was correcting the already correct DP of the sentence (i.e. **-***La capra guarda **foche,** response: ***No, la capra***).

-Inappropriate or no correction: when the provided correction was not acceptable or when the child did not proceed into correcting the sentence.

7.2.2 Results

7.2.2a. Target responses

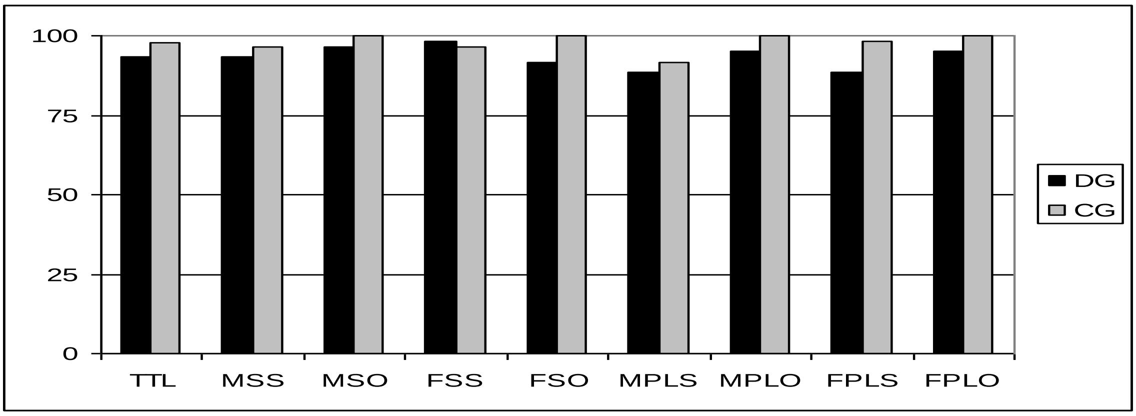
The raw percentages on Target responses are presented in Table 7.5.

Table 7.5: Raw percentages of Target responses on the Comprehension Task of Omissions of Definite Articles

Group	**Total**	**Masculine Singular**		**Feminine Singular**		**Masculine Plural**		**Feminine Plural**	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
DG -target	**93,33** (10,29)	**93,332** (11,65)	**96,66** (10,54)	**98,33** (5,27)	**91,67** (11,78)	**88,33** (17,65)	**95** (11,25)	**88,33** (20,86)	**95** (11,25)
CG-target	**97,913** (2,6)	**96,67** (10,54)	**100** (.00)	**96,67** (7,02)	**100** (.00)	**91,67** (8,78)	**100** (.00)	**98,33** (5,27)	**100** (.00)

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.5766	0.4765	7.506	<.001
groupCG	1.0693	0.7169	1.491	0.136

Figure 7.2: Target Responses on the Comprehension Task of Omissions of Definite Articles Definite Articles-Italian DG and CG children



As can be seen in Table 7.5, DG children do not appear to have noticeable differences on target structures as compared to their typically developing peers. When some differences occur, these are mostly caused by individual variability and due to the decreased performance of specific subjects. Indeed, the statistical tests verified these predictions. The model did not turn out to be significant ($x^2(1) = 2.1787$, $p = 0.1399$) and consequently did not show any significant group effects.

Overall, DG children were not found to differ significantly from their typically developing peers on *Target* responses.

7.2.2b. Erroneous responses

The mean percentages of erroneous responses on the Comprehension Task of Omissions of Definite Articles are presented in Table 7.6.

Table 7.6: Mean percentages of Erroneous responses on the comprehension task of omissions of definite articles-Italian DG and CG

Group	**Omissions**	**Other NP**	**Inappropriate or no correction**
DG	**3,74** (8,43)	**0,625** (1,00594)	**2,08** (2,04)
CG	**1,87** (2,67)	**0** (.00)	**0,2** (0,65)

As it appears in Table 7.6, DG children had a limited amount of erroneous items. However, we should refer to the last two error patterns. The first, labelled as "*Other NP*", was not found among the CG. These were very rare errors found in the DG and consisted of the correction of the already correct DP. This error pattern is more likely to be attributed to limited attention, upon unsuccessful recall of the sentence. The last error, labelled as "*Inappropriate Correction*" was also found among the CG, but the corrections were qualitatively different. In particular, in the CG there were only two inappropriate corrections concerning the noun "*calciatori*", which was corrected as *"*il calciatori"* instead of *"i calciatori".* This was also found in the DG along with a similar inappropriate correction for the noun "*cani*". Both of these nouns in the singular number end in –e *(calciatore-i, cane-i),* resulting in minimal differences when combined with the masculine article. Therefore, for this category of nouns such corrections can be found even in typically developing children. By contrast, in the DG such inappropriate corrections were found also for nouns which end in –o (i.e. *"*il cigni"*, instead of *"i cigni"*), something which was not noticed in the CG and clearly indicates a qualitative difference. In addition there were very rare instances of repetition of the sentence with the omission misplaced at the correct DP (i.e. probe sentence: **Drago tira la tigre*, response: *No, il drago tira tigre*), also something which was not noticed in the CG.

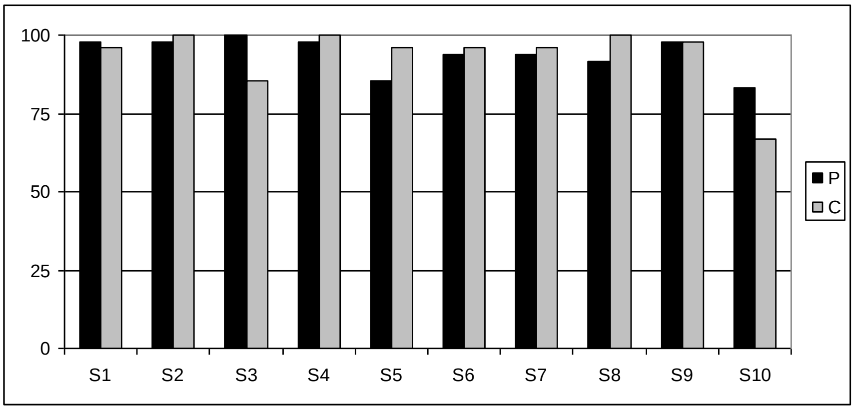
Thus, it appears that despite the fact that no significant differences were found on the overall performance of the two groups, within the DG there were few but characteristic errors which were not found in the CG, and this finding should be additionally investigated.

7.3. Individual Performance of the children of the Italian DG on the production of definite articles and on the grammaticality judgment task of omissions – comparisons between production and comprehension

7.3.1. Individual Performance

The individual accuracy scores of the children of the DG can be found in Figure 7.3.

Figure 7.3: Individual performance (%) of the children of the Italian DG on Target responses on the Production (P) and Comprehension (C) of definite articles



As can be seen clearly in Figure 7.3 not all DG children showed the same performance. The z-scores of the individual performance of the DG children on *Target* responses on the definite articles production task were calculated. Five children (S5, S6, S7, S8 and S10) were significantly lower than the mean of the CG (Mean raw on accuracy = 47,4, lowest raw score on accuracy for the CG was 46/48). Again, for these children the errors concerned mostly the masculine singular definite article and some instances of production of indefinite articles instead of definite ones.

In the comprehension task, the z-scores revealed that only two children (S3 and S10) were significantly below the mean of the CG (Mean raw on accuracy=47, lowest raw score on accuracy was 44/48).

To sum up, in the production task the errors on the masculine singular article can be indicative of difficulties even in school aged children who are characterized by more serious deficits in phonology. In the comprehension task, the errors are diverse and consist of both acceptance of the omission as well as of inappropriate corrections.

7.3.2. Comparisons between the production and comprehension

The items of the two tasks were not the same, contrary to the tasks of object clitics. Thus, the statistical analyses that were implemented were limited into t-tests, separately for each group.

The first analysis was conducted between the percentages on *Target* responses. No significant difference was found neither for the DG (t = 0,225, df = 9, p=0,827 two-tailed) nor for the CG (t = 0,841, df = 9, p = 0,422 two-tailed).

The next analyses concerned each definite article separately. For this purpose, the percentages of subject and object NPs were collapsed separately for each group. For the DG, the test revealed a significant difference for the masculine singular article ($t = 3{,}157$, $df = 9$, $p = 0{,}012$ two-tailed) and a marginally significant difference for the feminine singular article ($t = -2{,}250$, $df = 9$, $p = 0{,}051$ two-tailed). For the rest of the articles no significant differences were found ($p = 0{,}279$ two-tailed for the masculine plural and $p = 2{,}223$ for the feminine plural).

For the CG a significant difference was found for the masculine plural article ($t = -3$, $df = 9$, $p = 0{,}015$ two-tailed). No more comparisons were realized for the CG, as the differences between the percentages were minimal.

To sum up, DG children were significantly better in the comprehension task of articles for the masculine singular definite article, a difference which is probably attributable to deficits in phonological fluency in the production task.

7.3.3. Discussion-Italian data

In the previous sections, we presented the data obtained by the children of the Italian DG on the production of definite articles and the grammaticality task of omissions of definite articles. The results can be summarized as follows:

- DG children were found to differ significantly on the production of definite articles and these differences were found to be significant for the masculine singular article.
- In the omissions task, DG children were not found to differ significantly from their typically developing peers, but within-group variation was observed
- Contrary to the production task, the masculine singular article did not appear particularly vulnerable
- Certain erroneous corrections provided by children of the DG differed qualitatively from the ones provided by CG children

In the production task, DG children were found to differ significantly from their typically developing peers on *Target* responses (definite articles) and significant effects of group were revealed. However, further analyses showed that the reduced overall performance of the DG resulted by significant effects on the masculine singular article. Indeed, DG children obtained the lowest scores for this specific category. The errors that were attested for the specific article consisted of omissions and phonological reductions. The difficulties that the children of the DG exhibited are clearly attributed to their deficient phonological skills. Furthermore, since the specific article has been found to be particularly problematic in previous researches in SLI in Italian (Leonard et al. 1992, Bottari et al. 1998 among others) it is probable that it could constitute a reliable marker for such difficulties even in school aged children. At this point, it should be noted that errors for the specific article are expected to occur more for polysyllabic nouns and nouns which begin with the liquid consonant *r* with respect to the phonological complexity that these combinations bare.

To sum up, Italian DG children's performance on the production of definite articles can be comparable to the one of their typically developing peers, except from the masculine singular article. The results are in agreement with the phonological deficit theory of DD (Vellutino, 1979; Snowling, 2000), since the performance of the DG was found to be controlled by particular structures which are subject to phonological restrictions.

On the other hand, in the comprehension task, DG children were asked to detect and correct erroneous sentences which included omissions of definite articles. The statistical analysis did not reveal any significant differences on Target responses between the DG and the CG. Moreover, no particular difficulties were observed for the masculine singular article, by contrast to the production task, as it was further revealed by the statistical results which showed significantly better performance on the comprehension task for the specific article. One possible explanation for this finding could be the use of different nouns in the comprehension task but the lexical feedback provided by the probe sentence should also be considered, since in the production task limitations in lexical retrieval could have inhibited some children's responses.

Moreover, the errors that were observed in the comprehension task, although limited in number, in certain cases were not observed in the CG and this could pinpoint to a bias for qualitative differences. However, additional investigation is needed in order to be able to conclude about this finding with certainty.

As far as the individual variability is concerned, in the production task the reduced performance was mostly due to the difficulties in the masculine singular article for half of the children of the DG group, whereas in the comprehension task only two children were found to be significantly lower than the mean of the CG group. Moreover, one of these children's performance was found to be particularly different even when compared to the rest of the children of the DG and this is an issue that shall be discussed further.

7.4. Production and Comprehension of Definite Articles by Greek Dyslexic and Typically Developing Children

7.4.1. Classification of Responses

A total of 864 responses was obtained, 432 by each group. We counted as a *Target* response the one in which a definite article was produced correctly marked for gender and number. The rest of the responses were classified as follows:

-**Indefinite Article**: when an indefinite article was produced instead of the definite (these were grammatical responses)

-**Article**: when an article was produced (definite or indefinite) and irrespectively of phonological errors (i.e. *to* instead of *ton*)

-**Omission**: when the article was omitted

-**Phonological Error**: when there was a phonological error

-**Other**: responses that could not be classified among the aforementioned ones

7.4.2. Results

7.4.2a. Target responses

The raw percentages and standard deviations on *Target* responses for the DG and the CG are presented in Table 7.9. As can be observed in Table 7.9, in the case of the DG, the lowest score was obtained in the feminine plural accusative article. For this category the most common error was the one of phonetic errors and there was not even one instance of omission.

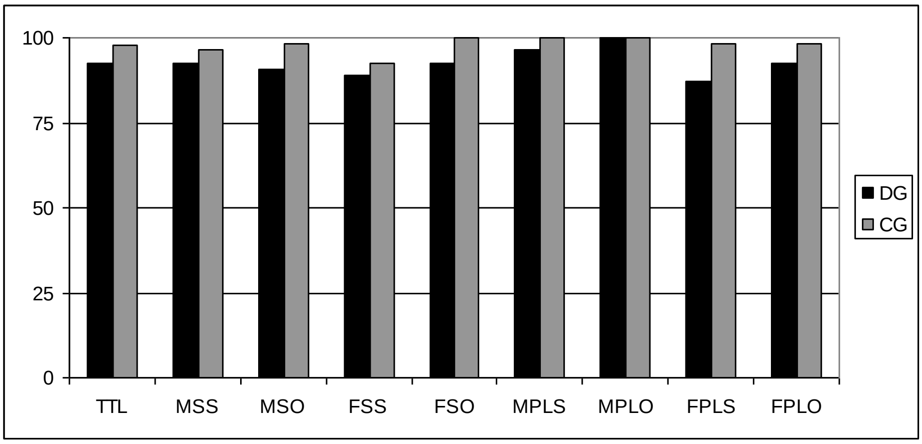
The first model on *Target* responses turned out to be significant ($x^2(1) = 9.7184$, $p = 0.001824$) and revealed an additional significant difference between the two groups. The addition of gender as a factor for *Target* responses did not result as significant ($x^2(1) = 3.0894$, $p = 0.0788$). Same results were obtained with the addition of number as a factor for *Target* responses ($x^2(1) = 2.0968$, $p = 0.1476$).

The last analysis on *Target* responses, concerned with the investigation of case and whether this could influence DG children's production. Again, the model did not turn out to be significant ($x^2(1) = 2.2478$, $p = 0.1338$) and consequently did not reveal any further significant effects.

Table 7.9: Raw percentages on Target responses on the Definite Article Production Task and fixed effects-Greek DG and CG

Target	**Total**	**Masculine Singular**		**Feminine Singular**		**Masculine Plural**		**Feminine Plural**	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
DG	**92,6** (4,18)	**92,6** (8,78)	**90,73** (12,11)	**88,88** (11,88)	**92,6** (8,78)	**96,3** (7,35)	**100** (.00)	**87,03** (13,89)	**92,6** (8,78)
CG	**97,91** (2,32)	**96,3** (7,35)	**98,15** (5,55)	**92,6** (12,11)	**100** (.00)	**100** (.00)	**100** (.00)	**98,15** (5,55)	**98,15** (5,55)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***					
Target									
(Intercept)	3.0175	0.2858	10.557	< .001					
groupCG	1.3990	0.4554	3.072	< .001					
(Intercept)	2.5946	0.3350	7.745	< .001					
Group CG	1.4004	0.4541	3.084	0.00204					
Gender	0.8263	0.4772	1.731	0.08337					
(Intercept)	3.3766	0.4043	8.351	< .001					
Group CG	1.4012	0.4551	3.079	0.00208					
Number	-0.6882	0.4866	-1.414	0.15729					
(Intercept)	3.3994	0.4076	8.341	< .001					
Group CG	1.4021	0.4554	3.079	0.00208					
NP	-0.1146	0.7940	-0.144	0.8852					

Figure 7.4: Accuracy scores on Target responses on the Definite Article Production Task-Greek DG and CG



7.4.2b. Article

The next analysis was conducted on the number of articles which where produced, irrespectively of errors. The model failed to show any significant groups effects, albeit its significance ($x^2(1) = 14.566$, $p = 0.0001354$).

To sum up, DG children were found to produce significantly less *Target* responses than the CG, but did not differ significantly from their typically developing peers on the number of articles that they produced.

Table 7.10: Raw percentages on Article responses on the Definite Articles Production Task

Group	Total	Masculine Singular	Feminine Singular	Masculine Plural	Feminine Plural
DG-Article	**96,29** (3,25)	**97,22** (4,16)	**97,22** (4,16)	**98,15** (3,67)	**92,6** (7,73)
CG-Article	**99,53** (.92)	**99,07** (2,77)	**100** (.00)	**100** (.00)	**99,07** (2,77)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***	
(Intercept)	3.6620	0.3497	10.473	<.001	
groupCG	18.3077	2697	0.007	0.995	

7.4.2c. Indefinite Articles

The mean percentages of indefinite articles are presented in Table 7.11, for both groups. As can be observed, the production of indefinite articles was rather limited and therefore the model did not result as significant ($x^2(1) = 0.0987$, $p = 0.7534$).

Table 7.11: Mean percentages of indefinite articles

Indefinite Articles	DG	CG
(/total items)	**1,62** (3,41)	**1,15** (1,83)
(/singular number items)	**3,24** (6,83)	**2,31** (3,67)

7.4.2.d. Erroneous Responses

Table 7.12 illustrates the mean percentages of erroneous responses for the DG and the CG. The first error analysis was conducted on omissions. The model turned out to be significant ($x^2(1) = 5.612$, $p = 0.01784$), but did not reveal any further significant group effects. The next model on phonological errors did not result as significant ($x^2(1) = 0.0761$, $p = 0.7827$) and similarly failed to show any significant group effects. Finally, the model on *Other*, resulted as significant ($x^2(1) = 9.0448$, $p = 0.002634$) but again, failed to show significant group effects. The statistical analyses on errors, as we observe from the percentages in Table 7.12, was not expected to indicate any significant group differences, due to the limited number of errors.

Table 7.12: Mean percentages of Erroneous responses on the Production of Definite Articles

Group	**Omissions**	**Phonological Errors**	**Other**	
DG	**2,31** (2,64)	**1,62** (1,73)	**1,16** (2,77)	
CG	**0** (.00)	**0** (.00)	**1,04** (1,11)	
Errors	**Estimate**	**SE**	**Z**	***p***
Omissions				
(Intercept)	-0.6203	0.6907	-0.898	0.369
Group	-18.1867	4059.7947	-0.004	0.996
Phonological errors				
(Intercept)	-30.00	45.98	-0.652	0.514
Group	-17.10	1327463.64	0.000	1.000
Other				
(Intercept)	-15.386	7.631	-2.016	0.0438
Group	14.329	10.532	1.360	0.1737

7.5. Comprehension of Definite Articles - Grammaticality Judgment Task of Omissions- Greek Dyslexic and Typically Developing Children

7.5.1. Results

As a *Target* response was counted the one in which a correction with a definite article correctly marked for gender and number. The classification of erroneous responses was the same as in Italian, since no different responses were observed. The analyses concerned a total of 864 items for both groups (432 items by each participant group).

7.5.1a. Target Responses

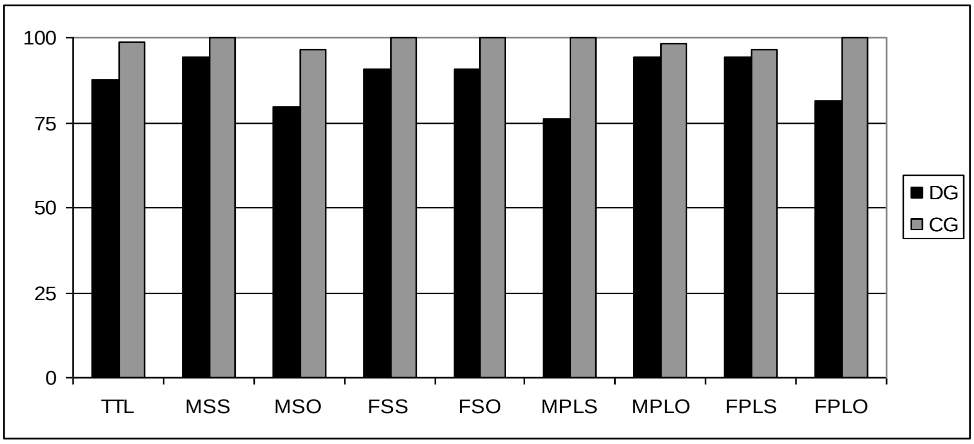
The raw percentages on *Target* responses for each participant group are presented in Table 7.13 and Figure 7.5. As can be observed, the lowest scores were obtained for the MSO, MPLS and FPLO and the overall performance of the DG is lower than the one of the CG. The statistical analyses on *Target* responses corroborated partially these observations. The model on *Target* responses turned out to be significant ($x^2(1) = 11.033$, $p < .001$) with additional significant group effects, showing that the DG performs significantly lower than the CG. The next analysis on gender did not result as significant ($x^2(1) = 0.1711$, $p = 0.6791$), neither revealed any significant group effects. The next model on number did not turn out to be significant ($x^2(1) = 2.3698$, $p = 0.1237$). Finally, the last model on case (nominative vs. accusative) did not turn out to be significant ($x^2(1) = 0.019$, $p = 0.8905$) and did not reveal any significant effects.

To sum up, DG children were found to perform significantly lower on Target responses, but for this significant difference the roles of gender, number and case were not found to be significant, indicating no particular pattern among the DG children.

Table 7.13: Raw percentages of Target responses on the Comprehension Task of Omissions of Definite Articles and fixed effects-Greek DG and CG

Group	**Total**	**Masculine Singular**		**Feminine Singular**		**Masculine Plural**		**Feminine Plural**	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
DG	**87,03** (11,66)	**94,44** (11,8)	**81,48** (17,56)	**90,74** (12,1)	**90,74** (12,1)	**75,92** (40,06)	**94,44** (11,8)	**87,03** (27,36)	**81,48** (21,15)
CG	**98,84** (2,33)	**100** (.00)	**96,3** (11,11)	**100** (.00)	**100** (.00)	**100** (.00)	**98,15** (5,56)	**96,3** (11,11)	**100** (.00)
Fixed Effects	**Estimate**	**SE**	**Z**	***p***					
Target **(Intercept)** **groupCG**	 2.3762 2.8668	 0.4573 0.8578	 5.197 3.342	 < .001 < .001					
(Intercept) **Group CG** **Gender**	2.4382 2.8672 -0.1243	0.4831 0.8577 0.3001	5.047 3.343 -0.414	< .001 < .001 0.67862					
(Intercept) **Group CG** **Number**	2.1489 2.8712 0.4585	0.4736 0.8569 0.2978	4.537 3.351 1.540	< .001 < .001 0.12364					
(Intercept) **Group CG** **NP**	2.35551 2.86700 0.04132	0.48064 0.85785 0.30035	4.901 3.342 0.138	< .001 < .001 0.890571					

Figure 7.5: Target Responses on the Comprehension Task of Omissions of Definite Articles –Greek DG and CG



7.5.1b. Erroneous responses

The mean percentages of erroneous responses on the Comprehension Task of Definite Articles are presented in Table 7.14.

Table 7.14: Mean percentages of erroneous responses on the comprehension task of definite articles

Group	Omissions	Other NP	Inappropriate or no correction	
DG	**7,17** (8,97)	**0,92** (1,51)	**4,62** (4,51)	
CG	**0,69** (1,47)	**0** (.00)	**0,46** (1,38)	
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Omissions	0.4800 1.0123	0.9965 2.4956	0.482 0.406	0.630 0.685
Inappropriate correction	-3.975 -4.931	1.906 4.670	-2.085 -1.056	0.037 0.291

As can be observed, there is a difference between the DG and the CG on the acceptance of omissions as correct and on inappropriate corrections. The first model concerned with omissions. The model did not turn out to be significant ($x^2(1) = 0.1589$, $p = 0.6902$) and did not reveal any significant group effects. Despite this fact, however, we can observe that were more instances of acceptance of omissions in the DG, with most of these cases in the MPLS (24,07% of the MPLS items), FPLS (12,96% of the FPLS items) and FPLO (7,4% of the FPLO items).

The next investigation concerned with the instances of inappropriate corrections. Again, the model was not significant ($x^2(1) = 2.8243$, $p = 0.09285$) and did not reveal any significant differences. However, we should note that most cases of non-target corrections involved the MSO (16,66%of the MSO items), FSO (9,25% of the FSO items), FPLO (5,55% of the FPLO items).

To recapitulate, contrary to the Italian DG, Greek DG children were found to differ significantly on *Target* responses on the comprehension of omissions of definite articles. The errors that were observed higher in the DG were the ones of acceptance of the omission as correct and the one of non-target corrections. None of the errors, however, resulted in significant group effects.

7.6. Individual Performance of the children of the Greek DG on the production of definite articles and the grammaticality task of omissions of definite articles- comparison between production and comprehension

7.6.1. Individual Performance

The individual data on the production and comprehension of omissions of definite articles of the children of the Greek DG are presented in Figure 7.6:

Figure 7.6: Individual Performance of the children of the Greek DG on the Production (P) and comprehension (C) of Definite Articles

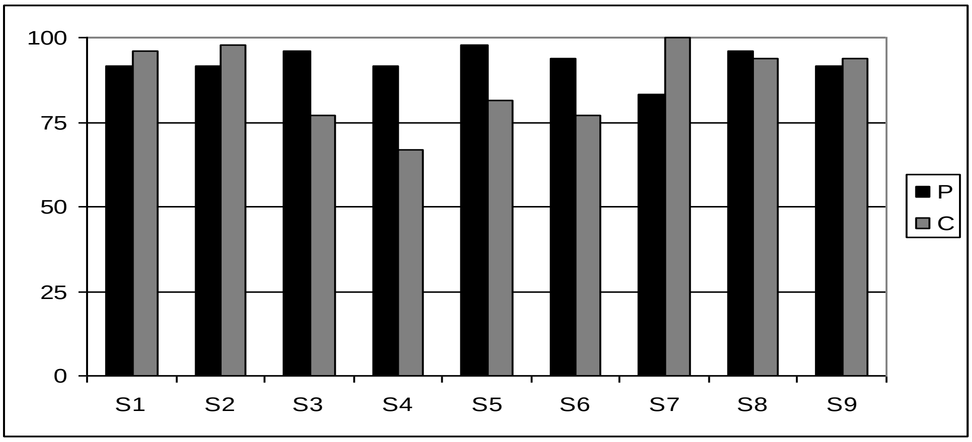


Figure 7.6 shows that the performance of the DG on the production task is again variable. Z-scores were calculated on the basis of the raw accuracy score of the CG

(M=47 and the lowest accuracy score in the CG on Target responses was 45). Six out of nine children (S1, S2, S4, S6, S7 and S9) were significantly below the mean of the CG.

However, not all z-scores that resulted significantly lower than the mean of the CG are indicative of impaired performance. In the case of S7 who had the lowest z-score for example, the non-target responses involved the production of indefinite articles for the singular nouns, one instance of indefinite article with phonetic error (**ena* krokodilo instead of *enan krokodilo*) and for the plural number the substitution of the definite article with "two" (i.e. *dio katsikes* instead of *i* katsikes), which is not a grammatical error.

Omissions were observed in the production of S1, S2, S3, S4 and S9. Most of these omissions occurred for the feminine plural accusative article (*tis*) and this finding is in agreement with the findings of Smith (2008), who also noted particular difficulties with this article in preschool SLI children.

The rest of the errors concerned with phonetic reductions for the accusative articles (*to* instead of *ton*) or with not clear pronunciation of the final –s of the accusative plural articles, something that was rarely observed in the CG as well.

In the comprehension task, as Figure 7.6 shows, there is a certain variation among the children of the DG. The z-scores were calculated on the basis of the raw accuracy scores of the CG on *Target* responses (M=47,44, and the lowest accuracy score in the CG was 45). S3, S4, S5, S6, S8 and S9 were found to be significantly below the mean of the CG.

Most of the errors that were attested concerned with the acceptance of the omission as correct and this was observed more for the plural articles. However, there were also some instances of acceptance of the omissions even for the singular articles. The other errors involved mostly inappropriate corrections, which in most cases were grammatical. We shall further refer to this in the discussion section.

The errors that were observed in the CG concerned with very few instances of acceptance of the omission for the nominative and accusative plural article and two instances of non-target correction with a phonological error in the accusative singular article (deletion of the final –n). For these errors, consequently there are quantitative differences between the DG and the CG. The qualitative errors were again the repetition of the correct NP, the correction of the erroneous NP with a different case, yet without any violation on the DetN agreement.

7.6.2. Comparisons between production and comprehension

The statistical analyses that were implemented included t-tests that were conducted separately for each group. For the DG the paired t-test on the total of *Target* responses between the two tasks, did not turn out to be significant ($t = 1{,}179$, $df = 8$, $p = 0{,}272$ two-tailed). Similar results were obtained for the CG as well ($t = -0{,}686$, $df = 8$, $p = 0{,}512$ two-tailed).

In Greek, contrary to the production data in Italian, no particular effects were revealed for a specific article. However, the analyses for each article were conducted separately and again, no significant differences were found for any type of article in any of the groups ($p > .05$ in all cases).

To conclude, no significant differences were revealed between the tasks for both groups and these results are similar to the ones we obtained in Italian in the comparison between the articles tasks. Contrary, though, to Italian, there were no significant differences between the different types of articles on the two tasks.

7.6.3. Discussion – Greek data

The present tasks investigated the production and comprehension of definite articles in Greek DD and TD children. The results can be summarized as follows:

- DG were found to differ significantly from their typically developing peers on their overall accuracy scores but were not found to differ on the number of articles that they produced
- Gender, number and case were not found to be significant factors for *Target* responses
- Omissions were sporadically observed and did not result in any significant group effects
- In the grammaticality judgment task of omissions, DG children were found to differ significantly from their typically developing peers on *Target* responses, but despite this difference no significant effects were revealed for any of the errors
- As far as the acceptance of omission responses is concerned, the MPLS and FPLS articles had the highest percentages.

In the production task, Greek DG children were found to differ significantly on *Target* responses as compared to their typically developing peers, but the errors that were observed did not concern only with a specific article, as in the case of Italian. However, most of the omissions in the Greek DG's production data were observed for the feminine plural accusative article *tis*. Reduced performance on the accusative plural articles has been reported by Smith (2008) for preschool SLI children. Moreover, later acquisition of plural forms has also been reported (Stephany, 1997).

Contrary to the finding of Smith (2008) that the masculine plural nominative article was the most vulnerable, in the present study there were more instances of errors for the feminine plural nominative article. Masculine and feminine plural articles are homophonous and for the majority of masculine nouns, ***oi*** (i) is the inflection for the nominative plural forms. In the case of feminine nouns, however, the inflection is –es, something that renders the NP even more difficult. Stephany (1997) had also noted the later acquisition of the feminine plural article. Hence, this could also be a possible explanation, at least for the omissions.

As far as the phonetic errors are concerned, these consisted of the deletion of the final –n of the accusative singular article in nouns where it was obligatory and some instances of not clear pronunciation of the final –s of the accusative plural article, something which was also observed in the CG. However, since the groups are composed by few participants, we should not exclude the possibility of deletion of the final –n even in TD children. Again, as it appears, the most promising error is the one of omissions, that are not allowed at any instance after a certain age.

To sum up, Greek DG children's performance on the production of definite articles was not found to be impaired, but still, significant differences were revealed and omissions appeared the most promising and indicative error of the DG, observed even in the oldest children of the group.

In the comprehension task of omissions, contrary to the Italian findings, Greek DG children were found to differ significantly from the DG on *Target* responses. Again, even in the case of Greek, the results are not comparable to any previous research due to the particularities of the task.

The first finding that we should note is the lower performance on the plural articles, and in particular for the MPLS, FPLS and FPLO that had the highest percentages of acceptance of the omission response. As far as the nominative case is concerned, this clearly has a phonological explanation, as ***i*** is phonologically weak.

There were also instances of acceptance of the omission of the homophonous FSS article ***i*,** but they were not as frequent or to the same extent as the plural article. Therefore, the phonological explanation accounts for many cases of these errors.

The later acquisition of the plural articles has been already reported by Stephany (1997). Moreover, Smith (2008), reported particular difficulties in the production of the nominative plural article by SLI children, something that is indicative of an even more serious delay for some of the children of the DG. Nonetheless, phonological deficits do affect these structures, and even more the ones that are phonetically weak.

However, since the limited errors that were observed in the CG group concerned with the specific article as well, this does not show a qualitative, but a quantitative difference in the performance of the children of the DG. Even if in Greek bare nouns are used in the plural number, the contexts in which they are used are different. (Chondrogianni et al. 2010).

As far the cases of non-target corrections are concerned, different errors were found. The first one that was also found in one child of the CG was the one of the phonetic reduction of the singular accusative article, which was observed in more instances in the DG. The next one was the correction with an indefinite article, which is grammatical, but taking into consideration the adequate and precise training on the task, it cannot be counted as a *Target* response. The next pattern that was observed and which is also grammatical was the production of a sentence including a direct object clitic (i.e. * I katsika kitazi fokjes –the goat is looking at seals, correction provided: ohi, tis kitazi-no, them-CLITfemplur. is looking at, is looking at them), a pattern which was also rarely noticed in Italian. Another pattern was the one in producing the wrong case of the NP, without however any violations on the DetN agreement (i.e. *I zevra klotsai rinokero, *the zebra kicks rhino, correction: o rinokeros, the-nom. rhino-nom. instead of ton rinokero-the-acc. rhino-acc.). This error probably is due to inversion of the thematic roles, but still, it is difficult to interpret. Finally, as in Italian, there was the rare error of repetition of the sentence with the omission misplaced to the correct NP and another error, the one of repeating the correct NP, as if it were a correction to the erroneous one.

To recapitulate, the most frequent error in the current task was the one of acceptance of the omission response, which was more frequent for the plural articles. There were, however such instances also for the singular number, but nonetheless they were more limited. The rest of the errors that were observed were in most cases grammatical non-target responses and others that are more likely to be attributed to attentional factors.

To sum up, production and comprehension of definite articles in the DG were found to be significantly lower than the mean of the CG. The results on comprehension were lower than the ones in production, yet without any significant differences between the two tasks. Furthermore, the errors in both production and comprehension show a clear contribution of phonology and the non-phonological errors that were observed are not likely to indicate an impaired profile.

7.7. Discussion: Italian and Greek data

The current chapter concerned with the investigation of production and comprehension of definite articles in Italian and Greek children with DD. The results between the two languages are at certain points similar and at others, they appear contrasting. First, we shall focus on the production data.

In the production of definite articles, both DG groups were found to perform significantly lower than the control groups, but generally, the performance of the Italian DG children was lower than the one of Greek DG children. Moreover, despite the significant differences, the overall performance of the DD groups was generally very good. In Italian, significant effects were revealed for the masculine singular article. For this article, there were instances of omissions and phonological errors which differentiated many children of the DD group. This finding is in agreement with previous research in Italian SLI (Leonard et al., 1992; Leonard et al., 1993) and shows that phonological deficits in DD affect additionally speech production (Snowling, 2000).

In Greek, no significant effects were found for any of the different articles. Omissions were observed and, most of them concerned with the feminine plural nominative article, something that contrasts the findings of Smith (2008) who reported that this article (***i***) was mostly omitted for masculine nouns. In Italian, no such pattern was observed. This was to be expected, since in Italian, articles only share agreement, whereas in Greek they share both agreement and case. The interpretations on the grammatical properties appear plausible but the phonological approach is undisputable. Omissions did not result in any significant group effect and the percentages in both DG groups were low. In Italian, this contrasts the findings of Bottari et al. (1998) on SLI, whereas the findings in Greek agree with Smith's (2008) study on SLI. Despite the non-significant effects in the present study, omissions characterized the production of certain DD children.

With respect to the findings on omissions in both languages, there is evidence that lexical retrieval limitations may additionally underlie this error. The performance on the particular task can be inhibited in some cases by limitations in lexical retrieval. This is something to be expected, taking into consideration the impact of phonological deficits on vocabulary development and the difficulties of DD children with naming and rapid naming tasks (view Snowling, 2000 for a review of the relevant researches). Let us consider the following responses provided by subjects of the DG:

ITDG child: hmmm….zebra, …la zebra
hmmm….zebra, ….the zebra

DG child: il, il, il......come si chiama....
The, the, the...what's its name....

Therefore, from the first example above, it appears that until the first response ***zebra***, a difficulty in naming is reflected, combined with the fact that at a first stage, the child first names the animal character. The DP is produced after self correction, and the difficulty on lexical retrieval becomes even more apparent. In the second example, the article is produced correctly but the noun cannot be retrieved. Hence, in some but not all cases, omissions found in similarly structured tasks could also be a result of naming difficulties. That is, there may be cases in which children may not omit the articles due to grammatical deficits but due to deficient lexical skills. Let us also consider the following response provided by a child of the Greek DG:

GRDG child's response: zebra….tin
zebra…the-acc.fem.sing.
zebra…the

The difficulty with naming is apparent, and the child is aware of the omission. However, an article produced after the noun, without further self correction and production of the target DP could not be counted as a *Target* response. Nonetheless, it shows once again that deficient naming skills can impede the performance on relevant tasks and that probably a part of the omissions are not due to major difficulties with the articles. As far as the rest of the errors are concerned, no significant effects were revealed in any of the two groups.

Another thing that should be noted is that there were not any instances of gender or number errors in any of the two DD groups. Even if in Greek there were some deletions of the final –n for the accusative singular articles, instances of not clear pronunciation of the final –s of the feminine plural accusative article or in the case of substitution of *il* with *i* in Italian, all these are clearly phonological errors and depend directly on the phonological properties of the noun. Therefore, in comparisons with SLI[14], the phonetic errors are expected, but gender, number and noun agreement errors can also occur. Since none of these latter patterns was observed in the DG groups, this could constitute a differentiating pattern between SLI and DD children.

As far as comprehension is concerned, there were contrasting results between the two languages. In Italian, no significant differences were observed between the DG and CG, whereas in Greek, significant differences were revealed. Moreover, in both languages there were errors which were observed only in the DG, but in the case of Italian there were few instances of additional qualitative errors. The first error that was observed in both DD groups, but was higher in the case of the Greek DG, was the one of the acceptance of the article omission. In both languages this occurred more for the plural number, but the difference between the two DGs is apparent.

In the Greek DG there was one child who judged almost all the sentences (5 out of 6 items) of the masculine plural nominative article as correct and another child who judged all of the sentences as correct, something which was not observed in Italian, despite the fact that this article is homophonous in both languages. In Italian there were only two children that for the specific category judged 2 out of 6 sentences as correct for the specific item. This difference is rather difficult to interpret only by means of speech perception skills, because the article *i* in this case would be more or less equally affected

[14]For the masculine singular article (*il*), omissions and phonological errors occurred in certain subjects of the DG. Thus, a prospective comparison with SLI children would show an overlapping pattern for the specific category. Although it can be supposed that the differences for the specific article can be only quantitative, additional qualitative differences should be re-examined, taking into consideration the phonological properties of the nouns. Moreover, it should be noted that for the specific article no gender errors were found even for masculine nouns which end in –e (i.e. *rinoceronte*). This is something that should be additionally investigated in comparison with SLI children (as well as masculine nouns ending in –a), since this could probably constitute a differentiating pattern.

across all its three categories (FSS, MPLS, FPLS). For the first aforementioned child the article was equally affected for the MPLS and FPLS but not for the FSS, whereas for the second child the only weak performance across these three homophonous articles was the MPLS. Therefore, a phonological explanation cannot fully account for both of these children.

Therefore, it appears that comprehension of articles in the Greek DG group is more vulnerable than in Italian, and for these weaknesses, both phonological and non-phonological interpretations can account. The findings in Italian again, do not completely agree with the findings reported by Bottari et al. (1998) on production, since there were not many instances of omission acceptance and the DG group's performance was not significantly lower than the CG's. For Greek, however, at least as far as the MPLS article is concerned the findings agree with the ones of Smith (2008).

As far as the common errors between the two languages in the comprehension task are concerned, the first was the one of the repetition of the correct DP, that is more likely to be attributed to limited attention. This error, however, was rarely attested in the DD groups and it was not observed in the current control groups. Another common error, which was also rare and probably more attributable to attentional factors, concerned with the repetition of the sentence with the omission misplaced in the correct DP. Finally, another rare error pattern, which is not ungrammatical and was observed in both languages, was the correction with a sentence including a direct object clitic. It appears that the performance of DG children on the specific task is characterized by particular errors and as far as the acceptance of omission is concerned, we found that this was more evident in Italian.

To recapitulate, the production of definite articles in both languages showed that DG children differ significantly from their typically developing peers, but their performance in most cases is determined by their deficits in phonology. In the comprehension task of omissions, significant differences were revealed only for the Greek DG. However, among the children of the Italian DG, again, different profiles were revealed, as well as errors that were not observed at any instance in the control group.

The findings of the current study on production are in agreement with previous studies in Greek and Italian SLI, at least as far as the phonetic errors are concerned: in the case of Italian for the masculine singular article (Bottari et al., 1998; Leonard et al., 1992) and in Greek for the plural nominative article ***i*** (Smith, 2008). As far as the grammaticality judgment task of omissions is concerned, additional research is needed and especially in comparison with younger children, in order to observe the developmental changes in the acceptance of omissions, as well as to evaluate the different correction strategies that are used by children on the specific task.

7.8. Grammaticality Judgment of Definite Articles-Ungrammatical Conditions-Italian Dyslexic and Typically Developing Children

7.8.1. Classification of Responses

We obtained 960 responses, 480 by each participant group. We counted as a *Target* response the one for which an appropriate correction with a definite or indefinite article was provided, marked correctly for gender and number. The rest of the responses were classified as follows:

-**Accepted as correct**: when the sentence with the erroneous item was judged as correct

-**Other NP:** when the child was correcting the already correct DP of the sentence (i.e. **-***La capra guarda **nelle foche,** response: ***No, la capra***).

-**Inappropriate or no correction:** when the provided correction was not acceptable or when the child did not proceed into correcting the sentence.

7.8.2. Results

7.8.2a. Target responses

The raw percentages on *Target* responses are presented in Table 7.15 and in Figure 7.7. As can be observed, there is a certain difference on the performance between the DG and the CG. However, at this point we should note that this difference between the two groups is mainly to one subject of the DG who exhibited particularly low performance (56,24%). It appears that S10's performance impacts on the group's overall scores, since if S10's overall score is removed then the TTL accuracy of the DG immediately is changed to 97,45%.

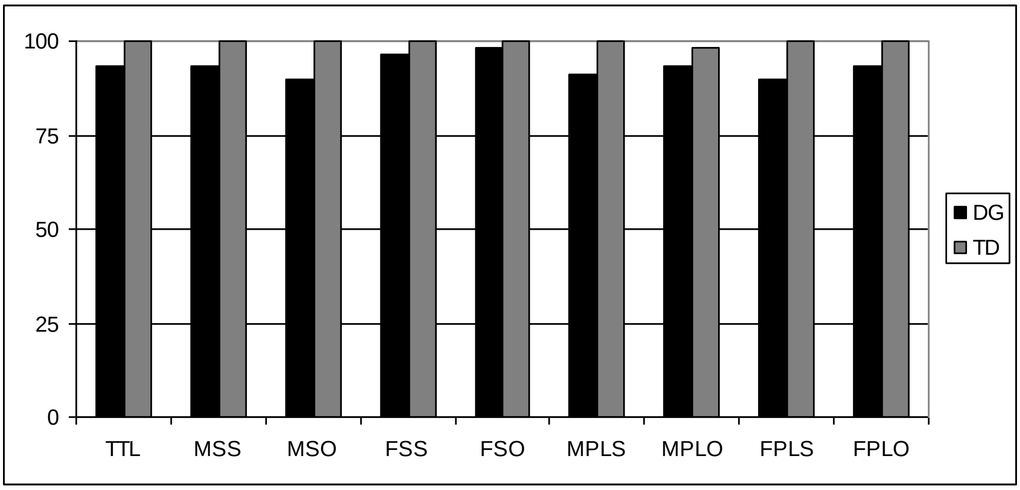
The statistical analysis corroborated these observations. We ran two separate models on the overall accuracy on *Target* responses: the first included all participants of the DG and the model turned out to be significant ($x^2(1) = 7.096$, $p = 0.007726$) and additionally revealed additional group effects. However, when S10's data were removed and the analysis was conducted between nine children of the DG and all ten children of the CG, the model still resulted significant ($x^2(1) = 5.5483$, $p = 0.0185$), but without subsequent group effects. Therefore for the second analysis, it appears that there are more non-target responses in the DG, but not enough to result in significant group effects.

Table 7.15: Raw percentages on Target responses on the Grammaticality Judgment Task of Definite Articles and fixed effects-Italian DG and CG

Target	Total	Masculine Singular		Feminine Singular		Masculine Plural		Feminine Plural	
		S	O	S	O	S	O	S	O
DG	**93,33** (13,4)	**93,33** (11,65)	**90** (21,08)	**96,66** (10,54)	**98,33** (5,27)	**91,7** (16,2)	**93,33** (11,65)	**90** (21,08)	**93,33** (21,08)
CG	**99,79** (0,65)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**98,33** (5,27)	**100** (.00)	**100** (.00)

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.9422	0.6439	6.123	<.001
Group	3.3594	1.7128	1.961	0.0498
(Intercept)	4.8712	0.5585	8.722	<.001
Group S10 removed	2.3625	1.4669	1.611	0.107

Figure 7.7: Target Responses on the Grammaticality Judgment Task of Definite Articles-Italian DG and CG



7.8.2b. Erroneous responses

The mean percentages of erroneous responses on the Grammaticality Task of Definite Articles are presented in Table 7.16. The percentages concern with all the participants of the DG.

The percentages of erroneous responses of the DG do not differ very much from the ones in the omissions task. However, in the case of omissions no significant differences had been found between the DG and the CG, apparently because the CG's performance was slightly lower than the one in the current task.

However, for the category *Other NP*, no analysis was conducted since there was only one relevant error found. The first model on the amount of sentences that were *Judged as Correct*, did not turn out to be significant ($x^2(1) = 2.3936$, $p = 0.1218$) and consequently, did not reveal any significant group effects. Similar results were obtained for the category of *Inappropriate correction* ($x^2(1) = 1.8529$, $p = 0.1734$).

Table 7.16: mean percentages of Erroneous responses on the Grammaticality Judgment Task of Definite Articles

Erroneous Responses	**Judged as correct**	**Other NP**	**Inappropriate or no correction**	
DG	**3,33** (8,4)	**0,2** (0,65)	**2,07** (5,55)	
CG	**0** (.00)	**0** (.00)	**0,2** (0,65)	
Fixed Effects	**Estimate**	**SE**	**Z**	***p***
Accepted as Correct				
(Intercept)	3.844	3.048	1.261	0.207
groupCG	-16.761	638.185	-0.026	0.979
Inappropriate Corrections				
(Intercept)	-0.4891	0.3841	-1.273	0.203
groupCG	17.0255	3897.8535	0.004	0.997

7.8.3. Individual Performance

In the previous section we noted that the significant difference between the DG and the CG was due to the data of S10. However, not all DG children showed at ceiling performance, whereas in the CG there was only one instance of an inappropriate correction. The individual performance of the DG children can be found in Figure 7.8.

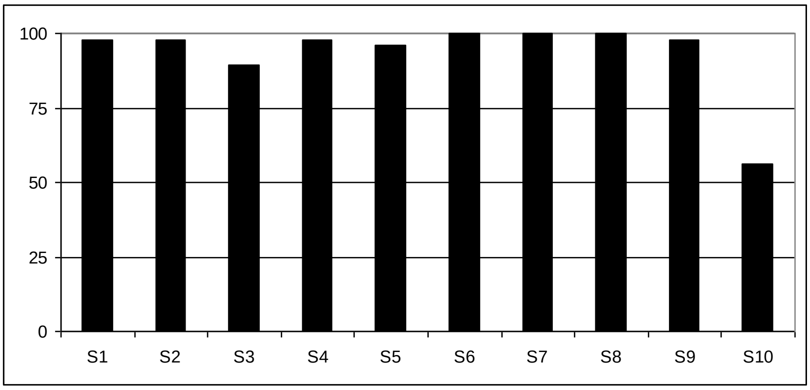
It is apparent that in the DG the lowest scores were obtained by S3 and S10. However, S10's performance is deviant even among the subjects of the DG.

Furthermore, the individual z-scores for the children of the DG were calculated, on the basis of the raw accuracy scores of the CG. The mean raw accuracy score of the CG was 47,9. Seven out of ten children (S1, S2, S3, S4, S5, S9 and S10) were found to be significantly lower than the mean of the CG.

S1 and S2 of the DG had only one error and this concerned with acceptance of the erroneous sentence as correct. This was also the case for S4 and therefore for these subjects this difference shall be ignored, as it could be additionally attributed to phonology or even attention. S6, S7 and S8 had at ceiling scores.

As far as the subjects with the most errors are concerned with, first of all S3 exhibited different errors. One of them, however, was similar to the one and only error found in the CG. More particular it concerned with an incorrect correction: **lo riccio*, instead of *il riccio*, vs. *gli* ricci instead of *i ricci*, which was the only error in the CG. One more error concerned with the *Other NP* and two errors concerned the substitution of *i* with *il* (**il cani*, instead of *i cani*)[15]. This was also the case of the one error noted in S9.

Figure 7.8: Individual performance (%) of the children of the Italian DG on Target responses on the Grammaticality Judgment Task of Definite Articles



As far as S10 is concerned, the mean percentage of sentences judged as correct (27, 07%) was higher than the one of inappropriate corrections (16, 66%). However, in the case of inappropriate corrections, S10 had errors which were not observed in other children. There were instances of substitution of ***nel*** with ***al*** (i.e**al cane* instead of *il cane*) or the use of *lo* for nouns which do not begin with a liquid consonant (i.e. **lo coniglio* instead of *il coniglio*). These are qualitative errors and since they were not observed in any other child of the DG probably indicate a language impairment.

[15] The specific error pattern was also found and discussed in detail in the omissions task.

To sum up, it appears that for the case of the current grammaticality judgment task, most of DG children do not have particular problems, but among the group deviant profiles were revealed and the evaluation of the different errors again can lead to differential profiles.

7.8.4. Discussion: Italian data

The current task investigated DD children's ability to correct grammatical violations on articles. However, for the specific task, a correction with both definite and indefinite articles was counted as a *Target* response.

The specific items, which we analyze here as a task, made part of more extended experiment on definite articles (they were tested simultaneously with the omissions of definite articles). That is, the sentences were pseudorandomized including both omissions and ungrammatical conditions and were presented into two different tasks. The analysis, however, was conducted separately for the two categories of sentences. Contrary to the omissions task, in which CG children did not obtain a ceiling performance, here, the performance of CG children was almost at ceiling and only one error was noted for the CG group. Therefore, the specific sentences with the ungrammatical conditions can provide even more insight for differential profiles and subsequently for diagnostic purposes.

The first analysis on *Target* responses revealed significant differences between the DG and the CG. However, this overall significant difference was due to the data of one subject of the DG who had particularly low scores. As soon as this child's data were removed from the analysis, the difference between the two groups was no longer significant.

As far as the errors are concerned with, first of all, we have to note the cases in which there were no instances of errors for the DG when S10 is excluded. This was the case of the feminine singular article (for both Subject and Object DPs) for which the accuracy performance of nine children of the DG was 100% as well as the case of the Object DP of the feminine plural article. For the category of judging the sentence as correct, when S10 is excluded, sporadic/rare errors may be found for the masculine singular and for the feminine plural.

Returning now to the category of inappropriate corrections, just like in the case of the sentences with omissions, we found substitutions of *i* with *il*. Since the specific error has already been commented on (with relevant examples) and no different pattern was observed in the specific sentences, we consider not discussing it further.

The errors that were found in the case of S10, however, are both quantitatively and qualitatively different from the ones of other children of the DG. Apart from the many cases of ungrammatical sentences that were accepted as correct, there were substitutions with the preposition *al* and the substitution of *il* with *lo* for nouns that do not begin with a liquid consonant. As we already discussed this child had a deviant performance even among the participants of the DG.

Furthermore, we consider discussing the acceptance of the ungrammatical sentences as correct. We have already noted that there is a minimal difference between the plural of the preposition - substitution of the definite article and the plural of indefinite articles in Italian. Therefore, the possibility of perceiving plural forms of some items as the plural of the indefinite article (taking into consideration that the audio stimuli were not presented through headphones) must not be excluded. In fact, there were instances even among CG children who perceived this as *delle* and asked whether it was indeed this case. Although this was not frequent and since the experimenter could not assist the child further, the sentence was repeated. Moreover, since the training was instructional and children were provided a specific feedback for the corrections, they knew that they had to correct with a definite article upon listening to the stimulus. Finally, there were also some sporadic corrections with an indefinite article for the plural, observed also in the DG and which for the specific task were counted as *Target* responses, something that confirms even more the resemblance between *nei*-*dei*.

To recapitulate, the performance of the children of the DG on the sentences with violations of definite articles was found to be variable and among the group there was a case of a child with particularly deviant performance. On the other hand, the performance of the CG was at ceiling with the exception of one error. The quality as well as the quantity of errors was found to provide differential profiles even within the DG.

7.9. Grammaticality Judgment Task of Articles – Ungrammatical Conditions-Greek Dyslexic and Typically Developing Children

7.9.1. Target Responses

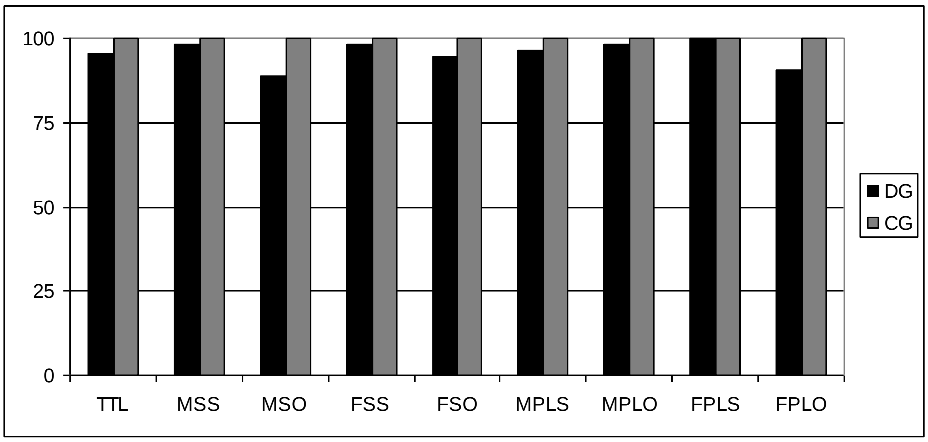
The analyses were conducted on a total of 864 responses for both groups (432 by each participant group). The raw percentages on *Target* responses and the fixed effects are presented in Table 7.17 and in Figure 7.9:

Table 7.17: Raw percentages of Target responses on the Grammaticality Task of Definite Articles and fixed effects-Greek DG and CG

Group	**Total**	**Masculine Singular**		**Feminine Singular**		**Masculine Plural**		**Feminine Plural**	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
DG	**95,6** (3,95)	**98,15** (5,55)	**88,88** (14,43)	**98,15** (5,55)	**94,44** (8,33)	**96,3** (7,35)	**98,15** (5,55)	**100** (.00)	**90,74** (8,78)
CG	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)	**100** (.00)

Fixed Effects	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.857	0.392	9.839	<.001
groupCG	18.487	2783.962	0.007	0.995

Figure 7.9: Target Responses on the Grammaticality Task of Definite Articles



As it can be observed, contrary to the CG, the DG did not achieve at ceiling performance. Nonetheless, however, the overall performance of the DG appears to be very good. Contrary to the Italian DG, in the Greek DG there were not any instances of deviant performance within the DG group. In the case of the Greek DG however, we can observe that the performance of the DG was better than in the omissions task.

The statistical model turned out to be significant ($x^2(1) = 17.153$, $p<.001$), but did not reveal any significant group effects. Thus, despite the fact that errors were observed in the DG group, these were not enough so as to result into significant differences between the two groups.

7.9.2. Erroneous responses

Although the DG group was not found to differ significantly from the CG on *Target* responses, the performance of DG children was not ceiling and different errors were observed. The percentages for the different erroneous items can be found in Table 7.18.

Table 7.18: Mean percentages of Erroneous responses on the Grammaticality Task of Definite Articles

Group	**Judged as correct**	**Other NP**	**Inappropriate or no correction**
DG	**1,15** (2,35)	**0,23** (0,69)	**2,77** (3,12)
CG	**0** (.00)	**0** (.00)	**0** (.00)

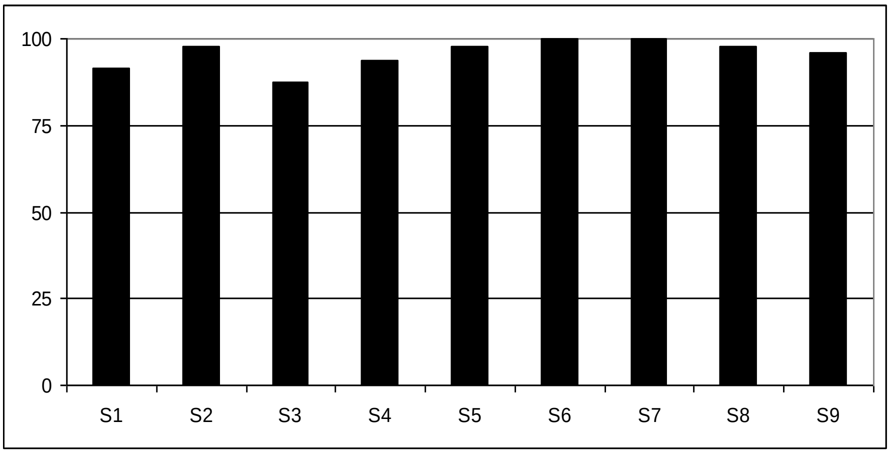
As can be observed, the instances of acceptance of the ungrammatical sentence as correct are lower in the current task than in the omissions task. This was to be expected, since Greek is a language with bare nouns and also because omissions of definite articles are observed during typical acquisition. On the other hand, ungrammatical forms of this particular kind are not allowed in any case.

As far as the inappropriate corrections are concerned, these mainly involved phonetic errors and corrections of the nouns, rather than the articles, so as to provide the correct agreement between the determiner and the noun. These were grammatical corrections, however, but the corrected DPs resulted in ungrammatical sentences. To sum up, DG children were not found to differ significantly from their typically developing peers, yet they were not all found to perform at ceiling.

7.9.3. Individual Performance

As we already observed, the performance of the CG group was at ceiling. The individual accuracy scores of the children of the DG are illustrated in Figure 7.10.

Figure 7.10: Individual Performance of the children of the Greek DG on the Grammaticality Judgment Task of Definite Articles



Since the performance of the CG was at ceiling and the z-scores cannot be calculated we consider again focusing on the presentation of each child's errors. The individual raw scores and details on the quantity and quality of errors are illustrated in Table 7.19.

Table 7.19: Individual raw scores and errors of the the children of the Greek DG on the comprehension task of definite articles

DG subjects	Raw score (/48)	Errors
S1	44	3 sentences accepted as correct, 1 inappropriate correction
S2	47	1 inappropriate correction
S3	42	1 sentence accepted as correct, 5 inappropriate corrections
S4	45	2 sentences accepted as correct, 1 correction to the other NP
S5	47	1 inappropriate correction
S6	48	0 errors
S7	47	1 inappropriate correction
S8	47	1 inappropriate correction
S9	46	2 inappropriate corrections

As can be observed, there were few instances of acceptance of the erroneous sentence as correct. However, even these ones should not occur. The violations on the accusative article result in phonologically weak (nominative case) forms and this can have a phonological explanation. The violations on nominative case, by contrast, do not depend exclusively on phonological properties. But again, there were only three instances of acceptance of violations on the nominative article as correct and therefore no conclusion can be drawn. These instances could also have an attentional explanation. Whatever the reason is, the only conclusion that can be drawn by the comparison of the DG with the CG is that acceptance of ungrammatical conditions is not allowed.

As far as inappropriate corrections are concerned, the majority consisted of phonetic reductions of the final –n in nouns where it is obligatory. Rare instances of mispronunciation of the accusative plural articles were also noted. This was a pattern found also in the omissions task, as well as to the article production task. Finally, among the few errors that were observed, there was the correction of the noun, rather than the article, again a pattern found also in the omissions task.

Again, the instances of inappropriate corrections did not result in ungrammatical structures, since most of them were phonetic. The correction of the noun, again, does not result in an ungrammatical correction, but the corrected DP cannot be used within the context of the sentence. We provide a relevant example:

" **I kirii travoun o maγo"*

The-nom.masc.plur gentlemen-nom.masc.plur. pull-3rdPlurPr the-nom.masc.sing. wizard-acc.masc.sing.

Child's response : *o maγos*

the-nom.masc.sing. wizard-*nom*.masc.sing

As it appears, the DP is perfectly grammatical, but if added in the sentence results in an ungrammatical structure:

" **I kirii travoun o maγos"*

The-nom.masc.plur gentlemen-nom.masc.plur. pull-3rdPlurPr the-nom.masc.sing. wizard-nom.masc.sing.

instead of

“ **I kirii travoun to(n) maγo”*

The-nom.masc.plur gentlemen-nom.masc.plur. pull-3rdPlurPr the-acc.masc.sing. wizard-acc.masc.sing.

This error does not appear to reflect any particular impairment. It is more attributable to attention or to difficulty to recall the sentence.

To sum up, the performance of most of the DG children was not at ceiling, but their overall performance was almost excellent and no significant differences were revealed. The few errors that were found cannot indicate any grammatical impairment. They are rather to be attributed to limitations in phonology and limited attention.

7.9.4. Discussion-Greek data

The current task investigated Greek DG children’s abilities to detect and correct grammatical (case) violations on definite articles. The violations in the case of feminine articles result into particular ambiguities, which in the case of the masculine gender are resolved because of the distinct inflections of the noun. Violations on case have been reported by Stavrakaki (2001) and Mastropavlou (2006) for SLI children. Even if they have been reported, they have not been exclusively investigated for articles. Rather, the existing researches (Stavrakaki, 2001) focused on the investigation of case violations on the DP, rather than the article per se.

Therefore, since substitutions of the nominative case with accusative case have been reported, we focused specifically on the violations of the definite article without any changes on the case of the noun. Taking into consideration previous findings in Greek, a relevant task appears promising for differentiating between SLI and DD children.

The findings from the comparison between the Greek DG and CG children resulted in no significant differences. This was a finding that contrasts the results in the omissions task and renders the present task even more reliable for possible differentiations. The few instances of errors that were found in the DG, as we already reported were more attributable to phonology and attention. However, the overall performance of the DG group cannot be characterized as impaired in any case.

Therefore, it appears that DG children do not have problems in the specific task and their errors are not indicative of any impairment. Moreover, none of the children demonstrated any difficulties with comprehending and completing the task, something that is an additional criterion for differentiating between SLI and DD.

Finally, no particularly variable performance was observed within the Greek DG group and even in the case of S3 who had the lowest performance (42/48), the inappropriate corrections were exclusively phonological. Hence, no diverse profiles were revealed within the Greek DG. With respect to the current findings, namely, the overall very good performance and the instances of errors that were observed, we believe that the present data can be used as a baseline for revealing differential profiles between DD and SLI.

As far as the differences with Italian are concerned, the analyses showed significance for the case of the Italian DG group. However, the significant difference in the case of the Italian DG group was caused by one child's particularly low performance. This, however, does not depend on the difference between the tasks in the two languages. It is a random finding and clearly depends on the subjects.

The items between Greek and Italian are rather different and the data on the current task, unlike the omissions task, cannot be further compared. However, despite the differences between the tasks in the two different languages, a common pattern that was revealed were the errors attributable to phonology.

To recapitulate, the purpose of the specific task was to highlight differential profiles in both languages, by providing details on the errors and investigating possible deviant profiles within the DD groups. This was made possible in the case of the Italian DG, but in the case of the Greek DG there were not gross qualitative or quantitative differentiations among the subjects of the DG.

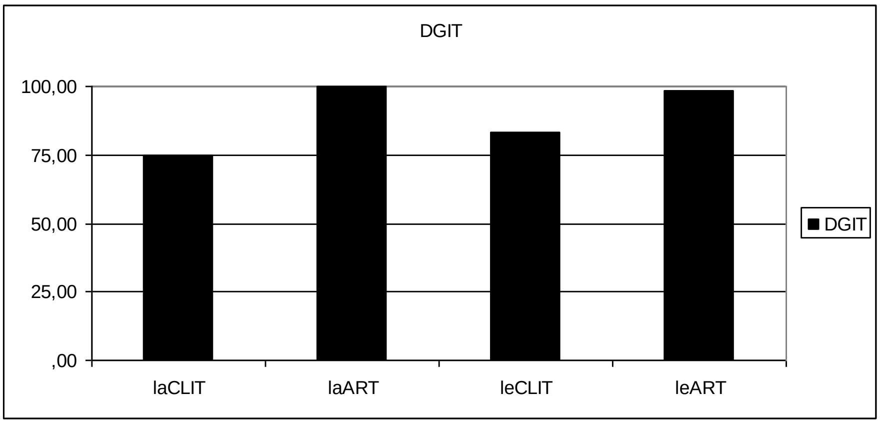
7.10. Comparisons between the production tasks of direct object clitics and definite articles

The differences between the production tasks of direct object clitics and definite articles, were further investigated in both languages. The analyses were conducted only for the DD groups. First, we present the comparisons between direct object clitics and definite articles.

7.10.1. Direct object clitics vs. definite articles-Italian DG

In Italian, the comparisons concerned the homophonous articles and clitics *la* and *le*. In the cases of articles, we collapsed the percentages for subject and object NPs. Figure 7.11 illustrates the accuracy scores on each object clitic and its homophonous articles separately for the Italian DG group.

Figure 7.11: Accurate performance (Target responses) of the Italian DG on homophonous clitics and articles

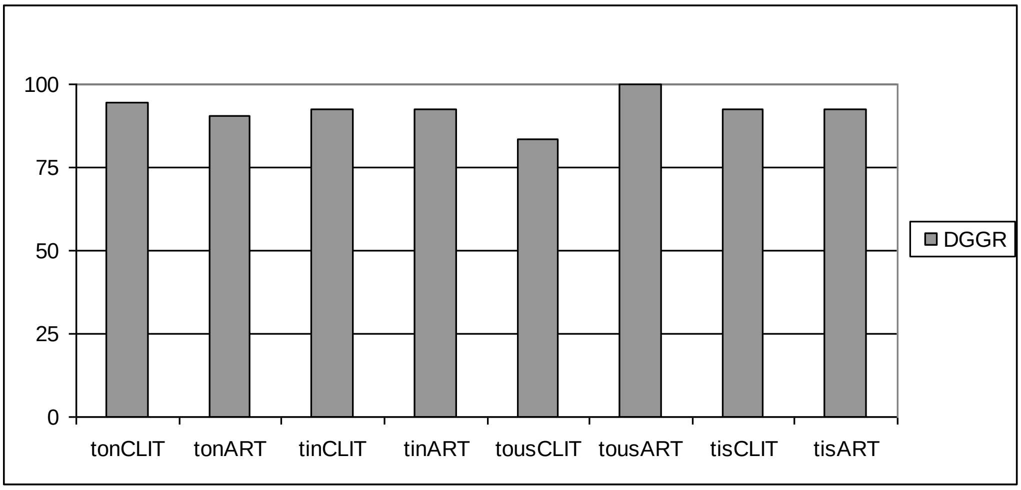


Non-parametric tests (Wilcoxon) were conducted and revealed significant differences in both cases. DG children were found to produce significantly more correct feminine singular *la* (Z= -2,588, *p*= 0,010-two tailed) and feminine plural *le* (Z=-2,003, *p* = 0,045-two tailed) definite articles than clitics. This finding is in agreement with previous studies in Italian SLI (Leonard et al., 1992) that report better performance on articles than clitics. Moreover, it is not in line with the findings by Bottari et al. (1998) who reported better performance on clitics.

7.10.2. Direct object clitics vs. definite articles - Greek DG

The performance of the Greek DG on the direct object clitics and accusative definite articles is presented in Figure 7.12.

Figure 7.12: Target responses of the Greek DG on direct object clitics and accusative articles



The only statistical analysis that we consider reporting concerns the masculine plural clitic *tous* and the homophonous accusative definite article, since in the case of feminine clitics and articles the percentages were equal and in the case of masculine singular the difference was minimal (94,44% for the clitic and 90,73% for the definite article respectively).

The comparison between the masculine plural direct object clitic *tous* and the definite article *tous* turned out to be significant (Z = -2,46, p = 0,014).

Although there were no particular differences between the performance on the homophonous clitics and articles in Greek, the results contrast the ones in the Italian DD group.

Chapter 8: Production of wh-questions by Italian and Greek children with Developmental Dyslexia

8.1. Production of wh-questions by Italian Dyslexic and Typically Developing Children

8.1.1. Classification of responses

8.1.1.1. Correct responses for *who* and *which* questions:

-WhVNP: when a question with a relevant structure was produced correctly

-NP-Topicalization: when the subject or object were moved to a preverbal position.

-Clefts: when a cleft was produced (only for *who* questions)

-Argument drop: these are grammatical structures in Italian and pragmatically acceptable for the context of the specific task.

-Wh-transform: when *che* was produced instead of *quale*, something that was not frequent, but is legitimate in Italian.

8.1.1.2. Erroneous Responses for who and which questions

-Reversed: In this error category were included instances of transformation of a subject to object question and vice versa. All structures (*WhVNP, NPTop, Clefts*) that resulted into the transformation of a *WhoS* to a *WhoO or a WhichS to WhichO* question and vice versa were included in this category.

-*Who* instead of *Which*: when a *WhoS* question was produced instead of a *WhichS* question and a *WhoO* question was produced instead of a *WhichO* question

-Ambiguous questions: when a Who or Which ambiguous question was produced

-Wh-element error: when the wh-element was erroneous, i.e. *che* instead of *chi*, without any other errors on the sentence

-Other: when the question could not be classified among the aforementioned categories[16].

[16] Errors on the wh-element, *WhoO* instead of *WhichS*, Agreement errors (i.e.* *il* conigli, **Chi tirano il mago* ?), lexical errors, ungrammatical questions. Detailed presentation of the classification of the sentences (including examples) can be found in Appendix VII

8.1.1.3. Classification of Responses for the Statistical Analyses

As we already discussed, contrary to the study of Guasti et al. (2012), the purpose of the present task is to investigate how DG children, after an instructional training differ on the production of wh-questions. Moreover, since there are different structures that can be produced for the different types of questions, an instructional training targeting the production of *WhVNP* structures, provides a strong feedback for the main experiment. Therefore, the primary purpose is to investigate the group differences on the production of accurate *WhVNP* questions, the group differences on all other structures and the group differences on the overall correct responses.

Therefore, for the purposes of the statistical analyses, correct responses were classified as follows:

- *WhVNP* correct responses
- Overall *Other Correct* responses (all the different categories of non *WhVNP* were merged into one category)
- Overall accurate responses (all the *WhVNP* and the different *nonWhVNP* correct responses were merged into one category)
- Different categories of *Other Correct* sentences

As far as the errors were concerned, they were classified as follows:

- Reversed: *Subject* instead of *Object* questions and vice versa without any change on the wh-element or the NPs)
- Who-Which: *who* instead of *which* questions and vice versa (*whoS* inst. of *whichS* and vice versa, *whoO* instead of whichO and vice versa).
- Ambiguous: *who* and *which* ambiguous questions
- Wh-pronoun error: when an error on the wh-pronoun occurred
- *Other*: other unclassifiable errors

8.1.2. Results

The correct and erroneous responses of the DG and the CG on *who* questions are presented in Table 8.1 and Table 8.2

Table 8.1.: Accuracy scores on the production of who questions-Italian DG and CG

WhoS							
	WhVNP	**Clefts**	**Argument drop**	**NPTop**	**Passives**	**Total Other Correct**	**Total correct WhoS**
DG	**75** (35,35)	**15** (33,74)	**1,67** (5,26)	**0** (.00)	**0** (.00)	**16,67** (33,33)	**91,67** (11,78)
CG	**85** (26,59)	**10** (26,29)	**1,67** (.5,26)	**0** (.00)	**0** (.00)	**11,67** (26,11)	**96,67** (10,54)
WhoO							
	WhVNP	**Clefts**	**Argument drop**	**NPTop**	**Passives**	**Total Other Correct**	**TTL correct WhoO**
DG	**66,66** (29,39)	**8,33** (16,19)	**0** (.00)	**8,33** (11,78)	**0** (.00)	**16,67** (31,47)	**83,33** (17,57)
CG	**81,67** (32,82)	**8,33** (26,35)	**0** (.00)	**3,33** (7,02)	**0** (.00)	**11,67** (31,47)	**93,32** (11,66)

Table 8 .2: Raw percentages of erroneous responses on who questions-Italian DG and CG

	WhoS				
	Reversed	**Ambiguous**	**WhichS**	**Wh-el. error**	**Other**
DG	**8,33** (11,78)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
CG	**3,33** (10,53)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
	WhoO				
	Reversed	**Ambiguous**	**Which Object**	**Wh-el. error**	**Other**
DG	**11,66** (11,24)	**0** (.00)	**0** (.00)	**1,67** (5,26)	**3,33** (7,02)
CG	**6,67** (11,65)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)

The correct and erroneous responses of the DG on *which* questions are presented in Table 8.3 and Table 8.4.

Table 8 .3: Raw percentages of accurate responses on which-questions-Italian DG and CG

WhichS							
	WhVNP	**Argument drop**	**NPTop**	**Passives**	**Che+NP**	**Total Other Correct**	**Total correct WhichS**
DG	**66,664** (32,39)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**66,664** (32,39)
CG	**95** (11,25)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**95** (11,25)
WhichO							
	WhVNP	**Argument drop**	**NPTop**	**Passives**	**Che+NP**	**Total Other Correct**	**TTL correct WhichO**
DG	**41,66** (34,47)	**8,33** (18,00)	**15** (21,44)	**5** (8,04)	**1,67** (5,26)	**30** (18,92)	**71,67** (24,91)
CG	**85** (14,59)	**3,33** (7,02)	**0** (.00)	**5** (11,24)	**1,67** (5,26)	**10** (11,65)	**95** (11,25)

Table 8 .4: Raw percentages of erroneous responses on which questions-Italian DG and CG

	WhichS				
	Reversed	**Ambiguous**	**ChiS**	**Wh-el. error**	**Other**
DG	**8,33** (16,19)	**3,33** (7,02)	**8,33** (14,16)	**5** (8,04)	**8,33** (21,15)
CG	**1,67** (5,26)	**0** (.00)	**0** (.00)	**1,67** (5,26)	**0** (.00)
	WhichO				
	Reversed	**Ambiguous**	**ChiO**	**Wh-el. error**	**Other**
DG	**5** (8,04)	**5** (8,04)	**8,33** (8,78)	**3,33** (7,02)	**8,33** (11,78)
CG	**1,67** (5,26)	**0** (.00)	**0** (.00)	**3,33** (7,02)	**1,67** (5,26)

8.1.2.1. Statistical Analyses

8.1.2.2. Total Correct Responses

The first model was applied on the *Total Correct* responses. The model turned out to be significant ($x^2(1) = 10.798$, $p = 0.001016$) and revealed significant group effects. The next analysis between *who* and *which* questions also turned out to be significant ($x^2(1) = 8.7228$, $p = 0.003143$) with significant group effects for *which* questions. The model comparing *subject* and *object* questions did not turn out to be significant ($x^2(1) = 0.4988$, $p = 0.48$).

To sum up, DG children were found to produce significantly less correct responses than their typically developing peers. This difference was further found to be significant for the case of *which* questions, but without any additional significance between *subject* and *object* questions. The summary of the statistical results is presented on Table 8.5

Table 8 .5: Summary of the statistical analysis on Total Correct responses

Total Correct Responses	Estimate	SE	Z	*p*
(Intercept)	1.4813	0.2937	5.043	<.001
groupCG	1.6255	0.4560	3.565	<.001
(Intercept)	1.9790	0.3404	5.814	<.001
Group CG	1.6259	0.4550	3.574	<.001
Which	-0.9907	0.3190	-3.105	0.001902
(Intercept)	1.3535	0.3403	3.978	<.001
Group CG	1.6261	0.4561	3.565	<.001
Subject/Object	0.2581	0.3623	0.712	0.476247

8.1.2.3. Correct *WhVNP*

The next analyses concerned with the correct *WhVNP* structures which were produced. The model turned out to be significant ($x^2(1) = 8.3122$, $p = 0.003938$) with additional group effects. Furthermore, the model on *who* and *which* questions did not turn out to be significant ($x^2(1) = 2.0525$, $p = 0.1520$), but the model on *subject* and *object* questions turned out to be significant ($x^2(1) = 9.6288$, $p = 0.001915$) and revealed additional significant effects for object questions.

Thus, DG children were found to produce significantly less correct *WhVNP* questions, and these differences were further found to be significant for *object* questions. The summary of the statistical results on *WhVNP* questions can be found in Table 8.6

Table 8 .6: Summary of the statistical analysis on Correct WhVNP responses

WhVNP	**Estimate**	**SE**	**Z**	***p***
(Intercept)	0.6114	0.3901	1.567	0.11712
groupCG	1.7731	0.5717	3.102	0.00192
(Intercept)	0.8149	0.4130	1.973	0.04850
Group CG	1.7724	0.5715	3.101	0.00193
Which	-0.4083	0.2752	-1.484	0.13794
(Intercept)	0.2036	0.3985	0.511	0.609420
Group CG	1.7756	0.5734	3.097	0.001957
Subject/Object	0.8187	0.2446	3.347	0.000816

8.1.2.4. Total Other correct responses/different categories of *Other Correct* responses

An additional model on the total of *Other Correct Responses* turned out to be significant ($x^2(1) = 7.6741$, $p = 0.005602$) and revealed significant group effects. The model on *who and which* questions did not turn out to be significant ($x^2(1) = 0.007$, $p = 0.9334$). A subsequent analysis on the distinction between *subject* and *object* questions turned out to be significant with significant group effects and effects for question type ($x^2(1) = 10.758$, $p = 0.001039$).

To sum up, DG children were found to produce significantly more *Other Correct* responses than CG children. This difference was not significant for either who or *which* questions, but was significant for *object* questions. The summary of the statistical results can be found in Table 8.7.

Table 8 .7: Summary of the statistical analysis on Total Other Correct responses

Total Other Correct Responses	**Estimate**	**SE**	**Z**	***p***
(Intercept)	-2.0923	0.3724	-5.618	<.001
groupCG	-1.6646	0.5750	-2.895	0.00379
(Intercept)	-2.07441	0.43721	-4.745	<.001
Group CG	-1.66496	0.57520	-2.895	0.0038
Which	-0.03962	0.46305	-0.086	0.9318
(Intercept)	-1.4178	0.3697	-3.835	<.001
Group CG	-1.6665	0.5729	-2.909	0.003625
Subject/Object	-1.3672	0.4079	-3.352	0.000802

The additional analyses that were conducted concerned only with the two categories with the highest percentages among the different types of the alternative correct responses, namely *NpTop, Clefts and Argument drop*.

The model on *NpTop* turned out to be significant ($x^2(1) = 7.9396$, $p = 0.004836$) with significant group effects. The model investigating differences between *who* and *which* questions did not turn out to be significant ($x^2(1) = 0{,}4292$, $p = 0{,}5124$).[17]

The model on *Clefts* did not turn out to be significant ($x^2(1) = 0{,}663$, $p = 0.7968$). Similar results were obtained by the model on *Argument drop* ($x^2(1) = 0.9511$, $p = 0.3294$).

To sum up, DG children were found to produce significantly more *NpTop* questions than the CG. Finally, no significant differences were revealed for the categories of *Clefts and Argument drop*. The summary of the statistical results can be found in Table 8.8.

[17] Since there were no instances of *NpTop* questions for *subject* questions, only possible differences between *who* and *which* questions were investigated

Table 8 .8: Summary of the statistical analysis on NpTop, Clefts and Argument drop

Correct Responses on the Different Types of *Other Correct Responses*	**Estimate**	**SE**	**Z**	***p***
NPtop				
(Intercept)	-3.3450	0.4453	-7.512	< .001
groupCG	-2.7317	1.3102	-2.085	0.0371
(Intercept)	-3.5488	0.5900	-6.015	< .001
Group CG	-2.7337	1.3045	-2.096	0.0361
Who/Which	0.4346	0.6820	0.637	0.5240
	Estimate	**SE**	**Z**	***p***
Clefts				
(Intercept)	-9.7306	3.1486	-3.091	0.002
Group CG	-0.6101	4.8758	-0.125	0.900
Argument drop				
(Intercept)	-4.6156	0.7028	-6.568	<.001
Group CG	-1.0456	1.2315	-0.849	0.396

8.1.2.5. Erroneous Responses

The first model on *Reversed* did not turn out to be significant ($x^2(1) = 0.518$, $p = 0.4717$) neither revealed any significant groups effects. Similar findings were obtained for the category *who/which* ($x^2(1) = 0.963$, $p = 0.3264$) and for the category *Other* ($x^2(1) = 1.6251$, $p = 0.2024$). The summary of the statistical results for these three error categories can be found in Table 8.9

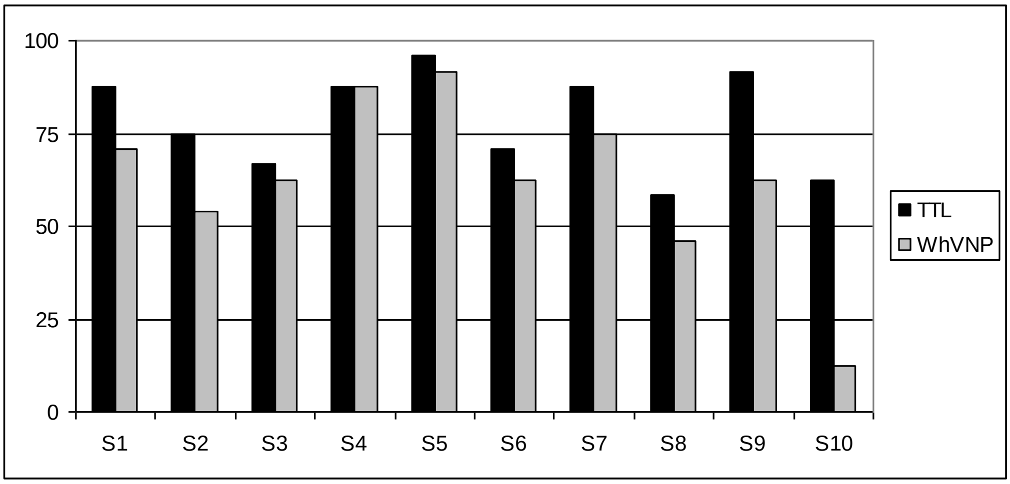
Table 8.9: Summary of the statistical analysis on the erroneous responses Reversed, who/which and Other

Erroneous Responses	**Estimate**	**SE**	**Z**	***p***
Reversed				
(Intercept)	-0.3874	0.5155	-0.752	0.452
groupCG	0.6411	0.8185	0.783	0.434
Who/which				
(Intercept)	-30.00	15.07	-1.991	0.0465
Group CG	-17.00	53881.41	0.000	0.9997
Other				
(Intercept)	-1.4120	0.4226	-3.341	< .001
Group CG	-1.3744	1.2333	-1.114	0.2651

8.1.3. Individual Performance

The percentages of the individual performance on the production of wh-questions refer to the category *Total Correct and WhVNP* responses. The individual performance scores for the DG can be observed in Figure 8.1.

Figure 8.1: Individual accuracy scores of the children of the Italian DG on the production of wh-questions-Total Correct Responses and WhVNP responses



As can be observed, apart from the differences on the *Overall Accurate Responses* (TTL), there is also a noteworthy difference on the production of correct *WhVNP* responses. The z-scores of the individuals of the DG, based on the raw score of total correct responses (M=22,8, and lowest accuracy score in the CG was 20/24). Five out of ten children of the DG (S2, S3, S6, S8, and S10) were found to be significantly below the mean of the CG.

Again, however, apart from the quantitative analysis, the qualitative inspection of the errors is that provides additional criteria for identifying deviant profiles. Therefore, we provide a relevant Table with the different errors that were observed only in the children of the DG.

Table 8.10: Different Erroneous responses produced by the children of the DG on which NP questions

Which Subject questions	
Target question	**Produced by children of the DG**
Quale lupo guarda i galli ?	*Chi guardano?* (*who object* question)
Quale coniglio spaventa i cani ?	*Chi spaventa i cani ?* (correct *who subject* question)
Quali signori tirano il mago ?	-*Chi tira il mago ?* (ambiguous *who* question) -*Chi tirano il mago? (*who object* question with agreement error)
Quali cigni inseguono il cane ?	-**Chi cigni insegue il cane* (erroneous wh-element and object question)
Which Object questions	
Quale lupo guardano i galli ?	-*Quale gallo stai vedendo ?* -*I galli, chi guardano* (who-object question)
Quale coniglio spaventano i cani ?	-*Che spaventano i cani* (what question)
Quali cigni insegue il cane ?	-**Chi inseguono dei cigni* ?
Quali maghi bagna il signore ?	* *Il signore, quali maghi li bagna* ? (*NpTop* with clitic doubling, a phenomenon which is not allowable in Italian)

It is apparent that the errors were of various types and that the majority were observed for *which NP* questions. The errors vary from the production of *chi* questions to the production of ungrammatical structures *(*Chi tirano il mago).* Nonetheless, the data confirmed by the statistical analyses showed that the major problem are the *which NP* questions, however, again not for all children.

For once again, just in the case of many previous experiments we see that the performance of the DG shows particular variation.

8.1.4. Discussion-Italian data

The results on the production of *who* and *which* questions by Italian DD and typically developing children can be summarized as follows:

- DG children were found to produce significantly less overall correct responses than CG children
- The analyses on the overall responses showed that DG children were generally significantly worse than the CG on the production of *which NP* questions, irrespectively of the type (subject-object).
- DG children were found to produce significantly less correct *WhVNP* responses than the DG

- The analyses on the correct *WhVNP* responses did not reveal significant group differences between *who* and *which* questions, but revealed significant differences between subject and object questions.
- As far as the alternative correct responses are concerned with, DG children were found to produce significantly more overall accurate responses than the CG and these differences were further found to be significant for the *NpTop* structure without additional effects on the wh-element or type of question.

DG children's overall accurate performance was found to be significantly lower than their typically developing peers. Moreover, as the individual analysis showed, five out of ten children of the DG were significantly lower than the mean of the CG. The finding on the overall significant difference is consistent with relevant studies on wh-production in SLI (Guasti, 2012 to appear; Stavrakaki, 2001, van der Lely and Battell, 2003). Thus, it appears that wh-production can be problematic in DD children as well.

In the case of the overall accuracy, we did not find an effect indicating asymmetry between subject and object questions. This finding however, can be attributed to the fact that in Italian, different structures can be produced and in fact, DG children were found to produce significantly more *NPtop* structures than the CG. Therefore, on the total of correct responses, the production of alternative structures can assist some children in producing successfully a certain amount of object questions. This finding is in agreement with Guasti et al. (2012), who reported an asymmetry between subject and object questions in young typically developing Italian children and furthermore demonstrated the use of alternative responses for object questions.

Contrary to the non-significant results on the type of question, a significant effect was found on the wh-element. DG children were found to produce significantly less correctly *which-NP* questions than their typically developing peers. Again, this finding is in agreement with the relevant studies on SLI. However, again, as we already noted above, *which NP* object questions were not found to be more impaired than which NP subject questions in the present study. The finding that *which NP* questions are more vulnerable than *who* in DD, is in agreement with Guasti (2011, 2012 to appear) on additional investigations in Italian DD. Nonetheless, our DG children in most cases are successful in the production of *who* questions and as it appears, with respect also to the findings by Guasti (2012 to appear) a more reliable criterion is the production of *which* questions.

As far as the *WhVNP* structure is concerned, again DG children were found to differ significantly from their typically developing peers. For this specific structure, however, no asymmetry between *who* and *which* questions was revealed. By contrast, we found an asymmetry between subject and object questions. For *WhVNP*, object questions are significantly more difficult for DG children. These findings confirm the findings reported by Guasti et al. (2012) for Italian young TD children. If we consider that DG children lag behind their peers, then, their performance patterns can be easily traced in similar findings concerning data of younger children. The aforementioned study reported an asymmetry between subject and object questions and pointed out the different strategies that children used in order to avoid the *WhVNP* structure.

Finally, as far as the asymmetry on subject-object questions is concerned, we should also refer to the findings by De Vincenzi et al. (1999) on comprehension. De Vincenzi et al. (1999) examined the comprehension of *who* and *which* questions of the *WhVNP* structure, and the findings showed that this asymmetry appears to diminish only by the age of 10-11 years, whereas children of 8-10 years perform in similar way, exhibiting a difference of more or less 40% on the accuracy between subject and object questions, irrespectively of the wh-element. Although the studies are not directly comparable, the results of the CG did not show any gross difference between *subject* and *object questions*, whereas the results of DG revealed significantly less *WhVNP* responses for object questions. Indeed, the results reported by de Vincenzi et al. (1999) show particularly reduced performance on object questions. Guasti et al. (2012) also found an asymmetry between subject and object questions by reporting that 4-5 year old children show higher performance than the age equivalent group in the De Vincenzi et al.'s (1999) study, but still production of subject questions was far better.

Again, at this point and at least for the case of the CG, we should refer to the difference in the training procedure, as it appears to have assisted the production of *WhVNP* questions. By considering further the training procedure's contribution on the so successful production of *WhVNP* questions in the case of the CG, then the difficulties of DG children can be considered as even more serious, as all children of both groups were guided equally.

As far as the errors of the DG are concerned, they were characterized by particular variability. They varied from the production of grammatically correct *who* questions instead of *which*, to the production of ungrammatical structures. The instances of production of *who* questions instead of *which* can derive from both discourse and processing factors (Avrutin, 2000), but in all cases, instances of these responses are characterized as non-grammatical errors. These, however, were errors that were not observed in the CG. Moreover, we should note that there were not any instances of production of *which NP* questions instead of *who* questions.

Another error that was observed only in the case of DG children, although rare, was the one of ambiguous questions. All of these instances, again, were observed for *which NP* questions. Such errors, depend clearly on the particularities of wh-question formation in Italian, as both subject and object questions share the same word order and due to the additional lack of morphological case, disambiguation is strictly based on the verb agreement.

If we combine these rare instances of ambiguous questions with further rare errors on agreement as in the following example (*i.e. *Chi tirano il mago)* , then once again the claims of Guasti et al. (2012) concerning on the particular difficulties that wh-questions bare in Italian are confirmed. The errors of the DG and their general performance do confirm these claims, but in addition show delayed linguistic behavior. Another claim that would be worth considering further, is the one made by De Vincenzi (1999) who held that *which object* questions in Italian appear particularly difficult contrary to *which subject* questions, because of the memory load they impose to the parser. However, this conclusion was based on the gross asymmetry between subject and object questions revealed in the comprehension experiment. In our study, DG children had almost equally lower performance between *which object* and *subject* questions and the asymmetry was revealed only when the *WhvNP* structure was examined separately. Even if the percentage of the DG on *WhVNP* structures for which-object questions was lower than the percentage for *which-subject* questions, in the case of *which* subject questions there were not alternative correct responses. In the overall accuracy there were not particular differences between *which subject* and *which object* questions (66,66% and 71,66% respectively).

The aforementioned claim, furthermore, entails the preference for *subject* over *object* questions. A prediction which arises is that children will tend to produce significantly more *subject* questions instead of *object* questions. This is the error that we labeled as *Reversal*. However, we also observed that there were instances of production of *object* questions instead of *subject* questions and the percentages were almost equal between the two question types. Therefore, the subject-object asymmetry was found for the case of *WhVNP* questions, but this was further resolved, as in the *Overall Correct*

Responses no further significance was revealed. Furthermore, the instances of production of *object* questions instead of *subject* questions, combined with the significant effects of *wh-element* on the overall accurate responses, clearly indicate that DG children's problems are not only specific to *which object* questions. After all, they showed that in some cases they can compensate for their difficulties by producing alternative correct responses.

8.2. Production of wh-questions by Greek Dyslexic and Typically Developing Chilren

8.2.1. Classification of responses

8.2.1.1. Correct responses for who and which questions

-WhVNP: when a question with a relevant structure was produced correctly without errors on the wh element, the verb or the NP

-NP-Topicalization: when the subject or object were moved to a preverbal position.

-Argument drop: these are grammatical structures in Greek and pragmatically acceptable for the context of the specific task.

8.2.1.2. Erroneous Responses for who and which questions:

-Reversed: In this error category we included instances of transformation of a subject to object question and vice versa. Other structures (*WhVNP*, *NPTop*) that resulted into the transformation of a *WhoS* to a *WhoO* question and vice versa were included in this category.

-Case Errors: when the NP was erroneously marked for case

-Agreement Errors: When there was an agreement error on the verb

-Who instead of which: when a *WhoO* question was produced instead of a *WhichO*

-Other: when the question produced could be classified among the aforementioned categories. [18]

[18] Errors on the wh-element: *what* instead of *who* question, lexical errors, agreement errors , phonetic errors (resulting into gender alteration). Detailed presentation of the classification of the sentences (including examples) can be found in Appendix VII.

8.2.2. Results

The correct and erroneous responses of the DG and the CG on *who* questions are presented in Table 8.10 and Table 8.11

Table 8.10: Accuracy scores on the production of who questions

Who S					
	WhVNP	**NPTop**	**Argument drop**	**Total Other Correct**	**Total correct WhoS**
DG	**98,15** (5,56)	**0** (.00)	**0** (.00)	**0** (.00)	**98,15** (5,56)
CG	**100** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**100** (.00)
Who O					
	WhVNP	**Argument drop**	**NPTop**	**Total Other Correct**	**Total correct WhoS**
DG	**72,22** (34,35)	**0** (.00)	**14,81** (29,39)	**14,81** (29,39)	**87,03** (13,89)
CG	**98,15** (5,56)	**0** (.00)	**0** (.00)	**0** (.00)	**98,15** (5,56)

Table 8 .11: raw percentages of erroneous responses on who questions

	WhoS				
	Reversed	**Case**	**Agreement**	**Case and Agreement**	**Other**
DG	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**1,85** (5,55)
CG	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
	WhoO				
	Reversed	**Case**	**Agreement**	**Case and Agreement**	**Other**
DG	**1,85** (5,55)	**3,7** (7,34)	**1,85** (5,55)	**0** (.00)	**5,55** (8,33)
CG	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**1,85** (5,55)

Table 8.12: Accuracy scores on the production of which questions

Which S					
	WhVNP	**NPTop**	**Argument drop**	**Total Other Correct**	**Total correct WhichS**
DG	**96,3** (7,35)	**0** (.00)	**0** (.00)	**0** (.00)	**96,3** (7,35)
CG	**98,15** (5,56)	**0** (.00)	**0** (.00)	**0** (.00)	**98,15** (5,56)
Which O					
	WhVNP	**Argument drop**	**NPTop**	**Total Other Correct**	**Total correct WhichO**
DG	**68,51** (32,75)	**3,7** (7,34)	**11,11** (27,63)	**14,81** (26,93)	**83,33** (27,64)
CG	**94,44** (11,78)	**3,7** (11,11)	**0** (.00)	**3,7** (11,11)	**98,15** (5,56)

Table 8.13: raw percentages of erroneous responses on which questions

Which S						
	WhoS	**Reversed**	**Case**	**Agreement**	**Case and Agreement**	**Other**
DG	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**3,7** (7,34)
CG	**0** (.00)	**1,85** (5,55)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
Which O						
	WhoO	**Reversed**	**Case**	**Agreement**	**Case and Agreement**	**Other**
DG	**11,11** (27,63)	**0** (.00)	**0** (.00)	**0** (.00)	**1,85** (5,55)	**3,7** (11,11)
CG	**1,85** (5,55)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)

8.2.2.1 Statistical Analyses

8.2.2.2. Overall Correct Responses

The first analysis concerned with the investigation of *Overall Correct responses*. The model turned out to be significant ($x^2(1) = 6.6107$, $p = 0.01014$) and revealed additional significant group differences. CG children were found to produce significantly more correct responses than the DG. An additional model investigating possible differences between who and which questions did not turn out to be significant ($x^2(1) = 0.9593$, $p = 0.3274$) and consequently did not reveal any significant group effects. The last model investigated the possible effects on type of question. The model resulted as significant ($x^2(1) = 6.8285$, $p = 0.008971$) and revealed additional group effects and effects of question type for subject questions.

Hence, DG children were found to differ significantly from their typically developing peers on *Overall Correct* responses and this difference was further found to be significantly lower for object questions. The summary of the statistical results is presented in Table 8.14

Table 8 .14: Summary of the statistical analysis on Total Correct responses

Total Correct Responses	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.1826	0.5192	6.130	<.001
groupCG	2.1630	0.9253	2.338	0.0194
(Intercept)	2.8800	0.6093	4.727	<.001
Group CG	2.1732	0.9286	2.340	0.0193
Which	0.7113	0.7349	0.968	0.3331
(Intercept)	2.3126	0.5199	4.448	<.001
Group CG	2.1679	0.9135	2.373	0.0176
Subject/Object	1.7753	0.7181	2.472	0.0134

8.2.2.3. *WhVNP*

The next series of analyses concerned with the investigation of *WhVNP* correct responses. The first model turned out to be significant ($x^2(1) = 8.2519$, $p = 0.004071$) and revealed additional significant group effects. CG children were found to produce significantly more correct *WHVNP* responses than the DG. The next model concerning with the wh-element did not result as significant ($x^2(1) = 0.7991$, $p = 0.3714$) and did not reveal any significant group effects. Finally, the model investigating possible effects of question type turned out to be significant ($x^2(1) = 29.261$, $p<.001$) revealing additional significant effects of group and subject questions.

To sum up, DG children were found to produce significantly fewer correct *WhVNP* responses and this difference was further found to be significant for *object* questions. The summary of the statistical results can be found in Table 8.15

Table 8 .15: Summary of the statistical analysis on WhVNP responses

WhVNP	**Estimate**	**SE**	**Z**	***p***
(Intercept)	2.4625	0.5428	4.537	<.001
groupCG	2.6299	0.9201	2.858	0.00426
(Intercept)	2.1962	0.6063	3.622	0.000292
Group CG	2.6309	0.9202	2.859	0.004248
Which	0.5413	0.5976	0.906	0.365090
(Intercept)	1.2961	0.5208	2.489	0.01282
Group CG	2.7084	0.9340	2.900	0.00373
Subject/Object	2.8617	0.6192	4.622	<.001

8.2.2.4 Other Correct Responses and *NPTop*

The next model concerned with the total of *Other Correct* responses. The model turned out to be marginally significant ($x^2(1) = 3.7493$, $p = 0.05283$) but did not reveal any significant group effects. The model on *NPTop* responses did not turn out to be significant ($x^2(1) = 0.4753$, $p = 0.4906$) and did not reveal any additional group effects.

To sum up, there were no significant differences between the DG and the CG on the production of *Other Correct Responses*. The summary of the statistical results can be found in Table 8.16

Table 8.16: Summary of the statistical analysis on Other Correct responses

Other Correct Responses	**Estimate**	**SE**	**Z**	***p***
Total Correct Responses				
(Intercept)	-5.167	1.091	-4.735	<.001
groupCG	-17.971	5478.484	-0.003	0.997
Nptop				
(Intercept)	-10.377	4.747	-2.186	0.0288
Group CG	-17.818	58707.085	0.000	0.9998

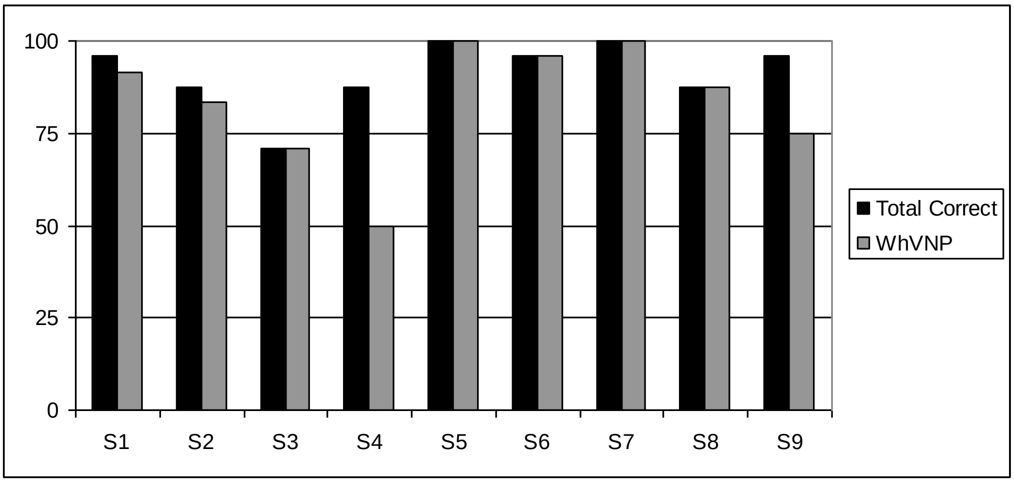
8.2.2.5. Erroneous Responses

Since the percentages of the erroneous responses were particularly low, no further analyses were conducted. Nonetheless, even in the previous experiments no significant differences were obtained for the different error categories due to the small amount of errors. Thus, we shall refer to the errors with more details in the discussion section.

8.2.3. Individual Performance

The individual accuracy scores on the *Overall Correct* and *WhVNP* responses for the DG can be found in Figure 8.2.

Figure 8.2: Individual Accuracy Scores for the DG on the Overall Correct Responses and Correct WhVNP responses



It is apparent that the performance of the DG is variable. However, the general performance of DG children on the production of wh-questions cannot be characterized as impaired comparing to Italian. It is a fact that the acquisition of wh-questions in Greek occurs much earlier than in Italian (Stavrakaki, 2001; Guasti et al. 2012), but nonetheless, the data are rather different. Despite this finding, there are differences among the subjects of the Greek DG and the subjects of the CG.

In order to investigate more the individual differences, the z-scores of the participants of the DG group were calculated (The mean raw score of the CG was 23, 6667). Four out of nine children (S2, S3, S4, S8) were found to be significantly below the mean of the CG.

S1 had only one error, but this error was on erroneous case assignment and should be taken into consideration. Therefore, it appears, that even one error can make a difference and specifically if this error is qualitatively different, just like in the case of S1. S2, whose score differed significantly from the mean of the CG had two errors on case and one error on case and agreement. S3, had a phonetic error that leads to erroneous gender marking of the *object* NP and five *WhoO* questions instead of *WhichO* questions. Finally, S8, had two errors of lexical substitution of the verb and one error of incorrect inflection of the subject NP in a *WhichO* question.

To conclude, the production of wh-questions in Greek was not found to be equally problematic as in Italian.

8.2.4. Discussion-Greek data

The results on the production of who and which local questions by Greek DD and typically developing children can be summarized as follows:

- DG children were found to differ significantly from their typically developing peers on the production of *Overall Correct Responses*
- DG children were found to produce significantly less correct *WhVNP* responses than their typically developing peers
- For both of the aforementioned responses there was an effect for object questions, whereas no effect was revealed between *who* and *which* questions
- No significant differences were revealed between the DG and the CG on the total of *Other Correct* responses.

Greek DG children, despite their overall good performance, were found to differ significantly from their typically developing peers on the production of wh-questions. This difference was found to occur due to the type of questions and not due to the wh-element. Hence, DG children were found to have certain difficulties with object questions. Moreover, they were found to produce significantly less correct *WhVNP* responses and again, for this structure *object* questions were found to be more problematic.

Despite the statistical findings, it is a fact that DG children were not particularly impaired and exhibited a limited number of errors. Certainly, the contribution of age is to be considered and probably if the participants of the DG group were younger, additional errors would have been noted. Of crucial importance, however, is the consideration of sporadic, yet ungrammatical errors that occurred.

More specifically, since the participants are of a certain advanced age and previous research (Stavrakaki, 2001) has shown almost excellent mastery of wh-questions in Greek typically developing children already at a young age, we were not expecting to find persistent difficulties, at least of the same extent as it has been reported for SLI (Stavrakaki, 2001, 2006). Therefore, the current findings do not agree with the findings in SLI in terms of severity. As far as the errors are concerned, within the DD group, there were two children who exhibited case and agreement errors. Case errors have indeed been reported for SLI children in Greek by Stavrakaki (2001, 2006). Therefore, this also shows an additional developmental contribution to the specific error pattern. If we also consider that these errors were found even in the oldest child of the DG (S2, CA: 11;5), then this shows a linguistic delay. Nonetheless, even if the number of these errors was very limited (4 errors: one for S1 and 3 for S2), it still differentiated DG children from their typically developing peers. After all, (as we already discussed about the advanced age of the children), even one error of this type can be indicative of deviant linguistic development. The other error that should be noted, although limited was the one of verb agreement, that was also found to occur with additional case error. Let us consider the examples below:

Case error

**Pjon travoun tous δrakous ?*

Who-acc.masc.sing. pull-3rdPlurPr the-acc.masc.plur. dragons-acc.masc.plur.

instead of

Pjon travoun i δraki ?

Who-acc.masc.sing. pull-3rdPlurPr the-nom.masc.plur. dragons-nom.masc.plur.

The error concerns the postverbal NP, in which nominative case is substituted by accusative case, indicating problems with checking operations (Chomsky, 1995). It can easily be assumed that probably the specific child (S1, CA; 10:5) had exhibited more serious difficulties with wh-question formation at a younger age.

Agreement Error

**Pjon chaidevi i laγi ?*

Who-acc. pet-3SingPr the-nom.masc.plur. rabbit-nom.masc.plur.

instead of

Pjon chaidevoun i laγi ?

Who-acc. pet-3PlurPr the-nom.masc.plur. rabbit-nom.masc.plur.

In this sentence, the error is specific to the verb, which is erroneously marked for 3rdSingPr instead of 3rdPlurPr, whereas the postverbal NP is correctly marked for case. Previous researches in Greek SLI (Clahsen and Dalalakis, 1999; Smith, 2008) have reported a generalization of the 3rd sing., a phenomenon that have been documented in the very early stages of typical language acquisition in Greek (Stephany, 1997).

This error was attested only in one child (S2), who also exhibited the next error (Case and Agreement) and only within the context of *object* questions. Therefore, it appears that the load of producing an object question, can reveal additional problems, which need to be further investigated in DD.

Case and Agreement Error

**Pjon laγo tromazi tous likous ?*

instead of

Pjon laγo tromazoun i liki ?

In this particular example, both the verb is erroneously marked (3rdSingPr) as well as the postverbal NP (accusative case instead of nominative), resulting in a combined error. This is a rather complex case of error, but it can be interpreted by previous findings in Greek SLI (Clahsen and Dalalakis, 1999; Stavrakaki, 2001; Smith, 2008, Mastropavlou, 2006) as well as by the complexity of the sentence, a *which object* question.

As far as the common errors between the DG and the CG are concerned, these were the ones of *who object* questions instead of *which object* questions. Only one error of this type was found in the CG. Nonetheless, even if this is not a grammatical error, it appears that it should not occur systematically after a certain age. The other common error (one instance in each group) was the production of a *what* question instead of a *who* object question, that could be also random.

Finally, in the DG there were some instances of non-classifiable errors included also in the category *Other* and which were not observed in the CG. First, there was an instance of a phonetic error, that even if this was unique, we consider reporting it:

Pji maγi vrechoun* ***to* *kirio ?*
Who-nom.masc.plur. wizard-nom.masc.plur. splash-3rdPlurPr the-acc.neut.sing. gentleman-acc.masc.sing.

instead of

Pji maγi vrechoun ***ton*** *kirio ?*
Who-nom.masc.plur. wizard-nom.masc.plur. splash-3rdPlurPr the-acc.masc.sing. gentleman acc.masc.sing.

This is clearly a phonetic error, caused by the deletion of the final –n of the definite article. However, it results into gender alteration of the article and the same subject (S3) exhibited similar phonetic errors in the articles experiments. This is something to be taken into consideration, as phonetic errors can occur in the production of DD children. Nonetheless, this cannot be characterized as a grammatical error, but should be taken into account when the experimental sentences include masculine and neuter nouns (something that was not the case for the current experiments), as this could cause further implications.

To conclude, it appears that wh-question production should be further investigated in children with DD in Greek and especially in children of a younger age. Nonetheless, when difficulties occur, these can be observed even at an older age, but they are attested in a limited number of errors. In cases in which errors occurred, these differentiated the children of the DG by the children of the CG successfully.

8.3. Discussion: Italian-Greek data

The current chapter investigated the production of wh-local questions in Italian and Greek DD and TD children. The findings in both languages can be summarized as follows:

- DD children were found to produce significantly less correct responses than their typically developing peers
- DD children were found to produce significantly less *WhVNP* correct responses than their typically developing peers and in Italian additional effects were revealed for *object* questions
- In both languages *object* questions were found to be processed with more difficulty than *subject* questions, but in Italian this was specific to the *WhVNP* structure
- In Italian, DG children were found to produce significantly more alternative correct responses, something that was not found in Greek.
- In Italian, DG children were found to have particular problems with *which* questions, something that was not statistically corroborated in Greek.
- The performance of Italian DD children was generally lower than the one of Greek DD children.

DD children in both languages were found to produce significantly less correct responses than their typically developing peers. This finding is in agreement with previous research in complex sentence processing in DD (Byrne, 1981).

This difference revealed further asymmetries between *who* and *which* questions on the *Overall Accurate* responses in Italian, a finding similar with the findings reported by Guasti (2012, to appear), suggesting that DD children have particular problems with *which* questions. Generally, *which* questions are more difficult to process due to additional discourse-linked status which interferes with the further syntactic complexity in the formation of *which object* questions (Avrutin, 2000). However, these difficulties were not observed equally or systematically across all DG subjects, a finding also in agreement with Guasti (2012, to appear).

The performance on *which* questions has to be evaluated according to the different errors that were attested and in the case of Italian DD, the *Overall Correct* performance between *which subject* and *object* questions was not particularly different. In particular, instances of production of *who* questions instead of *which* questions is a phenomenon that has been reported even for typically developing children of younger age (Guasti et al., 2012). However, such instances were not observed in the CG, and this probably shows a developmental difference between certain children of the DG and the children of the CG. Nonetheless, we should not exclude the possibility that such instances of *who* instead of *which* questions can also occur for TD children, due to the limited number of participants.

Contrary to the asymmetry between *who* and *which* questions in the *Overall Correct Responses* in Italian, in Greek there was an asymmetry between *subject* and *object* questions. We present the *Overall Accuracy Scores* for the DD groups in both languages in Table 8.17.

Table 8.17: Overall Accurate Responses in the production of wh-questions in the Italian and Greek DD groups

Overall Correct Responses	**WhoS**	**WhoO**	**WhichS**	**WhichO**	**Total**
Italian DG	**91,67**	**83,33**	**66,66**	**71,67**	**78,33**
Greek DG	**98,15**	**87,03**	**96,3**	**83,33**	**91,2**

The asymmetry between *who* and *which* questions in Italian is evident. In the case of Greek, even if the differences are not gross between *subject* and *object* questions, they are still attested. Despite the difference on the statistical findings between the two languages (*who vs. which* in Italian and *subject* vs. *object* in Greek), there are certain similarities. In both groups, the highest accuracy scores have been obtained for *who subject* questions, yet with an almost excellent performance in Greek. In the case of *who object* questions, the performance between the groups is more or less similar. In the case of *which subject* questions, however, there is a striking difference between the two groups, as in Greek the accuracy score is almost excellent and the two errors that were observed were not grammatical. In the case of *which object* questions, both groups show a lower performance, yet the performance is higher in Greek. There is also a difference on the Total accurate performance between the two groups, showing that the production of wh-questions in Greek DG children is not equally problematic as in Italian.

The contrasting difference between the two groups was the performance on *which subject* questions. In Italian, there were different errors attested for the specific category that were not observed at any instance in the Greek DD group. Furthermore, the study by Guasti et al. (2012) reports very high accuracy percentages for the specific question type by young Italian TD children. Therefore, it appears that this category is particularly problematic for Italian DD children. In Greek, Stavrakaki (2001) had reported difficulties with *which subject* questions for SLI children, which were not observed in the Greek DD group. *Which subject* questions are problematic only for certain Italian DD children.

The next finding between the two languages concerns with the production of *WhVNP* structures, which was found to result in significant differences between the DD and TD groups in both languages. Furthermore, in both languages an effect was revealed for object questions, whereas there was no effect between *who* and *which*. We present the results of both DD groups in Table 8.18.

Table 8.18: Correct WhVNP responses in the Production of wh-questions in the Italian and Greek DD groups

Overall Correct Responses	**WhoS**	**WhoO**	**WhichS**	**WhichO**	**Total**
Italian DG	**75**	**66,66**	**66,66**	**41,66**	**62,5**
Greek DG	**98,15**	**72,22**	**96,3**	**68,51**	**83,8**

Again, there are both differences and similarities between the two languages. First of all, in all cases, Greek DG children produce apparently more correct *WhVNP* responses than the Italian DG children, and there is a noteworthy difference for *who* and *which subject* questions. In both languages, the lowest accuracy scores have been obtained for object questions, yet there is a striking difference for *which object* questions and on the overall correct production of the *WhVNP* structure.

The difference on *WhVNP* was expected to be found, since previous researches in both languages (Stavrakaki, 2001; Guasti et al., 2012) have reported striking differences. In Greek, *WhVNP* structure is acquired much earlier than in Italian, and this phenomenon is more likely to be attributed to the contribution of morphological case, as already interpreted by Guasti et al. (2012), especially if we consider the findings on *object* questions.

In both languages, DG children were found to produce alternative correct responses especially for *object* questions. In Italian, however, there was a significant difference between the DG and the CG on the amount of *Other Correct* responses. The highest percentage of *Other Correct* responses was observed in the case of *which object* questions, as this can be observed in the following table:

Table 8.19: Other Correct responses in the Production of wh-questions in the Italian and Greek DD groups

Overall Correct Responses	**WhoS**	**WhoO**	**WhichS**	**WhichO**	**Total**
Italian DG	**16,67**	**16,66**	**0**	**30**	**15,83**
Greek DG	**0**	**14,81**	**0**	**14,81**	**7,4**

In Greek, there were also instances of alternative correct responses, but they did not occur to the same extent as in Italian, confirming also the previous findings on *WhVNP* and *Total Correct Responses*, and the conclusions by Guasti et al. (2012) on the particular difficulties that agreement operations impose in Italian, especially for *object* questions. In Italian, *NPTop* structures resulted in significant group effects and the children of the DG were found to produce significantly more *NPTop* sentences than the CG. This finding is in line with Guasti et al.'s (2012) who found that young Italian TD children produce *NPTop* questions as an avoidance strategy for the *WhVNP* structure in *object* questions and the results reported by Guasti (2011) on a group of Italian DD children.

Therefore, the results confirm previous findings, as far as the differences between the two languages and the alternative correct strategies are concerned. The summary of the findings on *Accurate* responses can be found in Table 8.21.

8.3.1. Erroneous Responses

As we have already presented so far, the accuracy in the Italian DG was lower than in the Greek DG. Consequently, the amount as well as the quality of errors was in many cases different between the two languages. We shall first comment on the common errors that were attested.

The first common error between Italian and Greek DG was the one of *whoO* questions instead of *whichO*, whereas in Greek there were no instances of *whoS* questions instead of *whichS*, something that was observed in Italian. Let us consider the Table 8.20:

Table 8.20: Percentages of who instead of which questions in the Italian and Greek DG

Who instead of Which questions	***WhoS* instead of *WhichS***	***WhoO* instead of *WhichO***	**Notes**
Italian DG	8,33	8,33	no relevant errors in the CG
Greek DG	0	11,11	Only one *whoO* instead of *WhichO* in the CG

Moreover, in the case of the Italian DG, there were additional instances of production of *who* reversed questions, as well as ungrammatical *who* questions, something that was not observed in Greek. Again, these findings show that *which* questions are more difficult for Italian DG children. In the case of production of *who* instead of *which* questions, there is a fundamental difference between the two languages. In Greek, the wh-element for *who* and *which* is homophonous and it is only the drop of the noun that transforms a *which question* into a *who* question. In Italian, however, a different *wh* pronoun is required, namely *quale* instead of *chi* or *che* instead of *chi*.

Therefore, a certain similarity can be attested between the two languages in cases of noun drop when a *which* question is formed on the basis of *che+NP*, since this is phonologically closer to *chi*, by contrast to *quale*. Still, there are dissimilarities, since in Greek the drop of the noun results into a *who* question, whereas in Italian the drop of the noun results in a *what* question. Let us consider the following examples:

(GR) *Pjon maγo vrechoun i kirii? whichO question*

Who-acc. wizard-acc. splash-3rdPlur *the gentlemen-nom. ?*

Which wizard are the gentlemen splashing?

(GR) *Pjon vrechoun i kirii? whoO question*

Who-acc. splash-3rdPlur *the gentlemen-nom?*

Who are the gentlemen splashing?

(IT) *Quale mago bagnano i signori ? whichO question*

Which-sing. wizard-sing. splash-3rdPlur the gentlemen?

Which wizard are the gentlemen splashing?

(IT) *Che mago bagnano i signori? whichO question*

What-sing. wizard-sing. splash-3rdPlur the gentlemen?

Which wizard are the gentlemen splashing?

Che bagnano i signori? whatO question

What splash-3rdPlur *the gentlemen?*

What are the gentlemen splashing?

Instead of

Chi bagnano i signori? whoO question

Who splash-3rdPlur *the gentlemen?*

Who are the gentlemen splashing?

Therefore, in Italian there are additional limitations for the formation of *which* questions and these were evident in the case of the DG. Consequently, the formation of *who* instead of *which* questions in Italian reflects even greater difficulties than in Greek, if we take into consideration the aforementioned examples. Nonetheless, there were no instances of noun drop when *which* questions introduced by *quale/i* were formed. However, there were instances of erroneous substitution of the *che+NP* with *chi+NP*, as in the examples below:

(S1): **Chi cigni insegue il cane?*

Who swans follows-3rdSing the dog?

(S3): **Chi mago…maghi bagnano il signore?*

Who wizard…wizards splash-3rdPlur the gentleman?

Interestingly, this substitution has not been reported by Guasti et al. (2012) for younger TD children. There is also the possibility that this substitution is due to the phonological similarity between *chi* and *che* and should be taken further into consideration, as far as DD children are concerned.

Finally, we must note that there were no instances of production of *which* questions instead of *who*, something that has been reported for Greek SLI (Stavrakaki, 2001; 2006). We consider reporting this finding, as this could probably differentiate between DD and SLI children in prospective studies.

Another common error that was noticed only once in each DD group was the production of an affirmative sentence with the placement of the wh-element independently after the sentence, as in the following examples:

(IT): I ricci svegliano qualcuno. Chi?

The hedgehogs are waking up someone. Who?

Instead of:

Chi svegliano i ricci? *who-object question*

Who are the hedgehogs waking up?

(GR): Kapjos travai tous δrakous. Pjos?

Someone is pulling the dragons. Who-nom?

In both cases, it is apparent that these children could not successfully form a wh-question. Even if this occurred only once in each group, it was not noticed at any instance in the TD groups.

The next common error, that again was very limited was the production of a *what* question and was classified in the category *Other*. The last common error that was observed, also included in the category *Other,* was the one of lexical substitutions of the verb.

No further common errors were observed between the two DD groups and the greater variety of errors was attested in Italian. We present a summary of the rest of the errors in Table 8.22.

Until this point, we have presented with details the accuracy scores between the two different DD groups on the different types of correct responses and we have also presented the errors. Moreover, we have presented in detail the differences concerning both the correct as well as the incorrect responses in the two languages.

We found that the production of wh-questions can be problematic for certain DD children, and that the errors can also be widespread and varying significantly from subject to subject. In Italian, the majority of the errors concerned with *which* questions, both *subject* and *object*. We also found that Italian DD children used significantly more alternative correct responses in order to overcome their difficulties in *which* object questions.

A really interesting finding is the reduced performance on *which subject* questions, which have been found to be mastered successfully relatively early (Guasti et al., 2012). The dominant errors for this category were the ones of *which object and who subject* questions. Another noteworthy aspect is that the three children who produced *which object* instead of *which* subject questions, did not produce *which subject* instead of *which object* questions neither *who subject* questions. In the CG there was only one instance of this reversed error. As already discussed at a previous section, we attributed this to a miscomprehension of the thematic roles. However, as the data by the CG also show, this error pattern should be observed in more than one item.

By contrast, in the Greek DD group, the performance on *which subject* questions was almost ceiling and the errors that were observed were not grammatical. This contrasts the findings by Stavrakaki (2001) on Greek SLI children. However, in a follow-up study (Stavrakaki, 2006), the same SLI children achieved high accuracy scores on *which subject* questions, showing a noteworthy improvement.

Returning now again to our findings and as far *which object* questions are concerned, these were found to be problematic for certain children of both DD groups. In Greek, however, there was only one instance of an ungrammatical *which object* question, something that was not the case in Italian. In Greek, most of the errors consisted of the production of *who object* instead of *which object* questions, an error that has also been observed in typically developing children. However, it is more likely that this pattern of error should not occur after a certain age, and probably as indicated by the performance of the control groups and previous research data of TD children (Stavrakaki, 2001), should not occur in more than one item.

By contrast, in Italian, the errors that were produced were characterized by a greater variability and more instances of ungrammatical questions were observed. The findings are in support of the theoretical approaches on the differences between Italian and Greek held by Guasti et al. (2012), since there were fundamental differences between the two languages. Nonetheless, in Greek, we were not expecting to find gross difficulties with wh-questions with respect to the findings of Stavrakaki (2001; 2006). In Italian, however, difficulties were expected with respect to previous researches (de Vincenzi et al., 1999; Guasti et al., 2012).

To conclude, the differences of DG children on wh-formation need to be further investigated. On the one hand, in Greek, these should be investigated in younger DD children, as it is also possible that the advanced age of many of the subjects of the Greek DG might have influenced the results. Despite this factor, within the DG group, there were some instances of sporadic errors which suggest that in younger DD children more difficulties could be observed. On the other hand, in Italian, a direct comparison with SLI children based on the qualitative analysis of the errors could provide additional insight and contribute to the characterization of language skills in DD.

Table 8.21: Summary on the findings on accuracy in the Italian and Greek DD groups

	Overall Correct Responses	***WhVNP***	**Other Correct Responses**	**NpTop**	**Argument Drop**
Italian DG	Significantly lower than the CG – significant group effects for *which* questions	Significantly lower than the CG- significant group effects for *object* questions	Significantly higher than the CG	Significantly higher than the CG	No significant effect
Greek DG	Significantly lower than the CG- significant group effects for *object* questions	Significantly lower than the CG- significant group effects for *object* questions	No significant difference	Not enough to conduct statistical analyses	Rare instances of production in both groups
Differences between Italian and Greek DG	Percentages higher in Greek, near ceiling performance on *whichS*	Percentages higher in Greek, near ceiling performance of the Greek DG on *whichS*	Higher percentages in Italian for *whichO* questions	Produced by more DG subjects in Italian	Higher percentage (yet not resulting into striking differences) in Italian for *whichO* questions
Similarities between Italian and Greek DG	No striking differences in *whoO* questions, outstanding difference on *whichS* questions	lowest scores for *object questions*	No particular differences for *whoO* questions, no alternative responses for *whichS* questions	No particular difference on the percentages	Mostly observed for *object* questions

Table 8.22: Summary of the Erroneous Responses in the Italian and Greek DD groups

Erroneous Responses	**WhoS**	**WhoO**	**WhichS**	**WhichO**
Italian DG	*WhoO* instead of *WhoS*	*Who subject questions*, Agreement Errors	-*WhoS* and *WhichO* grammatically correct questions instead of *whichS* -*Other Ungrammatical structures*	-*WhoO*, *WhichS* grammatically correct questions instead of *whichO*. -Ambiguous *who and which questions* -*Other Ungrammatical structures*
Greek DG	Performance almost at ceiling	Case errors Agreement Errors	Only two non-grammatical errors	-*whoO* questions -one instance of case and agreement error
Differences between the Italian and Greek DG	No reversed *WhoO* questions were observed in Greek	More *WhoS* questions in Italian	*WhichS* questions are problematic only for Italian DG children	No *whichS* questions were observed in Greek

8.4. Summary of the findings in Developmental Dyslexia and Conclusions

8.4.1. Summary of the findings

In the previous chapters we investigated Italian and Greek DD children's abilities in the production and comprehension of direct and indirect object clitics, definite articles and wh-questions. The profiles of DD children exhibited considerable variation across the tasks and across the two languages. We analyzed with details the relevant errors that differentiated the children of the DD groups and we discussed our findings according and against existing studies on SLI. Nevertheless, the data of the Greek DD children are discussed in relation with the findings in Greek SLI in the relevant chapter. Therefore, the current chapter concerns exclusively the findings in DD.

In order to proceed into the final discussion, the conclusions and the implications we present the findings on the two different languages in Table 11.1. We indicate the cases in which significant differences were detected. Moreover, the individual accuracy scores of the Italian and Greek DD children can be found in Appendix V and Appendix VI respectively.

The findings of the current study are presented in Table 11.1

Table 8.23: Summary of the findings in the Italian and Greek DD groups

Task	**Italian**	**Greek**
Direct Object Clitics Production	**<.05**	>.05
Direct Object Clitics Comprehension	**<.05**	>.05
Definite Articles Production	**<.05**	**<.05**
Definite Articles Omissions Task	>.05	**<.05**
Definite Articles Grammaticality Judgment Task	**<.05**	>.05
Indirect Object Clitics Production	**<.05**	**<.05**
Indirect Object Clitics Comprehension	>.05	>.05
Wh-questions Production	**<.05**	**<.05**

8.4.2. Object Clitics

In the production of direct object clitics, Italian children were found to differ significantly from typically developing children. The more frequent errors were the ones of omissions, gender and phonetic substitutions. We discussed our findings in relation with recent findings in Italian SLI and DD (Arosio et al. 2010; Cantiani, 2011; Guasti, 2012 to appear among others). The current findings confirm these previous researches, as well as the reliability of direct object clitics production for screening difficulties in language production. Italian DD children were also found to differ significantly on the comprehension of direct object clitics and different performance profiles were identified within the DD group. Their performance, however, was found to be determined also by deficient metalinguistic skills, since certain difficulties could not be attributed solely to the prosodic properties of direct object clitics in Italian.

First, the clitic response included the clitic in sentence initial position (*i.e. la bagna*) and this can account for a part of the omission responses. However, if the difficulty with direct object clitics were limited only to phonology, then, the majority of the DG children would exhibit a bias for the omission response. Six children's performance was unimpaired. The results show the need for additional investigation in Italian, with particular emphasis on the phonological properties of the verbs. Despite the aforementioned limitations in Italian, the data are in agreement with previous studies in DD that report deficits in phonological, metamorphological, and morphosyntactic processing (Altmann et al., 2008; Joanisse, 2004; Rispens, 2004 among others) and with previous studies in Italian DD and SLI (Arosio et al., 2010; Cantiani, 2011; Guasti, 2011).

In Greek, no significant differences were observed, but the omissions, (even if limited), differentiated two children of the DD group in the production task. In the comprehension task, DG children were compared to younger children and still, no significant differences were revealed. It is a fact, however, that the Greek DD group included also children of older age, and probably in the case of direct object clitics this could account for the findings on the overall non-significant differences between the DG and the CG. Nonetheless, the results indicated that direct object clitics were not particularly problematic and no different performance profiles were identified as in the case of the Italian DD group. Taking into consideration, however, the recent study of Talli (2010) in Greek DD, the research should be replicated with younger DD children.

In the production of indirect object clitics, both Italian and Greek DD children were found to differ significantly from typically developing children. In the case of Italian, the phonetic simplifications of the indirect clitic were the prominent error, whereas in Greek, different errors were detected. An interesting finding, however, between the two languages is the one of the omission of the direct object. This error pattern was attributed into difficulties in the formation of clitic clusters, which are commonly used in both languages and is probably manifested as a consequence of their deficient phonological skills (Vellutino, 1977, 1979). Alternatively, if the direct object was omitted in the form of an NP, it confirms the findings of Altmann et al. (2008) on deficient skills in complex sentence formation, taking into consideration that ditransitive verb constructions are more demanding.

As far as the production of direct and indirect object clitics is concerned with, we found contrasting patterns between the two languages. Production of indirect clitics is equally vulnerable in both Italian and Greek, but in Greek is more vulnerable than direct object clitics. Moreover, the errors that were attested indicate a developmental linguistic lag (Vellutino, 1977; Byrne, 1981) at least for the children who were found to have particular difficulties. In the comprehension, however, none of the DG showed significant differences and this is a finding that at least for now should be attributed to the experimental method. If we had used a task similar to the one of direct object clitics (grammaticality judgment task of omissions), then probably we would have obtained different results. Nonetheless, despite the non-significant differences, the performance of many DG children was not ceiling. Again, additional research is needed. Nonetheless, the current results on the specific test, taking into consideration the experimental method, are in agreement with previous studies in DD that report no significant differences (Smith et al., 1989; Shankweiler et al., 1995; Robertson and Joanisse, 2010) on sentence-picture matching tasks.

To recapitulate, as far as the production of direct and indirect clitics is concerned, the present study provides evidence that their production and comprehension can be impaired among children with DD and the findings are consistent with previous researches in both languages (Arosio et al. 2010; Cantiani, 2011; Guasti, 2012 to appear; Smith, 2008; Stavrakaki and van der Lely, 2010; Talli, 2010) as well as with previous research in morphosyntax in DD (Altmann et al., 2008; Jimènez et al., 2004; Joanisse, 2004; Rispens, 2004; Waltzman and Cairns, 2000, among others).

8.4.3. Definite articles

In both languages, DD children were found to differ significantly by their typically developing peers on the production of definite articles. Their overall, performance, however, was far better than the one observed in the production of object clitics. In fact, their performance on article production was comparable to one of their typically developing peers and only specific types of articles were found to be weaker.

In Italian, this was manifested as a weakness in producing the masculine singular article *il*, and in Greek the weaknesses were more apparent for the plural articles.

We have already discussed the different properties of these articles in Chapter 8 and we have also addressed the issue of limitations in lexical retrieval. The problems that were observed in the article production tasks, in the case of Italian are attributed to the deficient phonological skills that characterize DD (Vellutino, 1979; Snowling, 2000). In the case of Greek, also phonological deficiencies were found to determine the production of definite articles, but the performance was not equal across subjects. For this specific article omissions were attested. Certainly, the grammatical and phonological properties must be considered, but the impact of unsuccessful lexical retrieval must not be excluded either, at least as far as production is concerned. Nonetheless, we found that articles are processed rather successfully and that their production is not impaired, despite the significant differences. Furthermore, significant differences were revealed between the definite articles and their homophonous direct object clitics and this shows that in subsequent comparisons with SLI, the production of definite articles must be additionally considered.

The findings suggest that there is a clear discrepancy between direct object clitics and articles, contrary to the findings of Bottari et al. (1998) and in agreement with the findings of Leonard et al. (1992), Smith (2008) and Jakubowitz et al. (1998). In Greek, no particular differences were observed in the production tasks. These findings suggest that a phonological deficit cannot affect equally all word forms, since we found significant differences between the definite articles and their homophonous clitics in Italian and in Greek, the results were not discrepant. Certainly, we found errors that are related to deficits in phonology, but these were not observed in the production of all the forms systematically.

In the grammaticality judgment task of omissions, Italian DD children were not found to differ significantly from their typically developing peers. The corrections, however, that were provided differentiated certain children of the DD group from TD children. In Greek, significant differences were revealed, but most of the inappropriate corrections that were provided were grammatical. The dominant error was the one of acceptance of the omission. This can be attributed both to the phonological properties of certain articles, but also in some cases can indicate a developmental lag, at least as far the feminine plural articles are concerned (Stephany, 1997; Smith, 2008). Nonetheless, additional comparisons with younger children are needed in order to draw more definite conclusions.

In the grammaticality judgment task of definite articles (grammatical violations), Italian DD children were found to differ significantly because of the reduced performance of one child. Indeed, the specific child demonstrated deviant performance in both of the grammaticality judgment tasks. In Greek, no significant differences were revealed. Sporadic errors were attested, but they were not indicative of impaired processing. Moreover, none of the children failed the task, which is also an additional criterion [19].

To recapitulate, the performance of the DD children on the grammaticality judgment tasks was not found to be impaired, yet, individual variation was attested. Quantitative and qualitative differences were observed both between the DD and the CG, but also between the DD children, something that was more apparent in Italian.

8.4.4. Wh-questions

Since we provided a very detailed analysis of the differences between the two languages in the current Chapter, we shall limit the present discussion in relation with previous studies in DD. We already saw that in both languages DD children were found to differ significantly on the production of wh-questions. The greater difficulty, however, was attested in Italian, something clearly attributed to the particularities of wh-question formation in the specific language (De Vincenzi et al., 1999; Guasti et al., 2012). We found that Italian DD children have particular difficulties with the production of subject and object D-linked questions and as far as the *WhVNP* structure is concerned, the difficulties are specific to object questions. Object questions were found to be problematic in both languages.

Again, however, there was considerable individual variation and not all DD children were found to experience problems with the formation of wh-questions. Instances of ungrammatical errors were attested in both languages, but they were more frequent in Italian. In the Italian DG, five out of ten children were found to be significantly below the mean of the CG. In Greek, four children were found to be significantly below the mean of the CG.

[19] see Chapter 9 for the findings in Greek SLI

Even if our groups are composed by a small number of participants, in both languages, half of the children exhibited particular problems with the formation of wh-questions. Previous research in DD (Byrne, 1981; Mann et al., 1984) has reported limitations in the processing of syntactically complex structures, and in particular for object clauses. Our results are in agreement, as far as the complexity of object clauses is concerned, but the fact that half of the children of the DD groups exhibited non-age appropriate profiles cannot be interpreted according to the processing hypothesis (Mann et al., 1984). Nonetheless, in Greek, there were some very rare instances of case errors that have been documented in Greek children with SLI (Stavrakaki, 2001; 2006 and present study) and in Italian grammatical errors were attested as well.

The findings on wh-production are more compatible with the interpretation by Byrne (1981) and the developmental linguistic lag (Vellutino, 1977, 1979) that characterizes children with DD, since Italian DD children were found to use alternative strategies that have been found in typically developing children of younger age (Guasti et al., 2012). Certainly, the processing deficits caused by limitations in STM (Robertson and Joanisse, 2010; Shankweiler and Cairn, 1986) must not be excluded, but additional investigation is needed and in particular through a sentence repetition task with wh-questions.

To conclude, the production of syntactically complex sentences in DD is not equally problematic across all dyslexic children, a finding in agreement with Guasti (2012, to appear) on wh-production in Italian children with DD. This is apparently attributed to the fact that DD is a disorder that can be manifested with or without language deficits (Carroll and Myers, 2010), and subsequent researches should focus on these dyslexic children who have a history of early language delay.

8.4.5. Conclusions

Overall, the characterization of language deficits in DD appears rather complicated, taking into consideration that DD is not always manifested with problems in the non-phonological domains of language. Even in this case, however, and as our results indicate, the impacts of the deficits in phonology can differentiate DD from typically developing children.

The current study demonstrated, in line with previous researches in DD, that language production and comprehension are not intact in many cases of dyslexic individuals and that the role of phonology is crucial. It is difficult, however, to provide definite explanations, since there is considerable variation across subjects and across tasks. However, there were also cases in which their production and comprehension was more or less comparable to the one of their typically developing peers.

As far as the present series of tests is concerned with, in line with the findings by Cantiani (2011), Guasti (2012, to appear) and Talli (2010) we found that object clitics and wh-questions can be vulnerable domains. By contrast, definite articles were generally processed better, and the performance of DD children on the grammaticality judgment tasks should be probably reconsidered for subsequent comparisons with SLI. As Robertson and Joanisse (2010) noted, in previous studies with grammaticality judgment tasks that have reported significant differences (Rispens et al., 2004; Rispens and Been, 2007), the tasks were administered without supporting picture context, causing high storage and processing demands. The tasks of the present research included picture context and imposed the additional demand of correction. Considering the errors that we detected, which were mostly attributed to DD children's limitations in phonology, as well as the findings in Greek speaking children with SLI, that we report with details in the next Chapter, it is probable that similar tasks could be promising for differentiating between the two disorders.

To conclude, the performance of DD children on the current tasks indicate, that the investigation of language deficits between DD and SLI should focus on structures that are particularly problematic for SLI children through the implementation of different experimental designs. The need for additional crosslinguistic investigations is actual, but the existing researches suggest that the differentiation between the two disorders should be based on the qualitative investigation of each child's individual performance.

Chapter 9: The study in Greek Speaking Children with Specific Language Impairment

9.1. The study

The research was conducted within the framework of the abroad collaboration of the experimenter with the Department of Speech and Language Therapy -Technological Educational Institute of Patras, Greece. Ten SLI children were recruited and tested in the Center for Child and Adolescent Mental Health, in Mesolongi[20]. Two children were recruited from a private Speech and Language Therapy center in Athens[21], and two (S10 and S14[22]) were referred to the experimenter for evaluation of their difficulties[23].

A total of 14 children participated in the study, but not all children were tested across all the tasks. In most of the cases this was due to their extraordinary difficulties or because another testing session was not made possible. The age range of the group was wide 5:0-8:10 and the criterion for participation into the current study was the diagnosis of SLI, based on strict exclusion criteria. More specifically, non-verbal IQ within the normal range >85, no history of otitis media, no history of neurological damage and psychoemotional disorders. There were no specific criteria for inclusion according to the children's scores on verbal measures, since all but one child (S14) were receiving speech and language therapy services and their skills at many points were ameliorated.

Due to the complexity of the tasks, the children were matched on chronological age with 14 typically developing children. The individual chronological age, the z-scores of non-verbal IQ (as measured on the Raven's Coloured Progressive Matrices) and the raw scores on the verbal measures of Production of Morphology and Syntax (subtest of the DVIQ Test, Stavrakaki and Tsimpli, 1999) and Expressive Vocabulary as measured on the standardized Greek version of the Word Finding Vocabulary Test (Vogindroukas, Protopapas and Sideridis, 2009) can be found in Appendix VIII.

The children of the control group were additionally assessed on a translated version (by the experimenter) of the Italian version of TROG-2 (Bishop, 2009).

[20] S9, S11 and S13 had completed their Speech and Language therapy programs, S11 was enrolled in special educational program for learning difficulties

[21] S6 and S7 were tested on separate sessions within a period of 4 months

[22] S14 was tested also within a period of 5 months

[23] S10 was already enrolled into speech and language rehabilitation and had received a diagnosis of selective mutism, S14 had not received language therapy prior to the participation in the research

9.2. Production of Accusative Object Clitics- Greek SLI and Typically Developing Children

9.2.1. Classification of responses

The analysis was conducted on a total of 672 responses (336 from each group). As a *Target* response was counted the one in which a direct object clitic was produced correctly marked for gender and number. The other responses were classified as follows:

-**Clitic**: included all sentences in which clitics were produced, irrespectively of errors on gender or phonetic errors

-**Verb Substitution:** when the clitic was correct but the verb was substituted

-**Omission**: when the argument was omitted

-**NP**: for cases of production of a full NP instead of a clitic

-**Gender**: when the clitic was erroneously marked for gender

-**Gender and number:** when the clitic was erroneously marked both for gender and number

-**Phonetic error:** when phonological errors occurred *(i.e. tu instead of tus, ki* instead of *ti)*

-**Other:** all other unclassifiable responses

9.2.2. Results

9.2.2.a. Target and Clitic Responses

The mean percentages of *Target* responses can be found on Table 9.1.

Table 9.1: Raw percentages of Target and Clitic responses on the Direct Object Clitic Production Task-SLI and CA

Group	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculine Plural (MPL)	Feminine Plural (FPL)
SLI target	**55,95** (28,57)	**51,18** (31,66)	**72,61** (32,43)	**57,14** (35,63)	**42,85** (37,95)
CA-target	**93,45** (6,47)	**92,85** (10,77)	**96,42** (7,09)	**88,09** (20,07)	**96,42** (7,09)
SLI clitic	**80,05** (23,95)	**78,56** (23,95)	**88,09** (21,11)	**79,76** (26,29)	**73,8** (30,46)
CA clitic	**98,21** (3,54)	**98,80** (4,45)	**96,42** (7,09)	**100** (.00)	**97,61** (6,05)

The model on *Target* responses resulted as significant ($x^2(1) = 19.964$, $p<.001$) and revealed additional highly significant group effects. The model on gender did not turn out to be significant ($x^2(1) = 1.7348$, $p = 0.1878$). By contrast, the model on number turned out to be significant ($x^2(1) = 4.3293$, $p = 0.03746$) and revealed additional significant effects for the singular number.

The next analysis concerned with the number of clitics that were produced. The model turned out to be significant ($x^2(1) = 10.654$, $p = 0.001098$) and revealed additional significant differences. With respect to the amount of clitics, neither the model on gender ($x^2(1) = 0.014$, $p = 0.9059$) nor the model on number turned out to be significant ($x^2(1) = 1.2075$, $p = 0.2718$). The summary of the statistical results for *Target* and *Clitic* responses respectively can be found in Table 9.2.

Table 9.2: Summary of the statistical analysis on Target and Clitic Responses

Target	**Estimate**	**SE**	**Z**	***p***
(Intercept)	3.1794	0.4355	7.300	< .001
groupSLI	-2.8934	0.5570	-5.194	< .001
(Intercept)	2.8793	0.4461	6.455	< .001
Group SLI	-2.8933	0.5574	-5.191	<. 001
Number Singular	0.6006	0.2760	2.176	0.0295
Clitic	**Estimate**	**SE**	**Z**	***p***
(Intercept)	5.3919	0.8160	6.608	< .001
groupSLI	-3.0946	0.9655	-3.205	0.00135

To sum up, SLI children were found to differ significantly on *Target* responses than the CA group and were additionally found to produce significantly fewer *Target* responses than the children of the CA for the plural number. SLI children were additionally found to differ significantly from the CA on the number of clitics that they produced, but this difference was not significantly correlated either with gender or with number.

9.2.2b. Erroneous Responses

The mean percentages of the different erroneous responses can be found in Table 9.3.

Table 9.3: Erroneous responses on the Direct Object Clitic Production Task

Error Type	Group	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculine Plural (MPL)	Feminine Plural (FPL)
Omission	**SLI**	**7,73** (12,85)	**8,33** (14,24)	**4,76** (10,18)	**8,33** (18,19)	**9,52** (18,15)
	CA	**0,29** (1,11)	**0** (.00)	**1,19** (4,45)	**0** (.00)	**0** (.00)
NP	**SLI**	**6,84** (9,88)	**8,33** (15,67)	**5,95** (12,41)	**7,14** (12,6)	**5,95** (10,55)
	CA	**1,49** (3,5)	**1,19** (4,45)	**2,38** (6,04)	**0** (.00)	**2,38** (6,04)
Gender	**SLI**	**11,01** (7,93)	**11,9** (15,23)	**7,14** (14,19)	**9,52** (19,29)	**15,47** (17,85)
	CA	**3,57** (5,85)	**3,57** (7,09)	**0** (.00)	**10,71** (20,26)	**1,19** (4,45)
Phonetic	**SLI**	**4,76** (4,86)	**5,95** (10,55)	**2,38** (8,9)	**5,95** (8,28)	**4,76** (13,75)
	CA	**0,89** (2,41)	**2,38** (8,9)	**0** (.00)	**1,19** (4,45)	**0** (.00)
Verb Substitution	**SLI**	**2,38** (7,78)	**1,19** (4,45)	**3,57** (13,36)	**2,38** (8,9)	**2,38** (6,05)
	CA	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
Gender and Number	**SLI**	**1,19** (3,43)	**0** (.00)	**0** (.00)	**4,76** (13,75)	**0** (.00)
	CA	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
Other	**SLI**	**10,71** (18,68)	**9,52** (16,93)	**7,14** (22,37)	**7,14** (15,62)	**19,04** (26,83)
	CA	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)

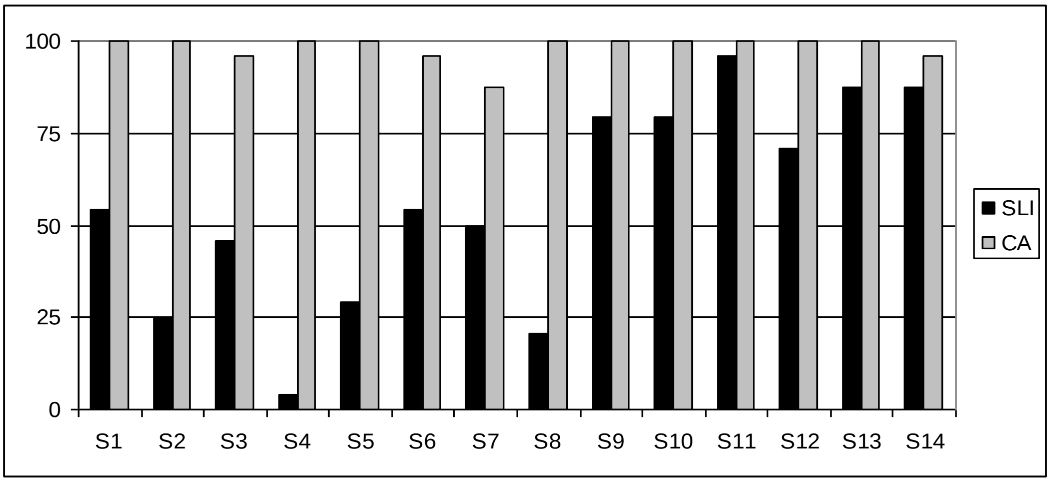
As can be observed, the errors of SLI children are variable. The highest percentages of errors concern the categories of *Gender* and *Other*. *Omissions* do not constitute the characteristic error of SLI children and were produced by the younger children of the SLI group. All the erroneous responses were included in the error analysis, but the models investigating group effects concerned the categories with the highest percentages, and in particular with *Omission, NP, Gender, Phonetic* and *Other.* The model on *Omissions* did not turn out to be significant ($x^2(1) = 1.4826$, $p=0.2234$). Similar results were obtained for *NP* ($x^2(1) = 0.2044$, $p = 0.6512$), *Gender* ($x^2(1) = 0.7568$, $p = 0.3843$), *Phonetic* ($x^2(1) = 0.2044$, $p = 0.6512$) and *Other* ($x^2(1) = 3.2369$, $p = 0.072$).

To sum up, no significant group effects were revealed for any of the error categories, something that is definitely to be attributed to different extent and manifestations of the deficits of SLI children on the production of direct object clitics.

9.2.3. Individual Performance on the Production of Direct Object Clitics

Due to the wide age range of the SLI group, we consider not to refer to z-scores, as far as the production task is concerned and present the individual performance of each SLI child according to the relevant performance of each child of the CA group (one to one matching). The individual performance on *Target* responses can be observed in Figure 9.1

Figure 9.1: Individual performance of the children of the SLI group on Target responses on the Direct Object Clitic Production Task as compared to the individual performance of the children of the CA group



As can be observed, the performance of SLI children is indeed variable and in most of the cases the difference between the SLI children and their CA control matched children is striking. The lowest scores of the SLI group concern mainly with the younger children. However, despite the fact that there are children who have performed better on the task, none of them has achieved ceiling performance. The individual performance of the SLI children shall be further discussed based on the individual raw scores and with a particular emphasis on the errors. Of particular interest is the fact that the children who have completed the SLT intervention, as well as the children who are characterized more by receptive and other broader cognitive deficits, do not show particular problems with direct clitic production. Nonetheless, after detailed observation of the data, it appears that these SLI children's production (S9, S10, S11, S12, S13) is mainly characterized by gender and phonetic errors. Gender and phonetic errors may sporadically occur in the CA as well, but the maximum amount of errors for the CA matched to these SLI children is 2. More than two errors can be indicative of difficulties.

The data of S5 and S7 are also of particular interest, since these children are characterized additionally by phonological deficits and specific learning difficulties. Combining the present data with the already existing ones and in particular the ones reported by Stavrakaki and Van der Lely (2010), the cases in which accusative object clitic production is still problematic in older SLI children are the ones of persistent SLI. However, as we already discussed, we included as many children as possible with different deficits in order to highlight their profiles and in order to be able to conclude on whether the production of direct object clitics can be a reliable marker for differentiating between SLI and DD in school aged children.

Again, as it appears, the production of direct object clitics appears to be particularly problematic in children with persistent SLI. Therefore, differentiating patterns must be probably investigated mostly in the cases of lighter-moderate impairments that could also meet the criteria for DD. We shall present details of the errors that were observed exclusively in the SLI group and were not observed at any instance in the DD group of our study. Moreover, we shall present even the errors that were observed in the younger SLI children, so that they can be reviewed in possible differentiation of SLI and pure speech and phonological disorders.

Table 9.4: Individual raw scores on Target and Erroneous responses of the participants of the SLI group

Subject	Raw	Omission	NP	Phonetic	Gender	Other	Notes
S1	13	1	4	1	5	0	Intact performance on the feminine singular clitic
S2	6	9	2	2	5	0	additional pragmatic limitations
S3	11	0	0	2	5	5	Intact performance on the feminine singular clitic
S4	1	3	1	14	2	5	Possible generalization of the feminine singular clitic
S5	7	0	0	0	1	16	verb substitutions, number errors, gender and number errors, verb agreement errors
S6	13	8	1	2	0	0	Intact performance on the feminine singular clitic
S7	12	1	6	1	2	2	erroneous NP
S8	5	4	7	0	1	7	erroneous NP-errors with word order
S9	19	0	0	0	4	1	
S10	19	0	0	3	2	0	
S11	23	0	0	1	0	0	
S12	17	0	2	1	4	0	Intact performance on the feminine singular clitic
S13	21	0	0	0	3	0	
S14	21	0	0	3	0	0	Only three phonetic errors on the masculine singular

There are several cases in which the feminine singular clitic is intact. Moreover, in the case of S4, a child additionally characterized by severe speech deficits, there were cases of production of the feminine clitic *ti* instead of the masculine plural. This, error, however, is not clear, since it could also reflect a phonological reduction of the feminine plural clitic *tis*. Nonetheless, since the feminine plural clitic has been found intact in other cases as well, the possibility of its generalization must not be excluded. Let us consider also the case of S6, a child also characterized by speech deficits, however, far more ameliorated than S4. The feminine singular clitic is the only one that is not omitted and is produced even with phonological errors i.e. *ki* instead of *ti*. In his production, other clitics are also produced successfully, but they are additionally omitted (at least two items in each of the other categories). Therefore, it can be assumed that probably the feminine clitic, along with the neuter, are the first to emerge in the initial stages of clitic production in SLI children. Even if we cannot make a statement, for which longitudinal data are needed, we have to report this possibility for diagnostic purposes.

To sum up, as far as young (preschool) SLI children's production is concerned and with particular reference to the subjects whose production was not limited by additional pragmatic deficits, for possible comparisons with pure speech/phonological disorders, where clitic production is expected to be characterized merely by phonological errors, the generalization of the feminine and the neuter clitic are probably expected to constitute a differentiating pattern.

In the cases of older children of the group, the errors were again variable and the interesting observation is that none of them achieved ceiling performance. However, the inspection of the individual data suggests that in school aged children, the deficits must be persisting in order to be able to characterize a child as Specifically Language Impaired based on the production of direct object clitics. The errors, however, that were observed in certain children of the group and which were not observed at any instance in the case of the CA or even the Greek DD group, could provide further insight.

9.2.4. Discussion

The current task investigated Greek SLI children's abilities to produce direct object clitics. The group was composed by children of different ages and the results that were obtained were characterized by particular variation. The findings can be summarized as follows:

- SLI children were found to produce significantly fewer *Target* responses than the children of the CA group and this difference was found to be significant for the clitics of plural number
- SLI children were found to produce significantly fewer *Clitic* responses than the children of the CA Group
- Gender of clitic was not found to be a significant factor neither for *Target* nor for *Clitic* responses
- The error analyses did not reveal significant effects for any of the errors

SLI children were found to differ significantly on the production of *Target* and *clitic* responses and this finding is in agreement with previously conducted studies on elicited production in Greek (Mastropavlou, 2006; Smith, 2008; Stavrakaki and van der Lely, 2010), as well as with other existing crosslinguistic studies (Arosio et al. 2010; Bortolini et al. 2006; Guasti, 2012 to appear; Jakubowicz et al., 1998). However, the findings on the different error categories are not in agreement with the aforementioned studies.

In the current study, no significant effects were revealed for the different errors, since as far as the errors are concerned, individual variation was attested. The errors of SLI children were variable and widespread. This finding was expected to occur, since first of all the group is composed by children of different ages and second, due to the fact that some of the SLI children had completed their SLT programs. The interesting finding is that even in the older children of the SLI group the performance on Target responses is not ceiling. The errors, however, are variable and clearly apart from the exposure to speech therapy, they depend on the severity of the deficits.

The rate of omissions was not high and this was an error that was not observed across all subjects. This finding holds probably for a developmental explanation and is in agreement with the findings by Stavrakaki and van der Lely (2010) in Greek and Arosio et al. (2010) in Italian.

As far as the substitutions are concerned, contrary to the findings of Mastropavlou (2006) and Smith (2008), we found only two instances of production of the neuter clitic *to* in substitution of the feminine singular. In some cases, the feminine singular clitic was intact, in one child it was found to be overapplicated and the SLI group's highest accuracy scores were attested for this category. Phonetic errors that result into the neuter clitic *to* were found in the case of the masculine singular and this is in agreement with these two aforementioned studies. In addition, gender errors had the highest percentage. These were errors that were also found to occur in the CA group. However, there were other errors that were not produced at any instance in the CA group and were characteristic of the linguistic impairments of SLI children.

After the detailed inspection of the errors that were attested in the SLI group, as well as in the Greek DD group, we consider presenting patterns the errors found exclusively in the production of SLI children, as these are qualitatively different. The relevant errors are presented in Table 9.5.

Table 9.5: Errors produced by the children of the SLI group on the Direct Object Clitic Production Task

Error Type	**Responses produced by SLI children**
NP	"*I kikni ***vrechi*** tis koukouvajies" the swans-plur. ***splash-3rdSPr*** the owls"
Number errors	***tin*** kitazi instead of ***tis*** pjani her-CLITfem.sing. look-3rdSPr instead of them-CLIT fem plur. catch-3rdSPr (number error with verb substitution)
Gender and Number errors	-i.e. *tous* instead of *tin* and vice versa (them-CLITmasc.plur. instead of her-CLITfem.sing.)
Verb substitutions, semantic and grammatical errors	-*ton kitazi* instead of *ton dagoni* (him-CLIT looks at-3rdSingPr, instead of him-CLIT bite-3rdSingPr) -tous mirizi instead of tin filai (them-CLIT.masc.plur. smell-3rdSingPr instead of her-CLIT.fem.plur. kiss-3rdSingPr)
Other	-"*kiniγoun tis ajeladhes ta aloγa"* VOS sentence possibly reflecting difficulty with clitic doubling (chase-3rdPlur the cows-acc. the horses-plur.) instead of *tis kiniγoun tis ajeladhes ta aloγa* (them-CLITfem.plur. chase-3rdPlur the cows-acc.fem.plur. the horses-neut.plur.) -irrelevant responses: i.e. target : tis cheretai-them-CLIT.fem.plur.: response: "tous cheretai i tin cheretai" (them-CLIT.masc.plur. or her-CLIT.fem.sing. greet-3rdSingPr)

As it appears, there are many points to be considered as far as the differentiation of DD and SLI is concerned on the direct object clitic production task. With respect to the findings on DD children in the present study, the expected differences between DD and SLI can be both quantitative and qualitative. We present the errors that are/are not expected to occur in these disorders in Table 9.6.

Table 9.6: Predictions about the different errors between SLI and DD

Error Type	**SLI**	**DD**	**Difference**
Omission	Expected	Expected	quantitative
NP	Expected	Expected	quantitative and qualitative
Gender Errors	Expected	Expected	quantitative
Number errors	Expected	Not Expected	qualitative
Gender and Number errors	Expected	Not expected	qualitative
Phonetic Errors	Expected	Expected	quantitative
Semantic Errors	Expected	Not expected	qualitative
Pragmatic limitations	Expected	Not expected	qualitative

Therefore, with respect to these predictions, both differences and similarities are expected to occur. At some points, these are expected to be quantitative and at others, qualitative. Another important criterion is the failure to produce direct clitics, irrespectively of the errors, something which is expected only in the case of SLI and not in the case of DD.

9.3. Comprehension of Direct Object Clitics - Greek SLI and Typically Developing Children

9.3.1. Accurate Responses

A total of 672 responses were obtained by both groups (336 from each participant group). In the SLI group there were children whose responses could not be considered as valid, even if they included a clitic. A different category was created, labelled as *Other* and shall be discussed further. The accurate responses for both participant groups are presented in Table 9.7.

Table 9.7: Accuracy scores on the Direct Object Clitic Comprehension Task

Group	Total	Masculine Singular (MS)	Feminine Singular (FS)	Masculine Plural (MPL)	Feminine Plural (FPL)
SLI	**66,66** (40,33)	**63,09** (39,32)	**67,85** (42,09)	**65,475** (41,58)	**69,04** (41,27)
CA	**98,51** (3,1)	**97,61** (6,05)	**98,8** (4,45)	**98,8** (4,45)	**98,8** (4,45)

As Table 9.7 illustrates, there is a sharp difference between the SLI group and the CA group on the accurate responses. Moreover, for the case of the SLI group, there is no particular difference between the different clitics. The statistical analysis corroborated these observations. The model on *Accurate* responses turned out to be significant ($x^2(1)$ =8.7844, p = 0.003038) and revealed additional significant group effects. An additional model on gender did not turn out to be significant ($x^2(1)$ = 1.8384, p = 0.1751). Similar results were also obtained for number ($x^2(1)$ = 0.1661, p = 0.6836).

The summary of the statistical results on *Accurate* responses can be found in Table 9.8.

Table 9.8: Summary of the statistical analysis on Accurate responses

Accurate Responses	Estimate	SE	Z	*p*
(Intercept)	8.498	2.506	3.390	<.001
groupSLI	-6.469	2.890	-2.239	0.025171

9.3.2. Erroneous Responses

The erroneous responses for the participant groups are presented in Table 9.9.

Table 9.9: Raw percentages of Erroneous Responses on the Direct Object Clitic Comprehension Task

	Omissions	Other
SLI	**9,52** (16,53)	**23,51** (42,16)
CA	**1,49** (3,1)	**0** (.00)

The model investigating group differences on omissions turned out to be significant ($x^2(1)$ = 4.5887, p = 0.03218) and revealed additional group effects. SLI children were found to select significantly more omission responses than the CA.

The model investigating the group differences on *Other* resulted as significant ($x^2(1)$ =33.476, p<.001), but did not reveal any further significant group effects. The summary of the statistical results on non-accurate responses is presented in Table 9.10.

Table 9.10: Summary of the statistical analysis on Erroneous responses

Non-accurate Responses	Estimate	SE	Z	*p*
Omission				
(Intercept)	-6.250	1.134	-5.512	<.001
groupSLI	2.679	1.354	1.978	0.0479
Other				
(Intercept)	-11.778	19.911	-0.592	0.554
Group CG	8.286	20.046	0.413	0.679

9.3.3. Individual Performance

Among the SLI group, there were six children with ceiling performance and four children whose responses could not be evaluated. As we already discussed, these were included in the category *Other*. Since there was a noteworthy variability within the SLI group and due to the fact that certain children's performance could not be equally evaluated, z-scores were calculated only for the children whose responses were judged as valid. We present only the children who demonstrated low performance on the task.

Table 9.11: SLI children with low performance on the direct object clitics comprehension task

Subject	Raw score (valid clitic response)	Raw score (omission response)	Raw Score (Other)	z-score	Particular Pattern Observed
S1	0	-----------	24	------	Exclusive selection of the male cartoon character
S2	18	6	0	-7,57	---------------------------------
S3	14	10	0	-12,94	---------------------------------
S4	12	12	0	-15,63	----------------------------------
S6	22	2	0	-2,2	---------------------------------
S7	0	------------	24	------	Could not distinguish the difference between the two answers
S8	0	0	24	------	Exclusive selection of the female cartoon character
S10	13	4	7	-14,29	In certain items, repetition of both responses, without further selection

As the results indicated, three different profiles can be identified. Children with ceiling or almost excellent performance, children with a bias towards selecting the omission response and children with particular profiles.

As far as the selection of the omission response is concerned, the maximum of omission responses in the CA group was 2. Therefore, this shows that only a very limited number of omission responses is acceptable. Hence, despite the low z-score, the accuracy score of S6 is not at all problematic. As we can further observe, four children are significantly below the mean of the control group, with particularly low accurate responses and four children whose responses could not be evaluated. Therefore, eight out of fourteen SLI children have particular difficulties on the specific task.

What must be underlined is the performance of S1, S7, S8 and S10. First, S1 and S8, were characterized by exclusive selection of the male or of the female cartoon character. This is however a result of the extraordinary difficulties that SLI children exhibit on linguistic tasks. S8 was retested at a later stage, but exhibited the same pattern, i.e. exclusive selection of the female cartoon character.

Second, as far as S7 is concerned, in many cases the child commented on the responses as follows: *"They are the same",* without selecting any of them. Only after repetition and encouragement, S7 proceed into selecting a response. However, his answers cannot be considered valid, since the child repeated the statement *"They are the same"* at different points of the task and his general behaviour did not indicate conscious response selection. Third, S10 completed the task as part of an assessment and the extraordinary difficulties were indeed indicative of language impairment. Even if eight out of fourteen children exhibited particularly low performance and demonstrated distinct profiles, there were children who completed the task successfully. Among these children, we must distinguish S9, S11 and S13 who have completed the SLT intervention and S14, a child with moderate SLI. On the one hand, this could indicate that these children do not have particular problems with the comprehension of the syntactic role of the clitic, but, nevertheless, this could also indicate that these children do not have particular problems with the experimental procedure.

As far as other existing studies on the comprehension of clitics are concerned, first of all, our results concerning the clitic responses are in line with Stavrakaki (2001) who had found that Greek SLI children show a preference for an NP response, rather than a clitic response. In Stavrakaki's (2001) task, however, also omissions had been included, but the task was rather different (i.e. all three alternative responses were provided by the investigator: clitic response, NP, omission response). Nonetheless, we cannot know what kind of results would have been obtained if the alternative responses had been clitic vs. omission and the experimental procedure had been different. By all means, taking together the two studies, this shows that SLI children show a strong preference for non-clitic responses.

With respect to sentence-picture pointing tasks that investigate the comprehension of direct object clitics, the present results are inline with the research of Stavrakaki and Van der Lely (2010) in Greek SLI, who showed that among other pronouns, object clitics are a structure that can be particularly problematic for SLI children. Our results are in partial agreement with Grüter's (2005) study on French speaking children with SLI. Among her experimental group (N=6), two subjects performed particularly low on clitic comprehension, while the rest of the subjects showed better performance on comprehension than production. The researcher concluded that despite their limited production skills, most of the SLI children were able to represent object clitics appropriately.

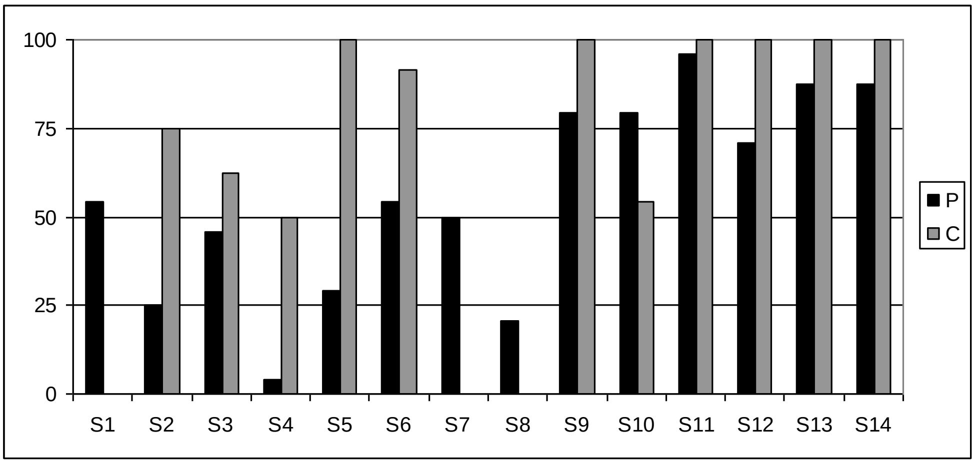
Clearly, the variation found even within the SLI groups but also between the different researches depends strongly on the non-homogeneous nature of the disorder. Yet, as it is has been demonstrated by many researches, clitics are a particularly vulnerable grammatical structure for SLI children. Even in our current group, we see that there are children who select more systematically the omission response in a language in which omissions of direct clitics have not been found to occur to the same extent as in Italian (Bortolini et al. 2006) or in French (Jakubowicz et al., 1998). Moreover, there are children who cannot distinguish between the clitic and the omission response and children who failed to complete the task.

With respect to the children who showed good performance, the only ones that can be evaluated are S12 and S14, since S9, S11 and S13 have completed their SLT intervention. S12 and S14 are two SLI children who do not have particular problems, something that has been found in other researches as well. The rest of the children, however, do demonstrate serious difficulties with the specific task and the difficulties are not in all cases task-dependent. Their difficulties are indicative of a syntactic deficit that affects computationally complex structures (Marshal and Van der Lely, 2007; van der Lely, 1998, 2005) and is in line with the findings of other crosslinguisitc studies that have demonstrated that the specific syntactic structure is particularly vulnerable (Jakubowicz et al., 1998; Smith, 2008; Stavrakaki, 2001; Stavrakaki and Van der Lely, 2010).

9.3.4. Individual Performance of the Children of the SLI group on the production and comprehension of Direct Object Clitics

We present the individual accuracy scores on Target responses on the direct object clitics production and comprehension tasks in Figure 9.2. However, due to the particular profiles that were observed and since there were responses that could not be counted as valid, no statistical comparisons were conducted between the two tasks.

Figure 9.2: Individual Performance of the SLI children on the Direct Object Clitic Production and Comprehension Task



The performance of the SLI children is indeed variable. For the subjects who did not exhibit particular profiles on the comprehension task, in most cases comprehension is higher than production. However, even if some subjects show better performance on comprehension, still, their accuracy scores are lower than the ones of their typically developing peers. Nonetheless, taking into consideration previous findings in comprehension and production of direct object clitics (Stavrakaki and van der Lely, 2010) both comprehension and production must be tested, since the profiles of SLI children can be particularly variable.

Finally, as far as the issue of omissions in Greek-speaking children with SLI is concerned, we have already discussed that the data are controversial. Certainly, the amount of omissions in Greek is less than the one in languages with participial agreement of the clitic. The fact that omissions do not occur extensively in production, cannot hold either for the findings on the comprehension of direct object clitics or for the failure in the detection of omissions in the current study that was observed in some children. The existing data show that even in Greek, direct object clitics are vulnerable, irrespectively of the pattern in which SLI children's weaknesses are manifested.

9.4. Production of Indirect Object Clitics- Greek SLI and Typically Developing Children

9.4.1. Classification of Responses

A total of 336 responses was obtained (168 by each participant group). We counted as a *Target* response the one in which an indirect clitic was produced marked correctly for gender in sentences that were complete and included the direct object as well, in the form of an NP or alternatively of a direct clitic (clitic cluster).

Other responses were classified as follows:

-(**Genitive) Clitic**: included all sentences in which clitics were produced, irrespectively of errors on gender

-Omission: when the indirect clitic was omitted

-PP: when a prepositional phrase was produced, that is, the indirect object was expressed in a periphrastic way (*i.e. petai ti bala stin ajelada* - throws the ball to the cow)

-**Gender error:** when the indirect clitic was erroneously marked for gender

-**Genitive Clitic and PP:** when the genitive clitic was produced with an accompanying PP (*i.e. *tis petai ti bala stin ajelada)*

-Direct clitic referring to the direct object: this is a grammatical response (including both direct object clitic doubling), but can also refer to omission of the indirect clitic and difficulty with clitic clusters or alternatively an incomprehension of the ditransitive status of the verb, since the indirect clitic has not been produced**,** i.e. *tin petai* or *tin petai ti bala*

-Direct object omission: when the direct object was dropped *i.e. *tou ferni*

-Other: responses that could not be classified among the aforementioned ones

9.4.2. Results

9.4.2a. Target and Genitive Clitic Responses

The accuracy scores on *Target* responses are presented in Table 9.12, and the mean percentages on *Genitive Clitic* responses can be found in Table 9.13.

Table 9.12: Target responses on the Indirect Object Clitic Production Task

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**
SLI-target	**34,52** (34,87)	**38,09** (40,52)	**30,95** (34,5)
CA-target	**91,07** (13,26)	**94,04** (14,03)	**88,08** (16,57)

Table 9.13: (Genitive) Clitic responses on the Indirect Object Clitic Production Task

Group	**Total**	**Masculine Singular (MS)**	**Feminine Singular (FS)**
SLI-genclit	**41,66** (38,81)	**46,42** (39,86)	**36,9** (41,95)
CA-genclit	**92,26** (13,33)	**94,04** (14,03)	**90,475** (15,62)

As expected, the model on *Target* responses turned out to be significant ($x^2(1)$ = 20.143, p <.001) and revealed additional significant group effects. The next model investigating the possible effects of gender, turned out to be marginally significant ($x^2(1)$ = 3.5471, p = 0.05965) and revealed additionally marginally significant effects for the masculine indirect clitic. The model on the number of genitive clitics that were produced turned out to be significant ($x^2(1)$ = 12.763, p = 0.0003535) and revealed additional group effects. An additional model on gender also turned out to be significant ($x^2(1)$ = 5.05, p = 0.02463) and revealed significant effects for the masculine gender. The summary of the statistical results can be found in Table 9.14.

Table 9.14: Summary of the statistical analysis on Target responses

	Estimate	SE	Z	*p*
Target				
(Intercept)	3.5542	0.7300	4.869	<.001
groupSLI	-4.8143	0.9656	-4.986	<.001
Target				
(Intercept)	3.2377	0.7417	4.365	<.001
Group CG	-4.8508	0.9740	-4.980	<.001
Gender Masculine	0.6870	0.3559	1.930	0.0536
Clitic				
(Intercept)	4.585	1.014	4.521	<.001
groupSLI	-4.726	1.298	-3.642	0.000271
Clitic				
(Intercept)	4.3160	1.0563	4.086	<.001
Group CG	-4.8888	1.3425	-3.642	0.000271
Gender Masculine	0.8544	0.3835	2.228	0.025879

To sum up, SLI children produced significantly fewer *Target* and *Clitic* responses than the children of the CA group and in both cases, the feminine clitic was found to be weaker.

9.4.2b. Erroneous Responses

The percentages of the different erroneous responses are presented in Table 9.15.

Table 9.15: Raw percentages of Erroneous responses on the Indirect Object Clitic Production Task

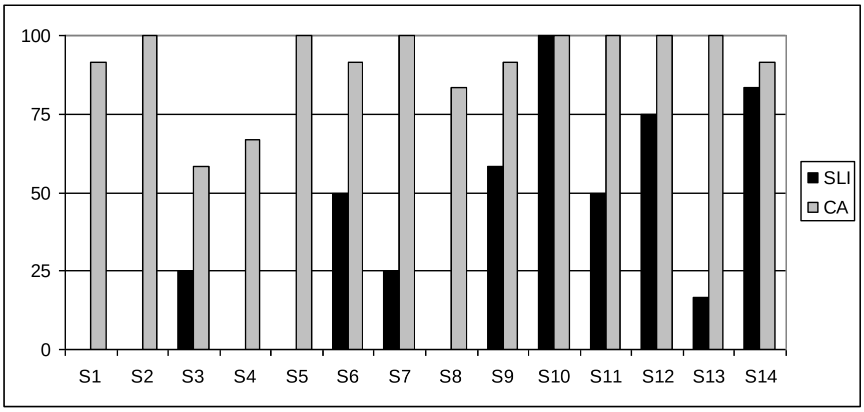
Group	**Indirect clitic Omission**	**PP**	**PP +genitive clitic**	**Gender errors**	**Omission of Direct Object**	**Direct Object Clitic**	**Other**
SLI	**18,45** (28,9)	**15,48** (22,37)	**4,76** (10,69)	**5,36** (8,4)	**2,38** (6,87)	**8,33** (24,89)	**10,11** (11,4)
CA	**3,57** (7,81)	**1,79** (3,54)	**0** (.00)	**1,19** (3,02)	**0** (.00)	**1,19** (3,02)	**1,19** (4,45)

The model on *omissions* did not turn out to be significant ($x^2(1) = 0.1708$, $p = 0.6794$). Similar results were obtained for the *PP* ($x^2(1) = 0.3107$, $p = 0.5772$), the *PP + genitive clitic* ($x^2(1) = 0.224$, $p = 0.636$), *gender* errors ($x^2(1) = 0.2146$, $p = 0.6432$), *omission of direct object* ($x^2(1) = 0$, $p = 1$), *direct object clitic* ($x^2(1) = 1.2393$, $p = 0.2656$) and *Other* ($x^2(1) = 0.3842$, $p = 0.5354$).

9.4.3. Individual Performance

The percentages of the Individual accuracy scores on *Target* responses can be found in Figure 9.3 for SLI and CA group children

Figure 9.3: Individual performance of the children of the SLI group on Target responses in the Indirect Object Clitic Production Task as compared to the individual performance of the children of the CA group



As can be observed, five SLI children produced 0 *Target* responses. However, it can also be observed that even for some CA children the production of indirect object clitics is not ceiling, and in particular for S3 and S4 who are of preschool age. If we also consider the individual performance of typically developing children reported by Smith (2008), the performance can be variable and typically developing children of preschool age are not expected to show intact performance either. Moreover, it can be observed that one SLI child (S10) showed ceiling performance. This is a child of an advanced chronological age (8;6) receiving speech therapy at the time of testing and who was mostly characterized by receptive language impairment. As we shall see in the next sections, her problems were more apparent in comprehension. This was also the case for S14, an SLI child with mild-moderate impairments.

9.4.4. Discussion

The present study investigated Greek SLI children's ability to produce indirect object clitics. The accuracy scores of SLI children were found to be particularly low. The findings can be summarized as follows:

- SLI children exhibited particularly impaired performance in the production of indirect object clitics

- SLI children were found to produce significantly fewer *Target* responses than the children of the CA group
- SLI children were found to produce significantly fewer *Genitive Clitics* than the children of the CA group
- For both *Target* and *Genitive Clitic* responses, indirect clitics of the masculine gender were found to be processed better.
- The errors were variable and none of the different error categories resulted into significant effects.
- Individual variation was also attested, but most of the SLI chidren exhibited impaired performance on the task

SLI children were found to demonstrate particularly impaired performance on the production of indirect object clitics, resulting into significant group effects. The findings on accuracy are in agreement with previous research in Greek SLI (Smith, 2008), who also reported particularly low scores for the specific clitics and overall worse performance than in the direct object clitic production task.

Moreover, SLI children were found to produce significantly less indirect clitics than the children of the CA group. This finding, first of all is in agreement with the findings on direct object clitics, showing that SLI children have particular difficulties with producing object clitics. However, there is a crucial difference. In the direct object clitics production task, SLI children differed significantly on the amount of clitics but first of all the task included more items (24) and the percentages of *Clitic Responses* were far better than the current ones on indirect clitics. The current task included only 12 items, that is, half of the direct object clitic task, and still, particularly impaired performance was observed. Taking into consideration previous controversial findings on direct object clitics (Smith, 2008; Stavrakaki and Van der Lely, 2010; Manika et al. 2011), it is probable that indirect object clitics are a more reliable marker of SLI in Greek.

We also found that the indirect clitic of feminine gender was weaker than the masculine clitic. This was relatively expected, if we consider that the clitic *tou* is homophonous between masculine and neuter and therefore, it can be used in more contexts. Lower performance on the feminine genitive clitic has been reported by Smith (2008) and again at this point our findings agree.

As far as the errors are concerned, the error with the highest percentage was the one of omissions and the next most common error was the one of the PP, an error equivalent to the one of the full NP in the case of direct object clitics. High percentages of omissions have also been reported by Smith (2008). The difference is that in Smith's (2008) study the percentages of omissions were higher, the SLI children were of younger age and the experimental procedure was different. As far as the omissions are concerned, also the error category that we labelled as *Direct Clitic* (referring to direct object) can reflect additional omissions of the indirect clitic, as a result of difficulty in producing clitic clusters, an error that was also sporadically found in the CA group as well. On the other hand, it could indicate a difficulty with interpreting and processing the ditransitive properties of the verbs.

Furthermore, there were errors that were not observed at any instance in the CA group. These were instances of production of the indirect clitic with a PP, instances of omission of the direct object, as well as errors that were included in the category *Other*. The production of the indirect clitic with a PP is an ungrammatical error, since the production of the indirect clitic automatically blocks the production of the PP (Dimitriadis, 1995). Probably, SLI children were influenced by the probe sentence that included the PP, but in any case, such errors should not occur, since they are ungrammatical. The next error that was observed, was the one of the drop of the direct object, either in the form of a direct object clitic or in the form of an NP. This error indicates difficulties with complex clitic structures (clusters) or alternatively, with complex sentence formation.[24]

In the category *Other* we included errors that could not be classified among the aforementioned categories. First of all, there were errors with phonetic reductions of the indirect clitic (*tis –ti*), but since this can also result into a direct clitic, we considered classifying such errors in this category. This classification was considered necessary since there were clear substitutions of the indirect clitic with a direct one, even in the case of the masculine clitic (*ton instead of tou*), an error that was also found in the CA group. However, such errors were not very frequent.

-Phonetic reduction possibly resulting into a direct clitic:
ti petai ti bala instead of *tis petai ti bala*

[24] These are errors that we have already discussed in the case of Greek DD.

Moreover, in the case of substitution with a direct clitic (for the specific sentence only) this results into a clitic doubling as in the following example:

tin petai ti bala instead of tis tin petai ti bala

this sentence is a grammatical clitic doubling construction, but still, can reflect an omission of the indirect clitic.

Returning now to the differentiation between DD and SLI, as far as the production abilities on indirect object clitics are concerned, the issue appears to be more complex. In the case of the Greek DD group we identified three children with impaired performance and the errors that were found were not very different from the ones detected here. The only error that was not observed in the DD group was the one of the production of direct clitic instead of an indirect. As far as the common errors are concerned (omissions, PP, PP and clitic), it would be easy to assume that for school aged children with undiagnosed SLI only quantitative differences would be observed, but this is not the case. All the SLI children of the group who were of an advanced age were receiving speech therapy and therefore, the error patterns that were observed are probably a lot different than the ones that would have been found if these children were not treated for their deficits. Moreover, the test did not include indirect clitics of the plural number, and probably this could constitute an additional differentiating pattern. Nonetheless, the results indicate the need for further investigation, both in TD children, as well as in DD and SLI children, since the specific structure is particularly difficult.

9.5. Comprehension of Indirect Object Clitics - Greek SLI and Typically Developing Children

9.5.1. Results

9.5.1a. Accurate Responses

A total of 336 responses were obtained (168 by each participant group). The accurate responses are reported in Table 9.16.

Table 9.16: Raw percentages of accurate responses on the Indirect Object Clitics Comprehension Task

Group	Total	Masculine Singular (MS)	Feminine Singular (FS)
SLI -target	**66,66** (18,49)	**57,13** (27,51)	**76,19** (20,37)
CA-target	**97,61** (5,09)	**100** (.00)	**95,23** (10,19)

As Table 9.16 shows, there is a striking difference between the SLI group and the CA group. As expected, the model on Target responses turned out to be significant ($x^2(1) = 27.802$, $p<.001$) and revealed additional highly significant group effects. The next model on gender did not turn out to be significant ($x^2(1) = 2.1845$, $p = 0.1394$) and consequently, did not reveal any significant difference between the masculine and feminine clitic.

The summary of the statistical analyses can be found in Table 9.17.

Table 9.17: Summary of the statistical analysis on Target responses

Target	**Estimate**	**SE**	**Z**	***p***
(Intercept)	4.1497	0.6327	6.559	<.001
groupSLI	-3.3057	0.6544	-5.051	<.001

9.5.1.b. Erroneous Responses

The percentages of erroneous responses are presented in Table 9.18.

Table 9.18: Raw percentages of erroneous responses on the Indirect Object Clitics Comprehension Task

Group	Masculine Singular (MS)			Feminine Singular (FS)		
	Reversed	**Omission**	**Incompre-hension**	**Reversed**	**Omission**	**Incompre-hension**
SLI	**35,71** (24,33)	**2,38** (4,45)	**4,76** (17,81)	**20,23** (20,86)	**1,19** (4,45)	**2,38** (6,04)
CA	**0** (.00)	**0** (.00)	**0** (.00)	**3,57** (7,09)	**1,19** (4,45)	**0** (.00)

The model investigating group effects of erroneous responses, as expected, turned out to be significant ($x^2(1) = 25.677$, $p <.001$) with additional highly significant group effects. SLI children were found to select significantly more responses with reversed thematic roles. The next model investigating possible effects of gender on the reversed thematic role interpretation did not turn out to be significant ($x^2(1) = 1.7695$, $p = 0.1834$), despite the difference on the percentages.

The rest of the erroneous responses were not analysed statistically, because of the very limited amount of items.

The summary of the statistical results can be found in Table 9.19.

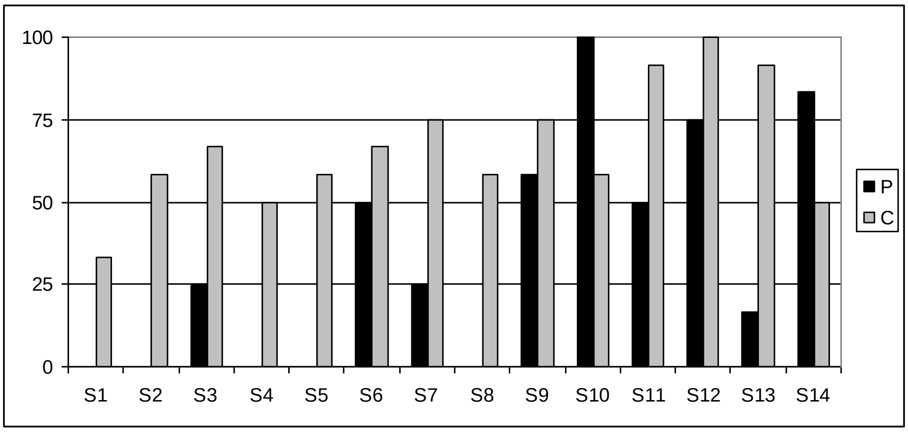
Table 9.19: Summary of the statistical analysis on Erroneous Responses

Reversed Thematic Roles	**Estimate**	**SE**	**Z**	***p***
(Intercept)	-4.5558	0.7405	-6.153	<.001
groupSLI	3.3531	0.7494	4.474	<.001

9.5.2. Individual Performance of the SLI children on the production and comprehension of indirect object clitics

Figure 9.4 illustrates the individual accuracy scores (*Target* responses) on the production (P) and the comprehension (C) of indirect object clitics.

Figure 9.4: Individual Performance of the SLI children on the Production (P) and Comprehension (C) of indirect object clitics



As can be observed, in most cases, the performance on the comprehension task is better than on the production task. This is not, however, the case for S10 and S14, who are characterized more by receptive deficits. Nonetheless, as it appears, the comprehension of indirect object clitics is vulnerable in most of the SLI subjects and it should be investigated in cases in which production is successful, as it can differentiate children with language impairments.

9.5.3. Discussion

The current task investigated SLI children's ability to comprehend indirect object clitics. SLI children were found to differ significantly from the children of the CA group and to show particularly low performance. The prominent error in the comprehension task was the one of the reversal of thematic roles. This finding is in agreement with a relevant investigation of comprehension of direct object clitics in Greek SLI (Stavrakaki and Van der Lely, 2010). Therefore, it appears that comprehension of both direct and indirect object clitics is particularly vulnerable in Greek children with SLI.

As far as the rest of the erroneous responses on the indirect object clitic comprehension task are concerned, there were only a few instances of selection of the omission response as well as few instances of the responses that indicate incomprehension of the probe sentence. Interestingly, this was a systematic response for S14, a child with moderate SLI, who had not been diagnosed prior to this assessment. Nonetheless, the performance of the children of the SLI group, was particularly vulnerable, as eleven out of fourteen children of the SLI group were found to be significantly below the mean of the CA group and the two children who had not been diagnosed prior to this assessment as specifically language impaired, namely S10 and S14 exhibited particularly low performance.

Our results agree with existing studies on production and comprehension of direct clitics (Stavrakaki and Van der Lely, 2010) and with the study of Smith (2008) on the production of indirect object clitics. It is clear that both direct and indirect object clitics are particularly vulnerable.

Finally, as far as the possible overlap with DD is concerned, in the case of the Greek DD group we observed that the maximum amount of incorrect responses was 2 and that there was only one instance of selection of an omission response. The rest of the erroneous responses concerned with the reversal of thematic roles. Apparently, the differences are expected to be quantitative and possibly qualitative if selection of incomprehension of the probe sentence responses occurs even in school aged SLI children.

9.6. Comprehension Task of omissions of Definite Articles - Greek SLI and typically developing children

In the specific tasks, we present the data of ten out of fourteen children of the SLI group. The SLI children whose data are not included in the current study were the following: S3, S4, S6 and S7. S3 and S6 could not respond to the demands of the task and the investigator abandoned the test. S4 could not provide any correction at all and therefore, his data were excluded. S7 completed only the first part of the task after two testing sessions, due to the fact that during the first testing the child could not understand the task. The completion of the study for S7 was not possible, due to the fact that the child interrupted the SLT program and another testing session was not made possible.

Finally, before proceeding into the presentation of the results, it is worth noting that even in the case of S12 the tests were repeated twice, because during the first testing session the child could not understand the task. Again, we should note that S10 and S14 had not been previously diagnosed as SLI and that S9 and S13 had completed their SLT programs.

9.6.1. Target Responses

A total of 1008 responses were analysed, 480 by the SLI group (10 children) and 528 by the CA group (11 children). The mean raw percentages of accuracy scores on *Target* responses are presented in Table 9.20.

Table 9.20: Raw percentages on Target responses on the Comprehension Task of Omissions of Definite Articles

Target	Total	Masculine Singular		Feminine Singular		Masculine Plural		Feminine Plural	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
SLI	**54,58** (22,71)	**55** (32,44)	**33,32** (26,05)	**71,66** (36,89)	**53,33** (30,22)	**66,66** (32,39)	**53,33** (26,98)	**63,33** (36,68)	**40** (33,51)
CA	**92,04** (9,44)	**90,90** (15,57)	**95,45** (10,77)	**98,48** (5,02)	**92,42** (15,57)	**95,45** (10,77)	**90,90** (11,46)	**92,42** (11,46)	**80,3** (23,35)

The model on *Target* responses turned out to be significant ($x^2(1)$= 17.475, p<.001) and revealed additionally significant group effects. The next model on *Case* resulted significant ($x^2(1) = 16.752$, $p<.001$) and revealed additionally significant effects for the nomative case. An additional model on number did not turn out to be significant ($x^2(1) = 0.1308$, $p = 0.7176$). Finally, the model on gender did not turn out to be significant ($x^2(1) = 0.1501$, $p = 0.6984$) either and did not reveal any further significant effects.

The summary of the statistical results on *Target* responses can be found in Table 9.21.

Table 9.21: Summary of the statistical results on Target *responses on the Definite Articles Comprehension Task*

	Estimate	**SE**	**Z**	***p***
Target				
(Intercept)	0.2895	0.3926	0.738	0.461
groupCG	2.8476	0.5648	5.042	<.001
(Intercept)	-0.1689	0.4002	-0.422	0.673
Group CG	2.8471	0.5653	5.037	<.001
NP-Nominative	0.9165	0.2075	4.416	<.001

9.6.2. Erroneous Responses

The classification of erroneous responses was common with the one in the Greek DD group. The raw percentages of the different Non-Target Responses are presented in Table 9.22 for both participant groups.

Table 9.22: Mean percentages of Erroneous responses on the comprehension task of omissions of definite articles (% out of total items)

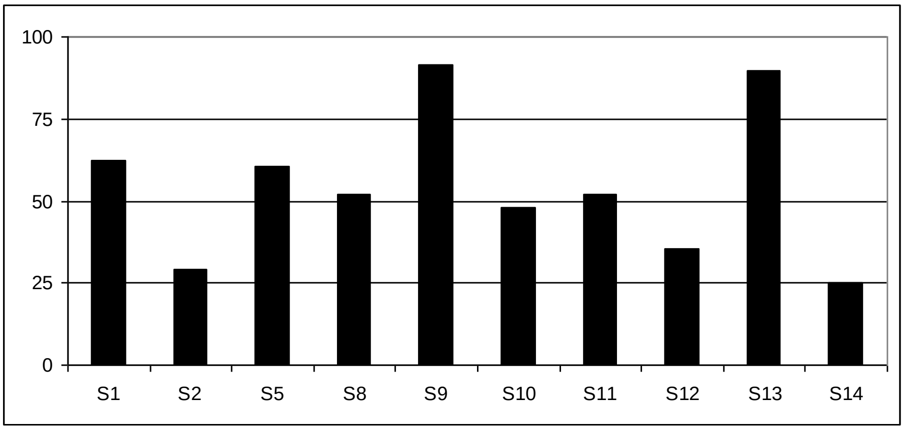
Group	**Omissions**	**Other NP**	**No correction**	**Inappropriate correction**
SLI	**30,2** (22,18)	**0,4165** (1,317)	**4,58** (8,43)	**10** (9,04)
CA	**6,05** (9,66)	**0** (.00)	**0** (.00)	**1,32** (2,51)

The error analysis was conducted only on the total of the erroneous items. The model on *Omissions* did not turn out to be significant ($x^2(1)= 1.0883$, $p = 0.2969$) and did not reveal any further significant effects. Same results were obtained for the case of no corrections ($x^2(1) = 3.3414$, $p = 0.06756$) and the case of inappropriate corrections ($x^2(1) = 0.0043$, $p = 0.9476$).

9.6.3. Individual Performance

The accuracy scores on *Target* responses of the children of the SLI group are presented in Figure 9.5

Figure 9.5: Individual Accuracy scores on Target responses on the Comprehension of Definite Articles-SLI Group



As can be observed, only two children S9 and S13 showed good performance on the task. These children had completed the SLT programs. The rest of the children's performance is particularly low. Again, of particular interest are the cases of S10 and S14 who had not been previously diagnosed as SLI. Also, the cases of S11 and S12, since they are of an advanced age, and in particular in the case of S12 the test was administered twice.

Detailed presentation of erroneous responses provided by the children of the SLI group can be found in Table 9.23.

Table 9.23: Examples of erroneous corrections provided by the children of the SLI group

Error Pattern	**Probe**	**Erroneous Correction by SLI children**
Repetition of the sentence with the articles omitted in both DPs	***Rinokeri** onirevode ton elefada (rhino-nom.masc.plur. dream-3rdPrPlur the elefant-acc.masc.sing..	*****Rinokeri** onirevode **elefada*** (rhino-nom.masc.plur. dream-3rdPrPlur elefant-acc.masc.sing.)
Repetition of the sentence with reversed thematic roles	*I fokja vrechi **pigkouino** (the seal-nom.fem.sing. splash-3rdSPr penguin-acc.masc.sing)	***O pagkouinos** vesi ti fokja* (The penguin-nom.masc.sing. splash-3rdSPr the seal-acc.fem.sing.)
Repetition of the sentence with agreement error on the verb	*I laγi sprochnoun **kotes** (The rabbits-nom.masc.plur. push-3rdPrPlur hen-acc.fem.plur.)	**I laγi **sprochni** tis kotes* (The rabbits-nom.masc.plur. push-3rdSPr hen-acc.fem.plur.)
Repetition of the sentence with agreement error on the verb and on NP	*I neraiδa sprochni **stratjotes** (The fairy-nom.fem.sing. push-3rdSPr soldier-masc.plur.)	*I neraiδa **sbochnoune tous statotous*** (The fairy-nom.fem.sing. push-3rdPlurPr soldier-masc.plur.with erroneous inflection)
Violations of agreement-DetN	***Kotes** sprochnoun tous laγous (Hen-fem.plur. push-3rdPlurPr the rabbit-acc.masc.plur.)	*I kotes sbonoune **<u>tis </u>γaγlous*** (The hen-fem.plur. push-3rdPlurPr the-acc.fem.plur. rabbit-acc.masc.plur.)
Lexical errors	***Krokoδilos** travai ta kagkouro (Crocodile-nom.masc.sing. pull-3rdSPr the kangaroo-neut.plur.)	***O likos** travai….* (The wolf-nom.masc.sing. pull-3rdSPr ….)
Other grammatical errors	*I koukouvajes vrechoun **kiknous** (the owls-fem.plur. splash-3rdPlurPr swans-masc.plur.)	**I koukouvajes vrechoun **tin kikni*** (the owls-fem.plur. splash-3rdPlurPr the-fem.sing. swans-fem.sing.)
Particular phonetic errors	***Krokodili** pjanoun to liodari	***Irkorkodili…**, instead of i korkodili*

In the case of the CA group, the erroneous corrections that were observed were phonetic, involving mostly the deletion of the final –n of the accusative singular article *(to papaγalo, instead of ton papaγalo)*, the correction with a direct clitic (*ton chtenizoun)*, or very rarely the repetition of the sentence with the omission misplaced to the other DP. These types of errors have already been reported in the cases of the Italian and Greek DD and TD groups.

9.7. Grammaticality Judgment Task of Definite Articles-Greek SLI and Target Responses

9.7.1. Target Responses

A total of 1008 responses were obtained by both groups, 480 by the SLI group (10 children) and 528 by the CA group (11 children). The mean raw percentages of the accuracy scores on *Target* responses for both participant groups are presented in Table 9.24.

Table 9.24: Raw percentages of Target responses on the Grammaticality Judgment Task Case of Definite Articles

Target	**Total**	**Masculine Singular**		**Feminine Singular**		**Masculine Plural**		**Feminine Plural**	
		S	**O**	**S**	**O**	**S**	**O**	**S**	**O**
SLI	**72,7** (22,7)	**60** (37,84)	**71,66** (30,47)	**66,66** (32,39)	**80** (18,92)	**76,66** (19,56)	**83,31** (17,56)	**65** (37,22)	**78,33** (32,44)
CA	**97,15** (2,68)	**98,48** (5,02)	**95,45** (10,77)	**98,48** (5,02)	**93,93** (8,4)	**96,96** (6,7)	**96,96** (6,7)	**98,48** (5,02)	**98,48** (5,02)

The model on the overall accuracy on *Target* responses resulted as significant ($x^2(1)$ =12.637, p <.001) and revealed additionally significant group effects. The next model investigating the possible effects of case, resulted as significant ($x^2(1)$ = 4.4222, p = 0.03547) and revealed additionally significant effects for the nominative articles. SLI children were found to be significantly less accurate on sentences that included violations on the nominative articles. An additional model on gender did not turn out to be significant ($x^2(1)$ =0, p = 0.9974). Similar findings were obtained for number ($x^2(1)$ = 2.8595, p = 0.09083).

To sum up, as far as *Target* responses are concerned, SLI children were found to have significantly lower performance than the children of the CA group and this difference was further found to be significant for the violations on nominative articles. Gender and number, however, were not found to result into significant effects. The summary of the statistical results on Target Responses can be found in Table 9.25.

Table 9.25: Summary of the statistical results on Target responses on the Grammaticality Judgment Task of Case of Definite Articles

	Estimate	SE	Z	*p*
Target				
(Intercept)	4.0820	0.4945	8.255	<.001
groupSLI	-2.6864	0.6457	- 4.161	<.001
(Intercept)	4.3423	0.5136	8.455	<.001
Group CG	-2.6885	0.6464	-4.159	<.001
NP-Nominative	-0.5119	0.2389	-2.142	0.0322

9.7.2. Erroneous Responses

The raw percentages of the different Erroneous responses are presented in Table 9.26 for both participant groups.

Table 9.26: mean percentages on erroneous responses on the grammaticality judgment task of Case of definite articles

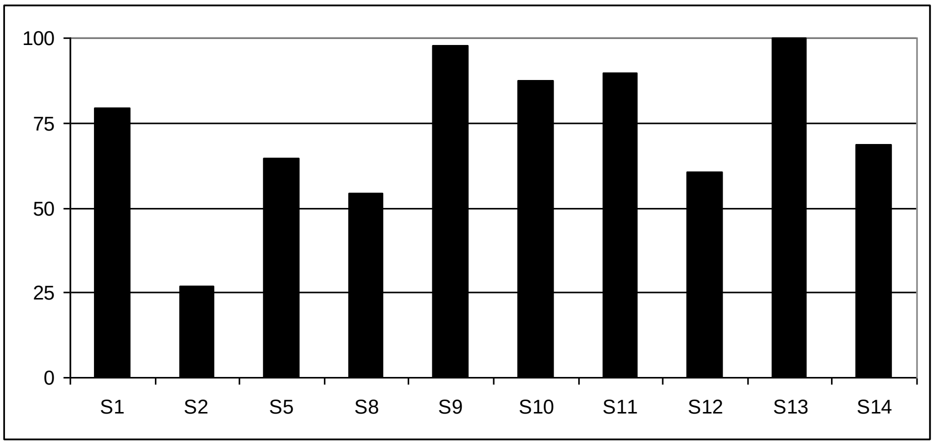
Group	Accepted as Correct	Other NP	No correction	Inappropriate correction
SLI	**13,12** (14,76)	**0** (.00)	**4,17** (11,06)	**9,37** (9,06)
CA	**0,57** (0,97)	**0,37** (1,25)	**0,37** (0,84)	**1,51** (1,63)

The first model on the *Acceptance* of the erroneous sentences as correct did not turn out to be significant ($x^2(1)$ =3.5301, p = 0.06026). Similarly, the model on inappropriate corrections did not turn out to be significant ($x^2(1)$ = 1.077, p = 0.2994).

9.7.3. Individual Performance

The individual accuracy scores on *Target* responses are presented in Figure 9.6 for the SLI children and in Figure 9.6 for the CA children.

Figure 9.6: Individual Accuracy scores on Target responses on the Grammaticality Judgment of Definite Articles-SLI Group



Since in the specific task no particular differentiation was observed in the CA group (contrary to the task on omissions of definite articles), the z- scores of the SLI children were calculated. The mean raw accuracy scores for the CA group was 46,6364 The mean raw scores and z-scores of the children of the SLI are presented in Table 9.27.

Table 9.27: Individual raw scores of the participants of the SLI group z-scores

Subject	**Raw score /48**	**z-score**
S1	38	-6,71
S2	13	-26,15
S5	31	-12,15
S8	25	-16,82
S9	47	+0,28
S10	42	-3,6
S11	43	-2,82
S12	29	-13,71
S13	48	+1,06
S14	33	-10,6

Again, it can be observed that the only children who did not exhibit significantly low performance are the ones who had completed the SLT programs. The errors that were noted, as far as the inappropriate corrections are concerned, again, were variable and did not differ much from the ones that we have reported in the omissions task.

In the case, however of common errors that were observed between the SLI and the CA children again, these were phonetic (deletion of the final –n of the accusative article), and in some cases it was the repetition of sentence with omission of the definite article. This error, however, was observed in one of the preschool children of the CA group. Therefore, this is expected to occur sporadically in preschool children. The other error that was observed only at one instance in the CA group was one that we had also observed in the case of the Greek DD. This consisted of the correction of the agreement violation between the article and the determiner as in the following example:

Probe*: *Tous-acc. krokoδili pjanoun to liodari* instead of *I krokoδili pjanoun to liodari*
Correction provided: tous krokoδilous

As we have previously discussed, this is not an ungrammatical correction. However, if this NP if is added in the sentence, it results in an ungrammatical structure:

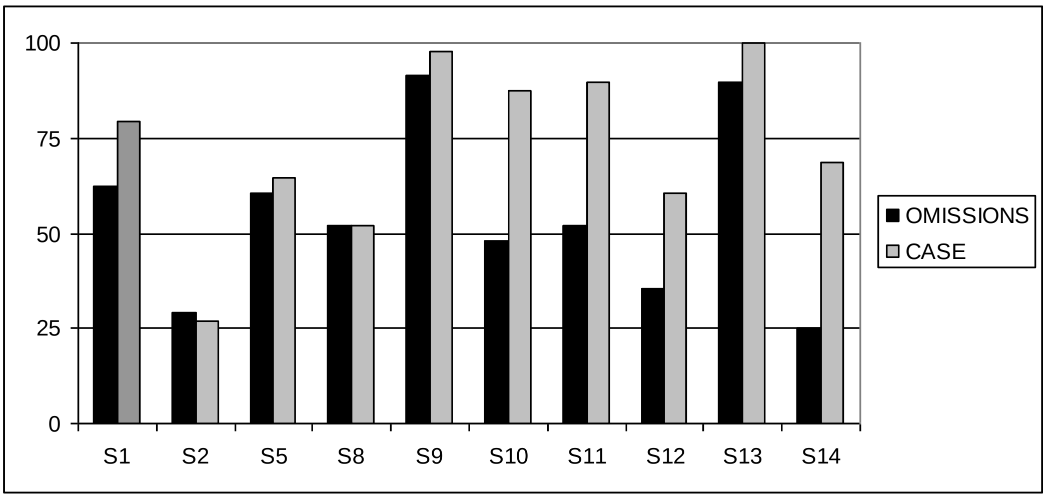
**Tous krokoδilous pjanoun to liodari*
the crocodiles-acc.masc.plur. catch-3rdPlurPr the lion-acc.neut.sing.

Finally, as far as the acceptance of erroneous sentences as correct is concerned, in the case of CA group, there was only one instance of acceptance for the feminine singular nominative article by one of the children of preschool age. The rest of the two sentences that were judged as correct concerned with accusative articles. In the case of accusative articles, acceptance of the erroneous sentence as correct is clearly attributed to the minimal phonological difference (i.e. *i-ti)*. Similar explanation can hold for the plural, since the phonologically weak article *i* in substitution of the accusative plural article (*tous* or *tis*) may not be perceived at all. In this case, it could be perceived as omitted and consequently judged as correct. However, in the case of the CA group there was only one instance of such an acceptance, concerning the feminine plural article.

9.7.4. Individual Perfomance of the SLI on the Articles Comprehension Tasks

Before proceeding into the discussion section, we consider reporting the individual accuracy scores of the children of the SLI on the comprehension task of omissions of definite articles and on the Case grammaticality judgment task. The results are presented in Figure 9.7.

Figure 9.7: Individual Performance of the SLI children on Target Responses on the Grammaticality Judgments of Definite Articles



As Figure 9.7 indicates, the performance across the two tasks can be variable. The highest scores were obtained by the children who had completed their SLT. All the other SLI children exhibited particular difficulties. Even if in some cases the performance on ungrammatical conditions is better, still, the performance on omissions is low. The specific tasks were proved to be particularly sensitive and the results obtained by the SLI, DD and typically developing children show patterns of differentiation.

9.7.5. Discussion

The present study investigated Greek SLI children's comprehension skills of definite articles. The first task was specific to the detection and correction of omissions of definite articles in subject and object DPs. SLI children were found to differ significantly from the children of the CA group on *Target* responses and these differences were further found to be significant for the object DPs. Apart from the frequent acceptances of the omission responses as correct, the erroneous corrections provided by the children of the SLI group differentiated them from the children of the CA group. Moreover, a closer inspection of the erroneous corrections shows that they are also qualitatively different from the ones that we have detected in the case of the Greek DD group.

In the case of the omission tasks, a significant effect was revealed for the omissions in object DPs. This was also a pattern observed, to a less extent, in the CA group and more for the plural number. This is apparently to be attributed to the fact that bare nouns in Greek are allowed in object positions, but in different contexts. Nonetheless, since this was a pattern observed in the CA group, the specific findings hold for a quantitative difference, at least for the plural number. By contrast, in the singular number, acceptance of omission in subject position was only observed in one child of the CA group, S14, a child of preschool age. In the SLI group, however, this was observed systematically even in the older children. Taking into consideration that this was found in one of the younger children of the CA group for the singular number, then this shows a developmental delay for the case of SLI children. Therefore, for the acceptance of omission responses as correct there are quantitative differences and the performance of SLI children appears extremely delayed. As far as the correct performance on the omissions task is concerned, and taking into consideration the variation that can be observed across typically developing children, at least 70% of accuracy must be obtained on Target Responses by typically developing children after the age of 5 and of course, no instances of ungrammatical corrections must occur.

As far as the differentiation between SLI and DD is concerned, in the case of the Greek DD we saw that there were instances of acceptance of omissions mostly for the nominative plural article, which is phonologically weak. An overlap is expected to occur and acceptance of omissions in the specific article cannot constitute a differentiating criterion. Also, instances of acceptance of omissions for the feminine plural accusative article are also expected in both disorders, however, with higher percentage for SLI children. Finally, none of the erroneous and ungrammatical corrections found in the case of the SLI group is expected to be found in the case of DD children and this is also another criterion.

In the grammaticality task of case of definite articles, again, SLI children were found to differ significantly from the children of the CA group, in which there was only one instance of acceptance of an erroneous sentence. Furthermore, the differences were found to be significant for the singular number, in which the violations can result even more difficult to detect. The task differentiated accurately SLI from typically developing children. The only SLI children who scored higher on the task were the children who had completed their SLT programs. Again, as in the case of the omission tasks, there were erroneous corrections, characteristic of the SLI children. At this point, we consider reporting characteristic instances of error patterns observed in S7 who completed only the first part of the test and whose data were not included in the analyses. We present a relevant example from S7's corrections as follows:

Probe: *O kirios vrechi **i** maγises
The-nom.masc.sing. gentleman-nom.masc.sing. splash-3rdSPr the-nom.fem.plur. witches-fem.plur.

Correction: *Ton kirio tis vrechi tis maγises
*The-acc.masc.sing. gentleman-acc.masc.sing. them-CLITfem.plur. splash-3rdSPr the-acc.fem.plur. witches-fem.plur.

In the example above, S7 substitutes the nominative case with accusative and a direct object clitic is additionally produced. The generalization of accusative case in the production of Greek children with SLI has been previously reported by Mastropavlou

(2006) and is also apparent in the production of wh-questions (Stavrakaki, 2001;2006, and current study).

In the omissions task, the acceptance of omissions was attested in typically developing children as well, indicating an extreme delay for children with SLI. However, for the violations on case, a similar interpretation is not plausible. SLI were found to have deficient performance on the task and their data indicate a deviant linguistic profile.

9.8. Production of wh-questions - Greek SLI and Typically Developing Children

For the current study, 11 SLI children's data were included. S2 was tested but was not providing answers, despite the help provided by the investigator. S3 expressed frustration during the training and during the first experimental item and did not want to continue the test. S4 was tested but his data were not included due to serious articulation problems and due to particular difficulties to produce wh-questions.

9.8.1. Classification of responses

The correct responses were classified as in the case of Greek DD group: *Overall Correct Responses, Wh V NP, Total Other Correct responses, NPTop and Null Argument.* The classification was the same as in the DD group also for Erroneous Responses, apart from erroneous responses that were observed only in the case of the SLI group. These were the following:

- **Affirmative:** when an affirmative sentence was produced instead of an interrogative
- **Reversed Affirmative:** when an affirmative sentence was produced with reversed thematic roles
- **Wh/WhNP only:** when the child produced only the wh-element (*i.e. pjos? who?)* or the wh-element and the NP (*i.e. pjos γaδalos?* which donkey?) instead of a complete question.
- **Grammatically correct but with alterations on number:** this was an error that was rarely observed only in the SLI group and consisted of the alteration of the plural NP into a singular NP as in the following: (i.e. *pjos γaiδaros pleni ton*

krokoδilo? which donkey is washing the crocodile? instead of *pjos γaiδaros pleni tous krokoδilous?* which donkey is washing the crocodiles?)

- **Grammatically correct but with lexical errors:** when lexical substitutions were attested
- **Incomplete or NA:** when the child produced an incomplete question or when no answer was provided. Instances of NA were a few and were found only in the children of the SLI group.

Before proceeding into the presentation of the results, we consider reporting that, in many cases, the affirmative sentences constitute a repetition of the probe sentence, but also show a strategy used by some children in order to produce a question. This was the case for S6 and S11:

SLI child's (S6) responses:

Kapjos pjani tous kiknous, rota pjos

Someone is catching the swans. Ask who.

I pigkouini plenoun kapjon. Pjon plenoun i pigkouini?

The penguins are washing someone. Who are the penguins washing?

SLI child's (S11) response:

Kapjos travai tous δrakous. Aftos kseri pjos. Rota pjos travai tous δrakous.

Someone is pulling the dragons. He knows who. Ask who is pulling the dragons ?

Taking into consideration the fact that the particular task is rather demanding, the cases in which a question was not produced were included in the category *Affirmative*, even if they included the sentence *ask who*. The cases in which a question was produced, even as in the example provided for S11, only the wh-question was evaluated. Nonetheless, this was a pattern observed in the younger children of the SLI group.

9.8.2. Results

The accurate responses for *who* questions are presented in Table 9.28 and the erroneous responses are presented in Table 9.29.

Table 9.28: Accuracy scores on the production of Who questions

Who S					
	WhVNP	**NPTop**	**Argument drop**	**Total Other Correct**	**Total correct WhoS**
SLI	**46,96** (37,13)	**0** (.00)	**15,15** (26,3)	**15,15** (26,3)	**62,11** (35,03)
CA	**98,49** (5,02)	**0** (.00)	**1,51** (5,02)	**1,51** (5,02)	**100** (.00)
Who O					
	WhVNP	**NPTop**	**Argument drop**	**Total Other Correct**	**Total correct WhoO**
SLI	**9,09** (17,26)	**12,12** (22,47)	**30,3** (32,33)	**42,42** (29,21)	**51,51** (29,3)
CA	**80,03** (25,62)	**0** (.00)	**3,03** (10,05)	**3,03** (10,05)	**83,33** (25,82)

Table 9.29: raw percentages of erroneous responses on Who questions

Who S										
	WhoO	**WhichS**	**Affirma-tive**	**Reversed Affirma-tive**	**Wh-only**	**Case**	**Agree-ment**	**Case & Agree-ment**	**Other**	**Incompl. or NA**
SLI	**1,51** (5,02)	**1,51** (5,02)	**6,06** (20,09)	**6,06** (20,09)	**4,54** (15,07)	**1,51** (5,02)	**1,51** (5,02)	**3,03** (6,73)	**1,51** (5,02)	**4,54** (10,77)
CA	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)
Who O										
	WhoS	**Which O**	**Affirma-tive**	**Reversed Affirma-tive**	**Wh/WhNP only**	**Case**	**Agree-ment**	**Case&Agreement**	**Other**	**Incomplete answers**
SLI	**1,51** (5,02)	**0** (.00)	**6,06** (20,09)	**0** (.00)	**4,54** (10,77)	**1,51** (5,02)	**4,54** (10,77)	**9,09** (13,66)	**9,08** (11,45)	**1,51** (5,02)
CA	**7,57** (13,66)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**3,03** (10,04)	**3,03** (6,74)

Table 9.30: Other grammatically correct responses and alterations on number or lexical errors on who questions

Group	Grammatically Correct Other Number		Grammatically Correct Lexical Error	
	WhoS	WhoO	WhoS	WhoO
SLI	**3,03** (10,04)	**9,08** (13,66)	**1,51** (5,02)	**3,03** (6,74)
CA	**0** (.00)	**0** (.00)	**0** (.00)	**3,02** (6,73)

As can be observed, the performance of SLI children is particularly low on both *who subject* and *object* questions. The most striking difference is the one on the production of correct *Wh V NP responses* for *who object* questions. In fact, SLI children used more alternative correct responses for *who object* questions, as *NPTop* and *Null Argument*. *NPTop,* however, were not as frequent as *Null Argument,* which were also observed for *who subject* questions.

In the category of erroneous responses, we observe that were instances of affirmative responses or instances of affirmative responses with reversed thematic roles. This was mainly observed in two subjects (S6 and S10) who could not produce *wh* questions. However, S6 had three instances of production of correct responses on *who object* questions and S10 had some instances of a production of an affirmative sentence followed by the wh-element *what*. Moreover, in the SLI there were instances of production of the wh-element *pjos or pjon,* instead of a complete question, something that was not observed in the CA group. This, again, was an error that was not found across all subjects.

The most characteristic errors found in the SLI group were the ones of *Case, Agreement* and *Case and Agreement*, which were observed more in the case of *who object* questions. Again this was an error that was not found in the CA group and differentiated the children of the SLI group. For the case of *who object* questions, the error that was observed in the CA group, was the production of *who subject questions* and other errors, such as the production of *what* questions or grammatically correct questions with lexical alterations.

To sum up, the performance of the CA group on *who subject* questions was ceiling, something that was not observed in the case of SLI children. Reduced performance of the CA group was observed in the case of *who object* questions, but the errors that were attested differed from the ones observed in the SLI group.

We proceed to the presentation of the accurate responses for *which* questions, that can be found in Table 9.31. The erroneous responses for both groups can be found in Table 9.32. and Table 9.33.

Table 9.31: Accuracy scores on the production of which questions

Which S					
	WhVNP	**NPTop**	**Argument drop**	**Total Other Correct**	**Total correct WhichS**
SLI	**22,73** (32,72)	**0** (.00)	**12,11** (15,07)	**12,11** (15,07)	**34,84** (34,52)
CA	**89,39** (13,48)	**0** (.00)	**0** (.00)	**0** (.00)	**90,9** (13,67)
Which O					
	WhVNP	**NPTop**	**Argument drop**	**Total Other Correct**	**Total correct WhichO**
SLI	**6,05** (11,23)	**7,57** (25,12)	**27,27** (36,72)	**34,84** (39,05)	**40,9** (38,26)
CA	**86,36** (22,13)	**0** (.00)	**9,09** (21,55)	**9,09** (21,55)	**95,45** (10,77)

As can be observed, SLI children showed significant limitations in the production of *which* questions, comparing to the children of the CA group. The particular difficulties of SLI children were even more apparent in the production of correct *WhVNP responses*. SLI children, apart from the great number of erroneous responses, used more alternative correct responses for *which object questions.* The errors that were observed, apart from the production of *who* questions, concerned again with errors that were attested also in the case of *who* questions.

Table 9.32: raw percentages of erroneous responses on which questions

Which S											
	WhoS	**WhoO**	**WhichO**	**Affirma-tive**	**Reversed Affirma-tive**	**Wh-only**	**Case**	**Agree-ment**	**Case &Agree-ment**	**Other**	**Incompl. or NA**
SLI	**13,63** (22,13)	**0** (.00)	**0** (.00)	**10,6** (20,1)	**1,51** (5,02)	**10,6** (25,02)	**4,54** (7,78)	**3,02** (6,73)	**7,57** (11,45)	**4,54** (7,78)	**3,02** (6,73)
CA	**3,02** (6,74)	**1,51** (5,02)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.0)
Which O											
	WhoO	**WhoS**	**WhichS**	**Affirma-tive**	**Reversed Affirma-tive**	**Wh/ WhNP only**	**Case**	**Agree-ment**	**Case &Agree-ment**	**Other**	**Incompl. or NA**
SLI	**10,60** (20,09)	**1,51** (5,02)	**0** (.00)	**16,67** (33,33)	**0** (.00)	**12,12** (29,89)	**3,02** (6,73)	**1,51** (5,02)	**3,03** (10,04)	**1,51** (5,02)	**3,02** (6,73)
CA	**3,02** (6,74)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)	**0** (.00)

Table 9.33: Other grammatically correct responses and alterations on number or lexical errors on which questions

Group	Grammatically Correct Other Number		Grammatically Correct Lexical Error	
	WhichS	WhichO	WhichS	WhichO
SLI	**1,51** (5,02)	**3,02** (6,73)	**1,51** (5,02)	**3,02** (6,73)
CA	**0** (.00)	**0** (.00)	**4,54** (7,78)	**1,51** (5,02)

9.8.3. Statistical Analyses

9.8.3.1. Total Correct Responses

The model on *Total Correct Responses* turned out to be significant ($x^2(1) = 17.955$, $p < .001$) and revealed additionally significant group effects. CA children were found to produce significantly more Correct Responses than SLI children. A second model investigating the differences between *who* and *which* questions also turned out to be significant ($x^2(1) = 4.4818$, $p = 0.03426$) and revealed additionally significant effects of group and *who* questions. Thus, SLI children were found to produce significantly less correct *which* questions than the children of the CA group. An additional model investigating the differences between *subject* and *object* questions did not turn out to be significant ($x^2(1) = 0.9072$, $p = 0.3409$) and consequently did not reveal any significant group effects.

To sum up, SLI children were found to produce significantly fewer *Total Correct Responses* than the children of the CA group and in particular for *which* questions. No further difference was revealed between *subject* and *object* questions. The summary of the statistical results can be found on Table 9.34.

Table 9.34: Summary of the statistical analysis on Total Correct responses

Total Correct Responses	Estimate	SE	Z	*p*
(Intercept)	-0.1962	0.4923	-0.399	0.69
groupCA	3.6352	0.7399	4.913	<.001
(Intercept)	-0.5534	0.5138	-1.077	0.2814
Group CA	3.6357	0.7405	4.910	<.001
Which	0.7158	0.3228	2.217	0.0266

9.8.3.2. Correct WhVNP

Subsequent analyses were conducted on the correct *Wh V NP* responses. The first model turned out to be significant ($x^2(1) = 29.546$, $p < .001$) and revealed additional highly significant group effects. CA children were found to produce significantly more correct *WhVNP* responses than SLI children. The next model between *who* and *which* questions did not turn out to be significant ($x^2(1) = 2.5702$, $p = 0.1089$) and did not show any further significant effects. The model between *subject* and *object* questions, however, turned out to be significant ($x^2(1) = 20.044$, $p<.001$) with additional effects on *subject* questions.

To sum up, SLI children were found to produce significantly fewer correct *WhVNP* responses than the children of the CA group and in particular for *object* questions. No significant differences were revealed between *who* and *which* questions. The summary of the statistical results can be found in Table 9.35.

Table 9.35: Summary of the statistical analysis on Correct WhVNP responses

Total Correct Responses	**Estimate**	**SE**	**Z**	***p***
(Intercept)	-1.9572	0.4962	-3.945	<.001
groupCA	5.0577	0.6646	7.610	<.001
(Intercept)	-2.3589	0.5541	-4.257	<.001
Group CA	5.0520	0.6652	7.595	<.001
Which	0.8054	0.4880	1.650	0.0989
(Intercept)	-2.9127	0.5156	-5.649	<.001
Group CA	5.0602	0.6696	7.557	<.001
Subject/Object	1.9067	0.3715	5.133	<.001

9.8.3.3. Other Correct Responses

The model on the total of *Other Correct Responses* turned out to be significant ($x^2(1) =11.375$, $p < .001$) with additionally significant group effects. CA children were found to produce significantly less *Other Correct Responses* than SLI children. The next model between who and which questions did not turn out to be significant ($x^2(1) = 0.1447$, $p = 0.7036$) and did not show any other significant effects. The model between *subject* and *object* questions turned out to be significant ($x^2(1) = 22.122$, $p < .001$) and revealed additional effects of group and type of question. CA children were found to produce significantly fewer *Other Correct Responses* for *object* questions, contrary to

SLI children. To sum up, SLI children were found to produce significantly more *Other Correct Responses* for *object* questions, without significant differences between *who* and *which* questions.

The summary of the statistical results can be found in Table 9.36.

Table 9.36: Summary of the statistical analysis on Total Other Correct responses

Total Other Correct Responses	**Estimate**	**SE**	**Z**	***p***
(Intercept)	-1.9082	0.7518	-2.538	<.001
groupCA	-4.1332	1.3353	-3.095	0.00197
(Intercept)	-2.0179	0.8042	-2.509	0.01210
Group CA	-4.1344	1.3358	-3.095	0.00197
who/which	0.2149	0.5574	0.386	0.69984
(Intercept)	-0.8637	0.7169	-1.205	0.22827
Group CA	-4.0967	1.3029	-3.144	0.00167
Subject/object	-2.0273	0.3724	-5.444	<.001

Subsequent separate models investigating the possible group differences on the two types of other correct responses, namely *Null Argument* and *NpTop* did not turn out to be significant (p>.05 in both cases).

9.8.3.4. Erroneous Responses

Within-error analyses were conducted for the different error categories, similarly as in the case of the DD groups. The first model on *Reversed Responses* turned out to be significant ($x^2(1) = 8.2726$, $p = 0.004025$), but without any additional group effects (Z=1.846, p=0.06488). Similar results were obtained for *Case* ($x^2(1) = 314.09$, $p < .001$) without any significant group effects (Z= -0.002, $p = 0.998645$). The model on *Other* turned out to be marginally significant ($x^2(1) = 3.5381$, $p = 0.05997$) but without any significant group effects (Z= -0.006, $p = 0.995$).

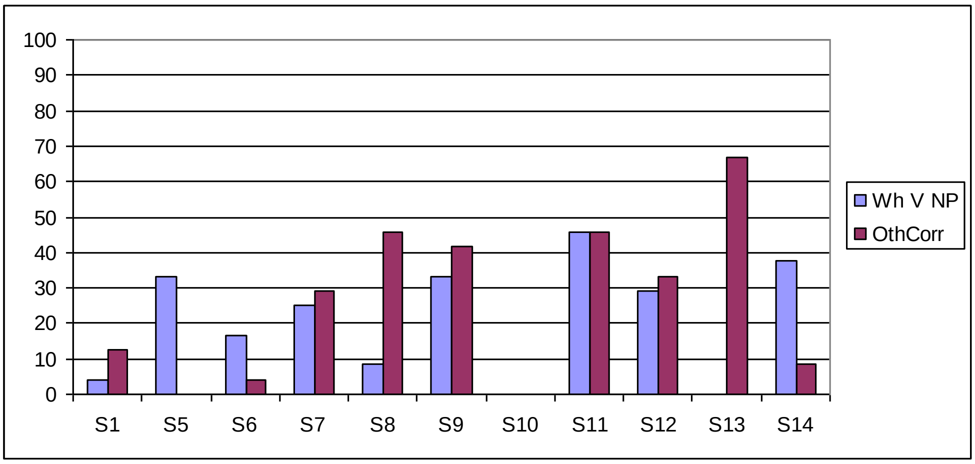
The next model on the production of who instead of which questions and vice versa did not turn out to be significant ($x^2(1) = 0.7586$, $p = 0.3838$). Similar, non-significant results were obtained for *Affirmative* ($x^2(1) = 0.4058$, $p = 0.5241$), *Wh/WhNP* ($x^2(1) = 0.0523$, $p = 0.8191$), *Agreement* ($x^2(1) = 1.6338$, $p = 0.2012$), *Case and Agreement* ($x^2(1) = 1.9412$, $p = 0.1635$). No other investigations were conducted on the rest of error categories, as these consisted of few items.

To sum up, no error resulted into significant effects, showing that the errors of the SLI children are widespread.

9.8.4. Individual Performance

The individual performance of the children of the SLI group on Wh V NP and Other Correct Responses is presented in Figure 9.8.

Figure 9.8: Individual Accuracy scores of the children of the SLI group on Wh V NP and Other Correct Responses



As it can be observed, the children of the SLI group exhibited variable performance. S1 and S6 who are the youngest children of the group were found to produce very few questions. The few questions that were produced included *Null Argument* and were all for *who object* questions.

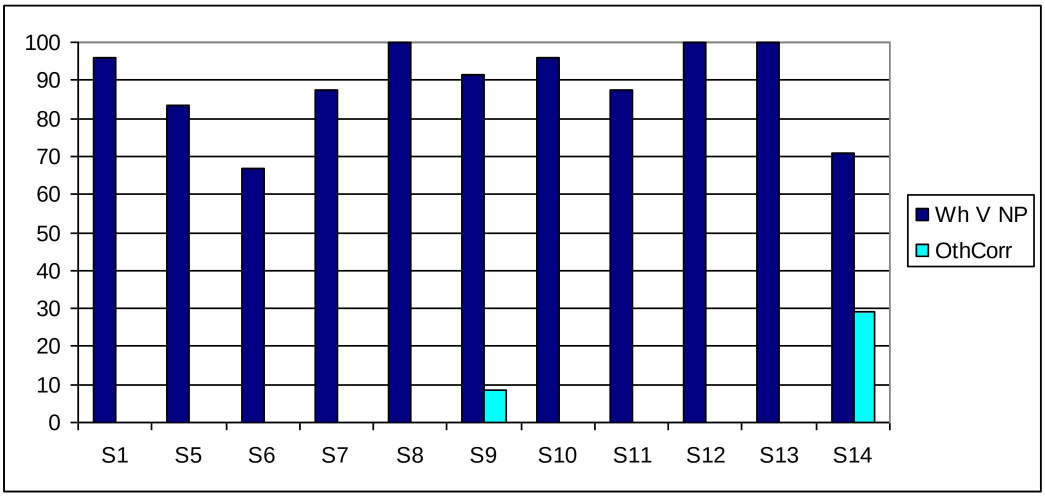
S10 did not produce any question at all and was characterized by failure. This clearly constitutes a clinical criterion, since this child had not received a diagnosis of SLI prior to this assessment. Her production was characterized by affirmative sentences and in some cases even with reversal of the thematic roles. Also in the cases of *which* questions, in the affirmative sentences which were produced the NP was dropped, and the affirmative sentence was similar to a probe sentence as the ones in *who* questions (i.e. the dogs are scaring someone, instead of the dogs are scaring one of the rabbits). This clearly demonstrates the extraordinary difficulties of this specific child with the processing of complex stimuli. Also, in some cases in which a wh-element was present, this was erroneous (*what)* and produced independently after an affirmative sentence.

Of particular interest is also S13, who produced only *Null Argument* structures, which were erroneous in many cases as well. This child had completed the SLT intervention program and still could not produce successfully *WhVNP* structures.

Finally, we should note that case, agreement, case and agreement errors were spread across subjects. The subjects who exhibited all of these three errors were S5 and S7. The rest were variable, but were observed in all SLI subjects, except from S10.

We shall now proceed to the presentation of the individual performance of the children of the CA group on *Wh V NP* and *Other Correct Responses*. The individual scores are presented in Figure 9.9.

Figure 9.9: Individual Accuracy scores of the children of the CA group on Wh V NP and Other Correct Responses



The difference between the SLI children and the CA group is striking, as far as the correct *WhVNP* structures are concerned. The only child of the CA group who exhibited more instances of *Null Argument* was S14, a child of preschool age. However, she achieved 100% on *Overall Correct* Responses.

The errors that were observed in the case of the CA consisted mostly by the production of *subject* instead of *object* questions, *who* instead of *which* questions and grammatically correct questions with lexical errors. There were also very rare instances of production of *what* questions, that we included in the category *Other*. We considered including instances of lexical errors in erroneous responses, as in many cases the verbs that were produced were semantically incorrect. Even if it did not result in any grammatical error, we considered reporting it in order to show that this error pattern can be observed also in typically developing children. There were also some rare instances of incomplete responses and no instance of *No Answer*.

As in the case of the DD, we consider reporting the errors observed in the children of the SLI group. The relevant examples can be found in Table 9.37 for *who* questions and in Table 9.38 for *which* questions:

Table 9.37: Errors produced by the children of the SLI group on who questions

Who Subject questions	
Target question	**Produced by children of the SLI group**
Pjos pleni tous pigkouinous ? who-nom. wash-3rdSPr the penguins-acc.masc.plur.	*Pjos vechoune tous pigkouinous ? who-nom. splash-3rdSPlur the penguins-acc.masc.plur. *Pjon katharizi ton pigkouino ? Who-acc. clean-3rdSPr the penguin-acc.masc.sing.
Pjos travai tous δrakous ? who-nom. pull-3rdSPr the dragons-acc.masc.plur.	Pjos ap' tous δrakous travai tous δrakous? who-nom. of the dragons-acc.plur. pull-3rdSPr the dragons-acc.plur.
Pjos dagkoni tous likous? who-nom. bite-3rdSPr the wolves-acc.masc.plur.	*Pjon dagkonete ta skilakja? who-acc. bite-2ndPlPr the doggies-neut. plur.
Pjos ksipnai tous skatzochirous? who-nom. wake up-3rdSPr the hedgehocks -acc.masc.plur.	I skatzochiri tromazoun kapjon ja na tous ksipnisi… The hedgehocks are scaring someone so that he wakes them up…
Who Object questions	
Target question	**Produced by children of the SLI group**
Pjon plenoun i pigkouini? who-acc. wash-3rdPlPr the penguins-nom.masc.plur.	*Pjon vechi tous bagkouinous? who-acc. splash-3rdSPr the penguins-acc.masc.plur.
Pjon pjanoun i kikni? who-acc. catch-3rdPlPr the swans-nom.masc.plur.	*Pji pjanoun i kikni ? *Who-nom.masc.plur. catch-3rdPlPr the swans-nom.masc.sing.* *Pjon pjani i kikni ? who-acc. catch-3rdSPr the swans-nom.masc.plur.
Pjon travoun i δraki? who-acc. pull-3rdPlPr the dragons-nom.masc.plur.	*Pjon tavate δrako? who-acc. pull-2ndPlPr dragon-acc.masc.sing. *Pjon i δraki travane ? who-acc. the dragons-nom.masc.plur. pull-3rdPlPr

Table 9.38: Errors produced by the children of the SLI group on which questions

Which Subject questions	
Target question	**Produced by children of the SLI group**
Pjos likos kitazi tous kokores? who-nom. wolf-nom.masc.sing. look at-3rdSPr the roosters-acc.masc.plur.	*Pjos likos vlepoun tous kokores? who-nom. wolf-nom.masc.sing. look at-3rdPlPr the roosters-acc.masc.plur. *Pjos tous kokores kitai? who-nom. the roosters-acc.plur. look at-3rdSPr
Pji kirii travoun ton maγo? who-nom.masc.plur. gentlemen-nom.masc.plur. pull-3rdPlPr the wizard-acc.masc.sing.	*Pjon travane ton maγo? who-acc. pull-3rdPlPr the wizard-acc.masc.sing. *Pjon tavai to maγos? who-acc. pull-3rdSPr the-acc.masc.sing. wizard-nom.masc.sing. *Pjous tavane ton maγo? who-acc.masc.plur. pull-3rdPlPr the wizard-acc.masc.sing.
Which Object questions	
Target question	**Produced by children of the SLI group**
Pjon liko kitazoun i kokores? who-acc. wolf-acc.masc.sing. look at-3rdPlPr the roosters-nom.masc.plur.	*I kotes, pji kitazoun? the hens-nom.fem.plur. who-nom.masc.plur. look at-3rdPlPr
Pjous kirious travai o maγos? who-acc.masc.plur. gentlemen-acc.masc.plur. pull-3rdSPr the wizard-nom.masc.sing.	*Pjous kirious tous travas? who-acc.masc.plur. gentlemen-acc.masc.plur. them-CLITmasc.plur pull-2ndSPr *Pjous kirious travate maγo? who-acc.masc.plur. gentlemen-acc.masc.plur pull-2ndPlPr wizard-acc.masc.sing.
Pjon γaiδaro plenoun i krokroδili? who-acc. donkey-acc.masc. wash-3rdPlPr the crocodiles-nom.masc.sing.	*Pjo γaiδaro pleni tous γaiδarous? who-acc. donkey-acc.masc. wash-3rdSPr the donkeys-acc.masc.plur.

It is apparent that the errors that were attested were variable. However, there were more case and agreement errors for *which subject* questions. First, this can be attributed to the bias for use of the accusative case instead of nominative and second, to the fact that alternative correct responses for *which subject* questions are more difficult, probably because they involve the use of direct object clitics. In the case of which object questions, less correct *WhVNP* responses were produced and more alternative correct responses. Indeed, the bias for producing more *Null Argument* responses reflects an avoidance strategy, since, in this way, case errors on the postverbal NP are avoided.

As far as the agreement errors are concerned, we have already discussed this parameter in the relevant section of the data obtained by the Greek DD group. However, in the SLI group substitutions of the 3^{rd}S with the 3rdPl also were attested, something that was not found in the DD group. The substitutions of the 3rdS with the 3rdPl may have also been a result of cognitive load and possibly because of exposure to both verb types. The fact, however, that such substitutions were observed also as an error in the comprehension tasks of definite articles in the case of the SLI group, implies the need for further investigation. Nonetheless, these errors are not specific to wh-question production, but within the context of the specific task, additional deficits are revealed.

To sum up, the errors that were found in the SLI group were variable and similarly variable was the performance of SLI children. Apart from the characteristic errors that differentiated the children of SLI group, failure to produce wh-questions was also observed in four subjects of the group, two of which were of school age.

9.8.5. Discussion

The current task investigated SLI children's ability to produce wh-questions. The findings can be summarized as follows:

- SLI children were found to produce significantly less correct responses than the children of the CA group. On the analysis of the *Overall Correct Responses*, an effect for *which* questions was revealed, whereas no difference was found between subject and object questions.
- In the case of *WhVNP* responses, SLI children were found to have particularly low performance and significant group effects were revealed. For this category, however, a significant effect was revealed for *object* questions, whereas no difference was found between *who* and *which* questions.
- SLI children were found to produce significantly more *Other Correct Responses* than the children of the CA group and group effects were revealed for object questions.
- Despite the fact that the within error analyses did not reveal any significant effects for any of the error types, the errors attested in the SLI group clearly differentiated SLI children.

The significant differences that the children of the SLI group exhibited in the production of wh-questions, are in line with previous findings in wh-production in SLI (van der Lely and Battel, 2003) and with previous studies in Greek SLI (Stavrakaki, 2001; 2006). Moreover, in the *Overall Correct Responses* significant effects were revealed for *which* questions. This was to be expected, since particular difficulties with D-linked structures have already been reported for SLI children. However, the omission of the NP was not the only error that was detected in the case of referential questions. Certainly, the errors that are related with the omission of the NP both in the SLI and the CA children are attributed to the discourse-linked status of these questions, but this cannot be the case for the errors on agreement or case.

The grammatical errors which were attested and were observed only in the children of the SLI group, are the manifestations of severe deficits in the production of wh-questions. These results are again in agreement with previous studies in Greek SLI (Stavrakaki, 2001; 2006). However, in the current study, we divided the correct responses. SLI children were additionally found to differ significantly from the children of the CA group on the production of correct *WhVNP* responses. Again, this was to be expected, taking into consideration the significant limitations of SLI children with the production of wh-questions. Moreover, for this specific category a significant effect was revealed and SLI children were found to produce significantly less correct *WhVNP* structures than the children of the CA group.

The aforementioned finding, again, is in agreement with previous findings in Greek SLI, since previous studies (Stavrakaki, 2001; 2006) do not report any other alternative correct structures. Therefore, the present findings confirm the findings of Stavrakaki (2001, 2006). In her studies, SLI children were tested over two periods of their linguistic development. Especially in the second study that was carried out five years after the first, she detected again, particular limitations in the formation of *object* questions and, furthermore, case errors were found to be the prominent error in SLI children's production. As we also presented in the error tables, case errors were also present in the current SLI group. If we also consider the fact that SLI children exhibited more instances of production of *Null Argument* responses for object questions, then this confirms our explanation. *Null Argument* structures are produced more by SLI children as an avoidance strategy of erroneous case marking on the postverbal NP (Stavrakaki, 2006). This observation however, applies, apparently, only to *object* questions, in which the postverbal NP in nominative case is replaced by accusative case.

The difficulties of SLI children, however, were not specific only to object questions. Even if an asymmetry was found between *subject* and *object* questions in the case of *WhVNP*, no asymmetry was found between *who* and *which* questions. Indeed, even if *WhVNP* who and which subject questions were better produced, still, the percentages were particularly low as compared to the ones of the CA group. Therefore, the specific structure is indeed problematic for SLI children. This is further supported by the fact that there were SLI children who could not even produce *who subject* questions at all or who produced also *Null Argument* responses. The second phenomenon, however, was not observed across all subjects. Even in subject questions, case errors were attested.

The next error pattern that should be noted again was the one of verb agreement. In many cases the 3rdPlPr was replaced by the 3rdSPr and more rarely, the opposite pattern was observed. Overgeneralization of the 3rdS has been reported for Greek SLI children (Clahsen and Dalalakis, 1999; Smith, 2008) and has been observed in very young typically developing children (Stephany, 1995). The substitution of the 3rdS with the 3rdPlur, however, is a rather peculiar finding. As we already noted in the previous section, these substitutions could have occurred due to cognitive load and possibly due to the exposure to both types. Certainly, such errors indicate underlying difficulties with agreement, but these difficulties are not likely to occur only within the framework of wh-production. Recall that in the cases of erroneous corrections in the grammaticality judgement tasks of definite articles, such errors were also observed. Therefore, we cannot hold that this is an error specifically related to wh-question production. Rather, it appears that these difficulties are revealed through the production of complex sentences as they could have also been revealed during a sentence repetition task. After all, in the grammaticality judgment task, when such errors were observed, these occurred after the repetition and correction of an SVO sentence. Similarly, in the current task, children had to produce a question on the basis of a probe SVO sentence, which they had to recall. Therefore, it is more probable that the errors on the verb are more likely to be attributed to these limitations.

Next, we would like to discuss the differences that were observed across the subjects of the SLI group as well as to attempt to define the different profiles of SLI children. The youngest children of the SLI group were not able to produce wh-questions and these difficulties were attested by not being able to respond to the task, by producing only the wh-pronoun (and/or wh-pronoun and NP) or by constant repetition of the probe sentence. The cases in which a question was produced were very limited. On the one hand, *Null Argument* responses were produced and on the other hand, the repetition of the probe sentence assisted the child into producing a question. The specific child (S6), however, was also characterized by echolalia. As we already noted in the section concerning the classification of errors, these instances of repetition were not taken as incorrect, when a question was produced. Apart from cases of echolalia, this could also indicate a child's strategy for producing the questions. Such a strategy should not be excluded even for typically developing children. Even for such instances, however, qualitative differences are expected. Let us consider an example of a question, as this was produced by S14 of the SLI group:

(S14's response) Pjos γaiδaros pleni tous krokodeilous?
who-nom. donkey-nom. wash3rdSPr the crocodiles-acc.?
Aftos kseri pjon. Rota ton pjon.
He knows who-acc. Ask him who-acc.
*Pjon plenoun tous korkoδilous?
Who-acc. wash-3rdPlPr the crocodiles-acc.?

Target: Pjos γaiδaros pleni tous krokodeilous ?
who-nom. donkey-nom. wash3rdSPr the crocodiles?

As can be observed, after the correct production of the sentence, the child continued producing other sentences and at the end an erroneous question, with drop of the NP, case error on the wh-pronoun and agreement error on the verb. This example clearly shows the extraordinary difficulties that SLI children have with the processing of complex syntactic structures, as well as the different profiles that are revealed through the implementation of relevant tasks. It is worth again to note that this child was characterized by less severe-moderate impairments, and still, demonstrated characteristic error patterns and deviant profile on the task.

In the more severe cases, as the ones of S5 and S7, who have not completed the SLT programs and in addition meet the criteria for dyslexia, again the dominant errors were the one of case and agreement. Their overall correct responses were 33% and 54,17% respectively, including lexical errors. A pattern that was observed in S5 was the alteration of number i.e. the correct production of the question but with the noun in singular instead of plural number as in the following example:

Pjos γaiδaros pleni ton krokoδilo ?
who-nom. donkey-nom. wash3rdSPr the crocodile-acc.masc.sing.
Which donkey is washing the crocodile?

instead of
Pjos γaiδaros pleni tous krokoδilous?
who-nom. donkey-nom. wash3rdSPr the crocodiles-acc.masc.plur.

This error could also be attributed to attentional factors. Alternatively, it could also indicate difficulties with the plural number, since this was an error that occurred more times in this child's production.

As far as the cases of children who had completed the SLT programs are concerned (S9 and S13), again, reduced performance was observed. S9 exhibited one agreement error and one YES/NO question whereas the rest of his errors were mostly lexical. Moreover, the alternative correct responses for *who* and *which object* questions, involved the production of *NpTop* structures. S13 did not produce any *WhVNP* response. All of her responses involved *Null Argument* structures with additional agreement errors and other correct Null Argument responses with number alteration. S11 had relatively better performance, but only *Null Argument Responses* for *who object* questions, five *Null Argument* responses for *which object* questions and one with an agreement error.

Finally, S12's production included a case and agreement error, erroneous word order WhNPV and incomplete responses. S10 produced only affirmative sentences in many cases with reversed thematic roles and with NP omission in the case of *which* questions. Her production was characterized by failure and since the child is of an advanced age this constitutes an additional criterion.

The profiles of SLI children on the production of wh-questions were characterized by variation, something which is expected within the SLI spectrum (Leonard, 1998). Certainly, the age, the nature and the severity of their language impairments as well as the SLT intervention influence diversely their production skills. Apart from the cases in which wh-questions were not produced or were produced very rarely, in all other cases, SLI children produced both correct and incorrect responses, with the second being more rare in these children who had completed their SLT programs. Our results again, agree with the ones reported by Stavrakaki (2001; 2006).

At this point I would like to discuss further the results, according to her notes and observations, and particularly the ones included in her 2006 research, the one of a follow-up study of the same SLI children. More specifically she addresses the issue of the developmental effects on the improvement of linguistic abilities in SLI and furthermore she addresses the issue of whether the improved performance of these children could be the result of compensatory mechanisms, or, alternatively a result of an extremely delayed acquisition process. Despite the fact that the current study is not investigating SLI children's performance on wh-questions in different stages of their development, the fact that we included children of different ages revealed different profiles and strategies.

First, we saw that SLI children produced significantly more *Other Correct Responses* with more frequent the one of *Null Argument*. In fact, even in the two younger subjects (S1 and S6), this was the *Other Correct* structure that was observed in the very limited number of questions that they produced. Moreover, in an older child, S13, this strategy was systematic, almost exclusive. On the other hand, in the case of the CA, this was rarely observed in school aged children. The only case in which it was observed more systematically for *which object* questions (four out of six items), was in the case of S14, a child of preschool age. Therefore, it appears that SLI children can compensate for their difficulties by using alternatively correct structures and since these structures can be observed in younger CA children, then their systematic production in older SLI children could indicate extremely delayed acquisition process. At this point, it would be easy to suggest that similar findings could be obtained in typically developing children. Nevertheless, the training procedure was identical for all the children and moreover, it was specific for *WhVNP* structures. If the children of the CA group were not successful in the production of *WHVNP* responses, then this would have been revealed. However, reduced performance of the CA children was not expected in any case, since previous research (Stavrakaki, 2001; 2006) has showed relatively early successful acquisition of the *WhVNP*. To sum up, it appears that the systematic production of correct but not *WhVNP* responses in school aged children can be indicative of a delay in linguistic development.

In the case of S5, S7 and S8 who exhibited more or less similar profiles, the common error was the one of case and agreement. However, despite the errors, these children were able to produce correct questions. Again, at this point we should refer to the conclusions of Stavrakaki (2006) who noted that case checking operations are not always successful in complex syntactic structures. And once again, we notice that the use of alternative correct responses appears to assist these children into producing correct questions.

Therefore, the inspection of the individual performance across subjects suggests different developmental stages and different compensatory strategies in the production of wh-questions. However, in order to be able to conclude and to provide definite conclusions, a follow-up investigation is needed and in particular in these children who were not able to produce wh-questions. Nonetheless, we saw that the performance of SLI children is variable, but that despite this variability their profiles were different from the ones of typically developing children. Most of the subjects exhibited particularly deviant performance and the less impaired were the ones who had completed their SLT programs. Moreover, relative failure or complete failure to the task was observed in five children, something that could also possibly constitute a clinical criterion for SLI, if we also take into consideration that SLI children’s performance on wh-production is limited (Stavrakaki, 2001; 2006).

Finally, as far as the possible overlap with DD is concerned, in the case of DD children, we did not notice particular difficulties. However, occasional errors on case may also be found in DD children, but the differences are expected to be quantitative and the overall correct performance in children with DD is expected to be higher than the one observed in SLI. Furthermore, DD children are not expected at any instance to exhibit failure to the task, something that can be attested in children with SLI. Nonetheless, more data are needed in order to provide more definite conclusions. But again, as the data of current studies indicate the comparative researches should be conducted between undiagnosed SLI children of school age and dyslexic children. Exposure to SLT programs and especially in cases in which SLI children manifest moderate impairments are possibly not very promising for differentiating between DD and SLI. Despite all these limitations, however, still predictions on the performance can be held and the differences are expected to be both quantitative and qualitative.

Chapter 10: Comprehension of wh-questions in Italian and Greek Developmental Dyslexia and Greek SLI: a metasyntactic approach

10.1. Experimental material and procedure

Children's comprehension of wh-questions was investigated through a comprehension task which focused on minimizing task-dependent difficulties that may influence the comprehension of these particularly demanding sentences and, with the ultimate purpose of introducing this method for purposes of metasyntactic intervention.

Some of the experimental images were adapted from De Vincenzi (1996) and other ones were constructed with clipart figures by the experimenter. Thus, the experimental images did not differ from the ones used in de Vicenzi et al's study (1999) in Italian or from the study of Ebbels and van der Lely (2001). The difference of the current task is the presentation of the experimental pictures.

The task is administered through a PPT presentation with prerecorded stimuli (female Native Italian and Native Greek speaker respectively). The presentation of the stimuli is realized in three different parts. We provide examples for who and which-object questions in both languages as follows:

10.1.1. Who-object questions:

1st picture-the agent appears on the screen

(IT): Ci sono due cani
Here there are two dogs-masc.plur.

(GR): Edho ine dhio skili.
Here there are two dogs-nom.masc.plur.

Here, there are two dogs

2nd picture- the agent appears between two hidden figures and the transitive action is described

(IT): I cani guardano qualcuno
The dogs-masc.plur. are looking at someone-sing

(GR): I skili kitazoun kapjon
The dogs-nom.masc.plur. look-3rdplurPR someone-acc.masc.sing.

The dogs are looking at someone.

3rd picture- The question is addressed, the characters are revealed and the child has to choose the correct character.

(IT): Chi guardano i cani ?
Who look-3rdplurPR the dogs-masc.plur.

(GR): Pjon kitazoun i skili ?
Who-acc. masc.sing. look-3rdplurPR the dogs-nom.masc.plur.

Who are the dogs looking at?

10.1.2 Which- object questions

1st picture-all the characters appear on the screen

(IT): Qui ci sono due cani bianchi, due cani grigi e un asino
Here there are two dogs-masc.plur. white-masc.plur., two dogs-masc.plur. grey-masc.plur. and a donkey-masc.sing.

(GR): Edho ine dhio aspri skili, dhio gkrizi skili ke enas ghaidaros
Here there are two white-nom.masc.plur., dogs-nom.masc.plur., two grey-nom.masc.plur. dogs-nom.masc.plur. and a donkey-nom.masc.sing.

2nd picture-the agent appears between two hidden figures and the transitive action is described

(IT): L' asino guarda due dei cani.
The donkey-masc.sing. look-3rdsingPR two of the dogs-masc.plur.

(GR): O gaidharos kitazi dhio apo tous skilous
The donkey-nom.masc.sing. look-3rdsingPR two of the dogs-acc.masc.plur.

The donkey is looking at two of the dogs

3rd picture- The question is addressed, the characters are revealed and the child has to choose the correct character.

(IT): Quali cani guarda l' asino ?
Which-plur dogs-masc.plur. look-3rdsigPR the donkey-masc.sing.

(GR): Pjous skilous kitazi o gaidharos ?
Which-acc.masc.plur dogs-acc.masc.plur. look-3rdsigPR the donkey-nom.masc.sing.

Which dogs is the donkey looking at?

The items were common in both languages and included only masculine nouns, as we followed the same rationale with the production task: plural nouns for who-questions, singular and plural nouns for the NPs in which-questions). The task included 24 items, 6 for each sentence type. The presentation of stimuli was pseudorandomized. The type of sentences, number of items and the verbs are presented in Table 10.1 and Table 10.2 for both languages. Samples of pictures can be found in Appendix IV.

Table 10.1: Verbs used in the wh-questions comprehension task in Geek and Italian (infitival forms)

Verb	Greek	Italian
chase	kinigho	inseguire
look	kitazo	guardare
pull	travo	tirare
follow	akoloutho	seguire

Table 10.2: Experimental items in the wh-comprehension task

Sentence Type-Number of Relevant Items	Italian	Greek
Who-Subject (6)	Introduced by ***Chi* – *singular verb***	Introduced by ***Pjos-nom. singular verb***
Who-Object (6)	Introduced by ***Chi* -*plural verb***	Introduced by ***Pjon-acc. -plural verb***
Which Subject (6) : • 3 sentences with singular masculine NP • 3 sentences with plural masculine NP	i.e. ***Quale-which sing***. asino-masc.sing. ***which donkey*** i.e. ***Quali-which plur.*** cani-masc.plur. ***which dogs***	i.e. ***Pjos who-nom.*** ghaidharos- donkey-nom. masc.sing. ***which donkey*** i.e. ***Pji-who nom. masc.plur.*** cani-nom.masc.plur. ***which dogs***
Which Object (6) • 3 sentences with singular masculine NP • 3 sentences with plural masculine NP	i.e. ***Quale-which sing***. asino-masc.sing. ***which donkey*** i.e. . ***Quali-which plur.*** signori-masc.plur. ***which dogs***	i.e. ***Pjon-who.acc.masc.sing.*** ghaidharo-acc.masc.sing. ***which donkey*** i.e. ***Pjus-acc.masc.plur.*** skilous-acc.masc.plur. ***which dogs***
Total of Sentences	**24**	**24**

10.2. Comprehension of wh-questions by Italian Dyslexic and Typically Developing Children

10.2.1. Results

We obtained 480 responses, 240 by each participant group. The accuracy scores of both groups are presented in Table 10.4.

Table 10.4: *Raw percentages and standard deviations of correct responses on the wh-questions comprehension task-Italian DG and CG*

Group	TTL	Who-S	Who-O	Which-S	Which-O
DG	**95,83** (5,2)	**95** (8,05)	**96,67** (7,03)	**96,67** (7,03)	**95** (11,25)
TD	**98,75** (2,81)	**100** (.00)	**96,67** (10,54)	**100** (.00)	**98,33** (5,27)

The results clearly show that there is no striking difference between the DG and the CG on the comprehension of wh-questions and the errors were limited. The statistical analysis verified this observation.

The model turned out to be significant ($x^2(1) = 5.35$, $p=0.02072$), but did not reveal any significant group differences. Hence, DG children were not found to differ in the comprehension of wh-questions from their typically developing peers. Similarly, as expected, the additional models also did not turn out to be significant both for wh-type who vs. which ($x^2(1) = 0.0899$, $p=0.7643$) and for question type subject vs. object ($x^2(1) =0.0899$, $p=0.7643$) and consequently failed to reveal significant group effects.

The summary of the statistical results can be found in Table 10.5.

Table 10.5: Summary of the statistical analysis on Accurate responses

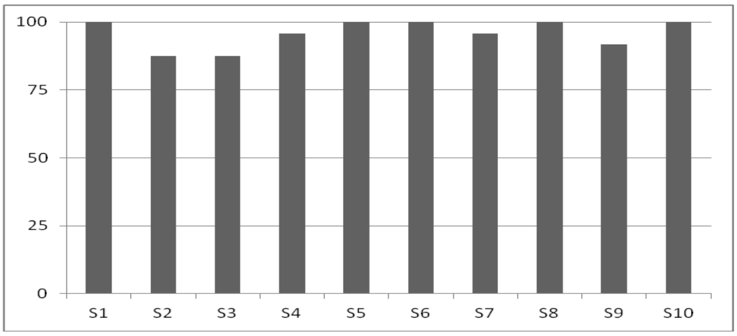
Fixed Effects	Estimate	SE	Z	*p*
(Intercept)	3.530	0.459	7.689	<.001
groupCG	2.343	1.292	1.813	0.0698
(Intercept)	3.6278	0.5938	6.109	<.001
Group CG	2.3435	1.2906	1.816	0.0694
Wh-type	-0.1964	0.6964	-0.282	0.7779
(Intercept)	3.4315	0.5585	6.144	<.001
Group CG	2.3435	1.2906	1.816	0.0694
Subject/object	0.1963	0.6964	0.282	0.7780

To sum up, DG children were not found to differ from their typically developing peers on the comprehension of wh-questions. Moreover, no significant effects were revealed for the different question types; in particular, asymmetries were not observed neither between *who* and *which* questions nor between *subject* and *object* questions.

10.2.2. Individual performance

The individual accuracy scores of the children of the DG on the comprehension of wh-questions for the DG are presented in Figure 10.1.

Figure 10.1: Individual accuracy scores of the children of the Italian DG on the comprehension of wh-questions



We can observe that among the DG group there are not major differentiations on the accuracy scores and the performance of DG children appears homogenous and does not contrast the one of the CG. Unlike the previous experiments, the performance of the DG is not variable.

Furthermore, we calculated the individual z-scores on the basis of the raw accuracy scores. The mean raw accuracy score of the CG was 23,7. 3 children (S2, S3 and S9) were found to be significantly below the mean of the CG. It should be noted, however, that the lowest raw accuracy score for the CG was 22. Therefore, for the current experiment, we cannot consider these children as having particular difficulties in comprehension.

However, there is a possibility that more than two errors could be indicative of other difficulties as well, such as attention, since even S4 and S10 who were characterized by limited concentration skills did not exhibit low performance and the task was designed in order to facilitate comprehension of the specific structure.

10.2.3. Discussion

The current task was designed to facilitate children's comprehension of who and which subject and object questions. The rationale emerged first of all by the relatively subjective way in which researchers are able to test the comprehension of the specific structures and above all, by the only existing study in Italian by De Vincenzi et al. (1999) that reports asymmetries between who and which questions and subject and object questions until an advanced age of typically developing children.

Hence, the purpose of the task was dual. First, we aimed to reduce attentional components on comprehension caused by the presentation of the characters. We used only verbs that involve actions in which the characters appear in a certain distance (i.e. chase vs. wash). Second, we used the method of introducing the characters involved in each action by providing both linguistic and visual feedback. This was succeeded by the simultaneous verbal presentation of the characters and the hidden or unhidden figures: both the agent and the patient of each action as well as their direction were made clear. It is apparent that the investigation of comprehension of wh-questions is far more complicated and that different components must be considered.

Since the task is rather different and we cannot compare directly the results we obtained with other existing researches, we shall limit our discussion on the comparison between the DG and the CG and of course on the comparison with De Vincenzi's study (1999) on Italian typically developing children. Finally, at the end of the chapter, we shall discuss the particularities of experimental designs on wh-comprehension and the further use of the specific task for intervention purposes.

Returning now to the evaluation of the results which we obtained for the participant groups, it would be useful to start with the predictions by referring first to the results reported by De Vincenzi et al. (1999) which we present here in Table 10.6 and concern 8-11 year-old children. The accuracy scores are particularly low for object questions even until the age of 10. After this age range, a remarkable increase in the performance can be observed, without an intermediate stage that precedes it. That is, there is no difference noted between the children of 8-9 years old and the ones of 9-10 years old.

Table 10.6: Accuracy scores on the comprehension of wh-questions in different age groups of Italian typically developing children as reported in the study of De Vincenzi et al. (1999), Proceedings of ECCS, p. 305

Group	Who-S	Who-O	Which-S	Which-O
7-8	97	54	97	47
8-9	96	60	99	52
9-10	97	58	98	53
10-11	97	83	99	81

Therefore, these results reported in Table 10.6 suggest that if the comprehension of object questions is at these low levels for typically developing children (almost at chance level), the overall performance of DG children would be even lower. Moreover, if DG children have difficulties in the comprehension of object questions, this would be apparent even in the current task. Certainly in the current task, comprehension is facilitated, but even in this case a more apparent difference would be expected (i.e. an overall accuracy score of 80 to 85% for the DG).

The DG group in the current study did not differ significantly from the CG and, the performance of dyslexic children was almost excellent. The same was observed for TD children, whose accuracy scores are strikingly different than the ones reported in the aforementioned study. Clearly, the results obtained in the current experiment pinpoint to the difference between the experimental designs.

As far as the difference between the DG and the CG is concerned, no significant results were obtained and this is to be further investigated. Taking into consideration the present findings, there is still a possibility that in a similar task as the one of De Vincenzi et al. (1999) some DG children would demonstrate more errors on subject questions as well, something that could differentiate them from typically developing children.

In all cases, it appears that wh-question comprehension should be reinvestigated in Italian, since the data are rather limited and report low accuracy scores for object questions until the age of 10. Therefore, De Vincenzi et al's (1999) study cannot be used as a baseline, a reference for estimating deviant performance on object questions. The only prediction can be based on subject questions, since in the current task, we found some instances of sporadic errors.

To sum up, the current experiment showed that DG children did not differ on the comprehension of wh-questions from their typically developing peers, but despite the design of the task that aimed to facilitate wh-question comprehension, two children were found to have significantly lower z-scores than the CG.

10.3. Comprehension of wh-questions by Greek Dyslexic and Typically Developing Children

10.3.1. Results

The data of the DG were compared to the ones of the CG2, since in Greek the acquisition of wh-questions occurs in a much earlier stage than in Italian (Stavrakaki, 2001; Guasti et al. 2010). We obtained 432 responses (216 for each participant group). The accuracy scores for each participant group on the different types of questions are presented in Table 10.7.

Table 10.7: *Raw percentages and standard deviations of correct responses on the wh-questions comprehension task-Greek DG and CG2*

Group	TTL	WhoS	WhoO	WhichS	WhichO
DG	**98,61** (1,84)	**100** (.00)	**100** (.00)	**96,3** (7,35)	**98,15** (5,56)
CG2	**94,9** (4,55)	**96,3** (7,35)	**94,44** (8,33)	**96,3** (7,35)	**92,6** (12,11)

It is apparent that the score of the DG is higher than the one of the CG. This is the only case that the accuracy scores of the DG are higher than the ones of the CG2. In the comprehension tasks of direct and indirect object clitics the DG had scored a little lower than the CG2 but without any significant differences.

Again, the model turned out to be significant ($x^2(1)$= 4.0455, p=0.04429), but without any significant group effects, showing that there were some differences between the DG and the CG2, but these were not enough to result in significant differences. Similarly, the additional models also did not turn out to be significant both for wh-type who vs. which ($x^2(1)$ =0.7503, p=0.3864) and for question type subject vs. object ($x^2(1)$ =0.2536, p=0.6146). The summary of the statistical results can be found in Table 10.8.

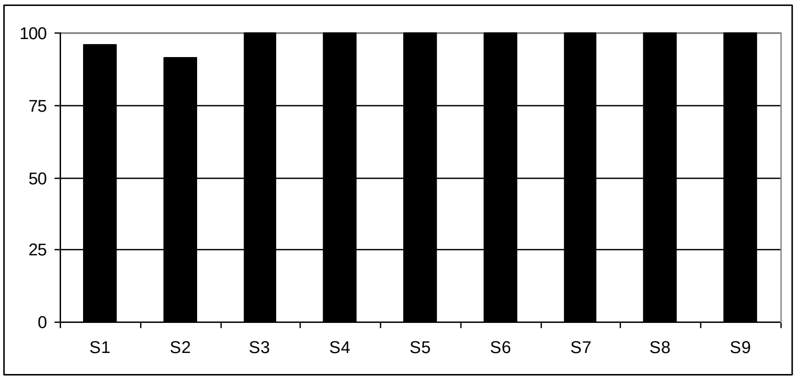
Table 10.8: Summary of the statistical analysis on Accurate responses

Fixed Effects	Estimate	SE	Z	*p*
(Intercept)	4.7027	0.6983	6.734	<.001
groupCG	-1.3724	0.7684	-1.786	0.0741
(Intercept)	4.3778	0.7365	5.944	<.001
Group CG	-1.3720	0.7599	-1.806	0.071
Wh-type	0.5875	0.7033	0.835	0.404
(Intercept)	4.5412	0.7649	5.937	<.001
Group CG	-1.3733	0.7681	-1.788	0.0738
Subject/object	0.3421	0.7136	0.479	0.6317

10.3.2. Individual Performance

Figure 10.2 illustrates the individual performance of the DG on the wh-questions comprehension task.

Figure 10.2: Individual accuracy scores of the DG on the comprehension of wh-questions



It is apparent that most of the DG children scored at ceiling, something which was not the case for the CG2. Nonetheless, S8 and S9 of the CG2, who are the older children and 6 out of nine children of the chronological age group (CG) who were tested, all performed at ceiling. However, since the task does facilitate comprehension and the already existing research in Greek has showed high accuracy percentages even in children of a younger age, it would be better to comment on results according to the ones of younger children.

First of all, as far as S1 and S2 of the DG are concerned, and since 8 children (S8, S9 of the CG2 and 6 out of 9 of the CG) have shown at ceiling performance, here again, it is more or less like in the case of the Italian CG group. However, in the current case of the Greek DG, apart from S1 who had only one error, the only subject who had two errors was S2 (CA: 11;5) and differs even among the DG group.

In addition, z-scores were calculated even for this case, since in the comprehension tasks of direct and indirect object clitics, there were two instances of significant individual difference as compared to the CG2. Again, the z-scores were calculated according to the mean raw score of the CG2. The mean raw score of the CG2 was 22,78. None of the children of the DG was found to be significantly below the mean of the CG2.

However, the two errors in the case of S2 must not be ignored, since as we already discussed after a certain age, the performance to the specific task is at ceiling and probably not even one or two errors are allowed.

10.3.3. Discussion

The current experiment investigated DG children's comprehension skills of wh-questions. Previous research in Greek SLI (Stavrakaki, 2001) has reported particular difficulties in the comprehension of local *who-object*, less difficulties but still reduced performance on *which-object* questions. The lowest performance of the SLI was on the comprehension of which subject and object long distance questions. However, in the current task we only tested local wh-questions.

For the case of the chronological age group (5;1-9;3) who participated in Stavrakaki's (2001) research, the results on local questions (*whoS, whoO, whichS, whichO*) were at ceiling for all four types of questions. The procedure was different and the structures were tested on a basis of an acting-out task. In our study, we see that not all children of the CG2 had scores at ceiling. This could be also due to the difference between the tasks or due to the fact that our task tested sentences with nouns in plural number.

Nonetheless, taking into consideration the aforementioned research combined with our findings in Greek, it appears that typically developing children do not show any particular difficulties contrary to the only research that has been reported until now in Italian (De Vincenzi et al., 1999). However, in all these cases, there are differences between the tasks, but this shall be discussed further.

As far as the Greek DG children are concerned and with respect to previous findings in SLI, differences were expected to be revealed, at least for object questions. These differences, however, were not expected to be striking, if we consider the facilitation provided by the task. In most cases, the DG children's performance was at ceiling and there were only three errors found in the DG. However, in the rest of the experiments the DG did not demonstrate an overall at ceiling performance. Therefore, this shows that the task has assisted these children and even minimal errors in most of the subjects were avoided. Moreover, none of the children demonstrated incomprehension of the task and even in the case of these errors the erroneous responses were the ones of reversed thematic roles and did not involve pointing to the middle character, something that would also be indicative of incomprehension of the sentence.

To sum up, although if DG children were expected to show some pattern of difficulty on the specific task, most of the children demonstrated ceiling performance. This is probably attributed to the facilitation provided by the task, but the possibility of no particular problems with the comprehension of wh-questions should not be excluded.

10.4. Discussion: Italian and Greek data

The current chapter concerned with the investigation of comprehension of local wh-questions in Italian and Greek DD children. The task was designed in order to facilitate comprehension, since previous research in Italian (De Vincenzi et al., 1999) had demonstrated very low performance profiles even for typically developing children. As far as clinical data are concerned and at least for Italian, no previous research has been conducted and therefore we cannot compare the results directly. On the other hand, in Greek, there are data from a group of SLI children (Stavrakaki, 2001) on both local and distant wh-questions, however on a task rather different than ours and than the one of De Vincenzi et al. (1999). For Italian, in addition, a recent research in production (Guasti et al., 2012) has demonstrated discrepancy between *subject* and *object* local wh-questions in typically developing children.

The results on the current task contrast all the previous aforementioned findings, since no differences were observed neither between subject and object questions nor between who and which questions. It is a fact that the DD groups are composed by children of older age. But this is not the case for the children of the Greek CG2. If apparent differences were to occur, then this would have been revealed by the performance and subsequent relevant significant effects on the statistical analysis. In contrast, nor the accuracy results or the statistical analysis indicated any discrepancy between the different types of questions.

As the current findings suggest, in Italian there are striking differences between the results of De Vincenzi et al. (1999), whereas in Greek, no particular differences are noted. Therefore, this fact provides an additional support for the facilitation provided by the task, at least for the Italian data. The implications which arise for further investigation are more than necessary. Are the data provided by De Vincenzi et al. (1999) representative of the actual performance of Italian TD children on the comprehension of wh-questions or has the task (picture designs and verbs) affected the results? Apparently, more research is needed and with different experimental designs in order to be able to conclude.

To recapitulate, with the specific task DG children in both languages were not found to demonstrate particular difficulties in the comprehension of local wh-questions. In Italian, however, there were instances of significant differences of few DG children as compared to the mean accurate performance of the CG. The results strongly suggest that the research on wh-questions comprehension must be repeated in both languages through different experimental designs.

10.5. Comprehension of wh-questions by Greek SLI and Typically Developing Children

In the current experiment, twelve SLI children participated and eleven typically developing children. The SLI children whose data could not obtained were S6 and S7, and the child from the CA group whose data could not obtained was S9. These children could not be tested because an additional testing session was not made possible.

10.5.1. Results

The mean percentages and standard deviations of the SLI and the CA children on *Accurate* responses are presented in Table 10.9.

Table 10.9: Raw percentages and standard deviations of Accurate responses on the wh-questions comprehension task-Greek SLI and CA children

Group	TTL	WhoS	WhoO	WhichS	WhichO
SLI	**85,06** (14,37)	**79,16** (17,59)	**83,33** (22,47)	**86,1** (15,62)	**90,27** (13,21)
CA	**97,73** (3,41)	**98,5** (5,02)	**98,5** (5,02)	**96,96** (6,74)	**96,96** (6,74)

The model on *Accurate* responses turned out to be significant ($x^2(1)$ =8.8754, p = 0.002890) and revealed additionally significant group differences. SLI children were found to select significantly less Accurate Responses than the children of the CA group.

The model investigating differences between *who* and *which* questions did not turn out to be significant ($x^2(1)$ =1.0253, p = 0.3113) and did not reveal any further significant effects. Similar results were obtained in the model investigating possible differences between subject and object questions ($x^2(1)$ = 0.3708, p = 0.5426).

To sum up, SLI children were found to select significantly less *Accurate* responses, but these differences occurred irrespectively of the different types of questions. The summary of the statistical results can be found in Table 10.10.

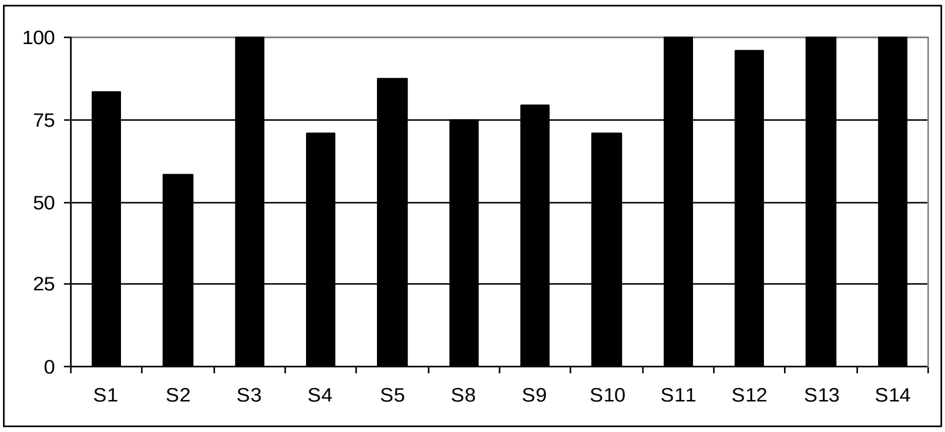
Table 10.10: Summary of the statistical analysis on Accurate responses

Fixed Effects	Estimate	SE	Z	*p*
(Intercept)	4.7325	0.6685	7.08	< .001
groupSLI	-2.3276	0.7607	-3.06	0.00221
(Intercept)	4.9989	0.7235	6.909	< .001
GroupSLI	-2.3278	0.7607	-3.060	0.00221
Who/Which	-0.5189	0.5066	-1.024	0.30571
(Intercept)	4.8872	0.7204	6.784	< .001
Group CA	-2.3276	0.7606	-3.060	0.00221
Subject/Object	-0.3130	0.5060	-0.618	0.53626

10.5.2. Individual Performance

The individual Accuracy Scores of the children of the SLI group on the specific task are presented in Figure 10.3.

Figure 10.3: Individual Accuracy Scores on the wh-comprehension task-Greek SLI children



Moreover, since there was no particular variation attested across the children of the CA group, we calculated the z-scores of the SLI children. The mean raw accuracy score of the children of the CA group was 23,4545. Despite the facilitation provided by the specific task, seven out of twelve SLI children (S1, S2, S4, S5, S8, S9, S10) had scores significantly lower than the mean of the CA children. Moreover, the lowest performance was obtained by S2, S4 and S10 who had failed in the production task of wh-questions. Even if their performance on comprehension is better and no failure was attested, still, they exhibited particular difficulties.

In the case of the CA group, the maximum number of errors was 2, therefore the results of the SLI appear to be very weak in some cases. In the cases of older children, the lowest performance was obtained by S9 and S10. In particular, S10 also exhibited particular performance profile (selection of the middle character of the picture or no answer).

10.5.3. Discussion

These results do not fully agree with previous findings on wh-question comprehension in Greek speaking children with SLI (Stavrakaki, 2001). Her task was different than the present one and SLI children, contrary to their LA controls, were found to process better *which* than *who* questions. The researcher attributed this finding to the referential *NP* that assisted SLI children into processing better *which* questions. Furthermore in her study, the performance on object questions was found to be lower for both the SLI and the LA group. The children of the SLI group were found to differ significantly on the comprehension of *who object* questions, whereas no differences were found for *which subject questions*. Our findings agree as far as the better performance on *which* questions is concerned. However, the performance on *who object* questions on the current task is better.

Finally, the fact that better performance was observed in children who had failed to the production task as well as the fact that no differences were revealed between *who/which* questions and *subject/object* questions, renders the specific method appropriate for purposes of rehabilitation. As far as the differences with the Greek DD group are concerned, again quantitative and qualitative differences are observed, at least according to the performance of these school aged SLI children who exhibited low accuracy scores.

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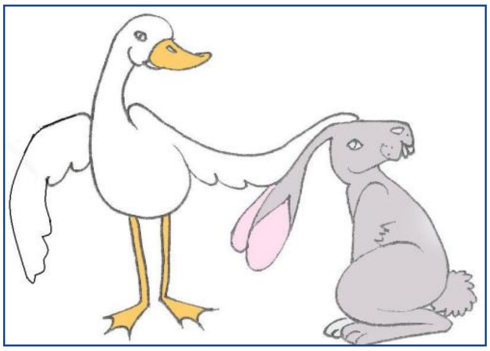
APPENDICES

APPENDIX I
Direct Object Clitics Tasks

Direct Object Clitics Production Task-Picture Sample

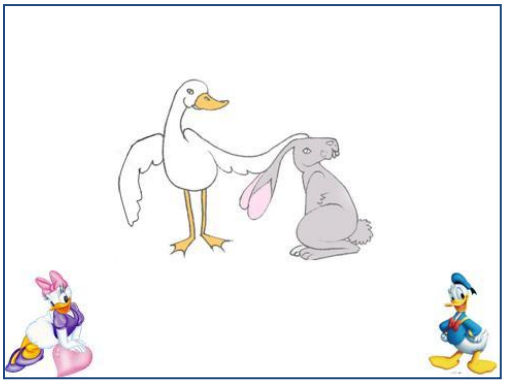


(IT)-“La papera accarezza il coniglio. Cosa fa la papera al coniglio?”

(GR)-“I papja chaidevi ton lago. Ti kani i papja ston lago?”

The duck is petting the rabbit. What is the duck doing to the rabbit?

Direct Object Clitics-Grammaticality Judgment Task of Omissions-Picture Sample



(IT)-“La papera accarezza il coniglio. Cosa fa la papera al coniglio?”

Female cartoon character: lo accarezza (clitic response)

Male cartoon character: *accarezza (omission response)

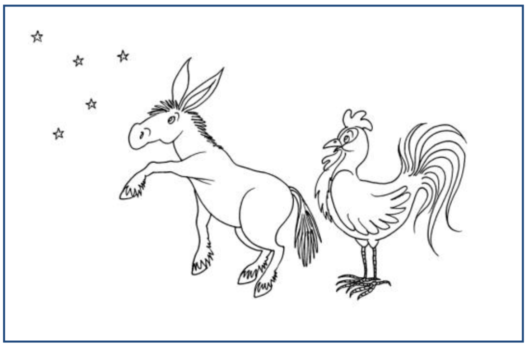
(GR) “I papja chaidevi ton lago. Ti kani i papja ston lago?”

Female cartoon character: ton chaidevi (clitic response)

Male cartoon character: *chaidevi (omission response)

APPENDIX II
Indirect Object Clitics Tasks

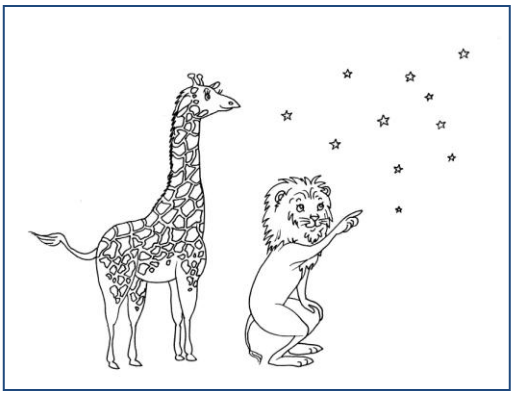
Indirect Object Clitics Production Task-Picture Samples



(IT) – "L' asino mostra le stelle al gallo. Cosa fa l' asino al gallo ?"

(GR)- "O gaidaros dichni ta asterja ston kokora ti kani o gaidaros ston kokora?"

The donkey shows the stars to the rooster-masc.sing. What is the donkey doing to the rooster?

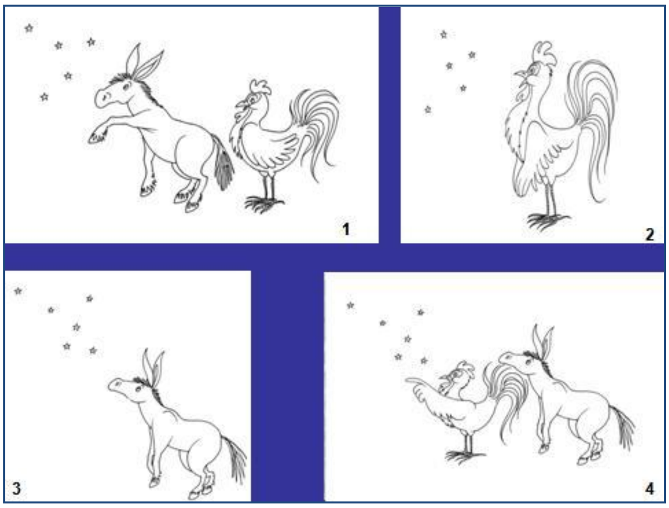


(IT) – "Il leone mostra le stelle alla giraffa. Cosa fa il leone alla giraffa ?"

(GR)- "To liodari dichni ta asterja stin kamilopardali.Ti kani to liodari stin kamilopardali?"

The lion shows the stars to the giraffe-fem.sing. What is the lion doing to the giraffe?

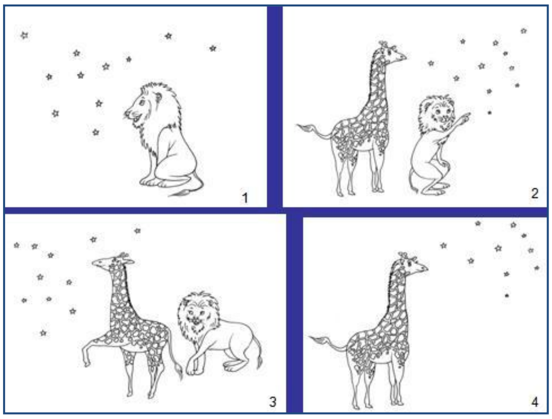
Indirect Object Clitics Comprehension Task-Picture Samples



(IT) - “In questa storia c’ è un gallo e l’ asino gli mostra le stelle”

(GR)- “Se afti tin istoria ine enas kokoras kai o gaidaros tou dichni ta asterja”

In this story there is a rooster-masc.sing. and the donkey is showing him the stars.



(IT)-“In questa storia c’ è una giraffa e il leone le mostra le stelle”

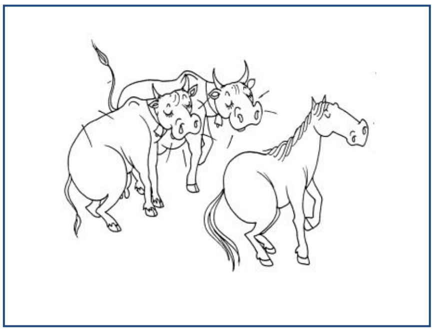
(GR)- “Se afti tin istoria ine mia kamilopardali ke to liodari tis dichni ta asterja”

In this story there is a giraffe-fem.sing. and the lion is showing her the stars.

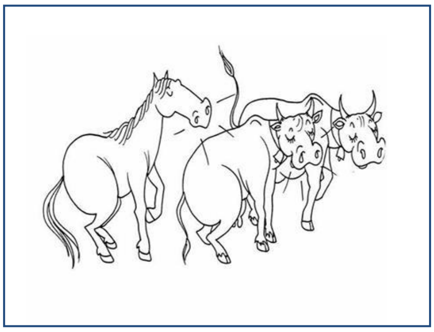
Appendix III
Definite Articles Tasks

Production of definite articles-Picture Sample

Subject DP



Object DP

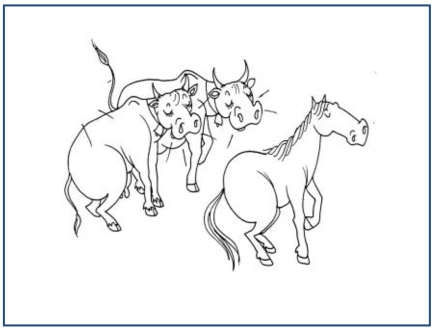


(IT)-Chi è che annusa il cavallo?
(GR)-Pji mirizoun to alogo?
Who is smelling the horse?

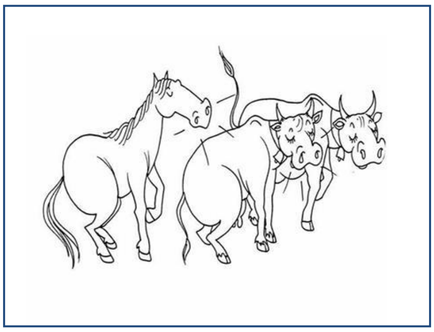
(IT)-Chi è che il cavallo annusa?
(GR)-Pjous mirizi to alogo?
Who is the horse smelling?

Grammaticality judgment task of omissions of definite articles-Picture Samples

Subject DP



Object DP

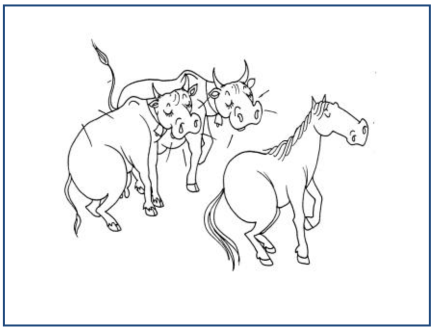


(IT)-*Mucche annusano il cavallo
(GR)-*Ajelades mirizoun to alogo
*Cows are smelling the horse

(IT)-*Il cavallo annusa mucche
(GR)-*To alogo mirizi ajelades
*The horse is smelling cows

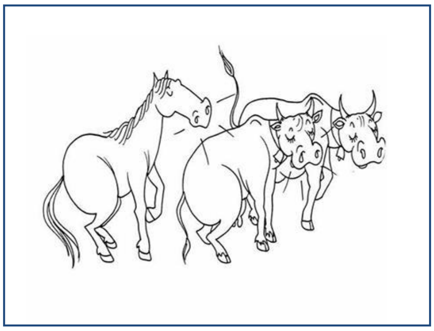
<u>Grammaticality judgment task of ungrammatical conditions of definite articles-Picture Samples</u>

Subject DP | Object DP



(IT)-*Nelle mucche annusano il cavallo

(GR)-*Tis ajelades mirizoun to alogo

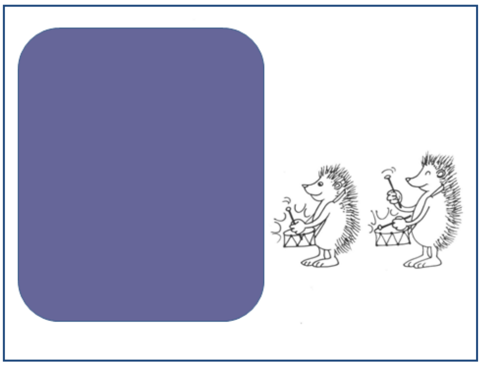


(IT)-*Il cavallo annusa nelle mucche

(GR)-*To alogo mirizi i ajelades

APPENDIX IV
WH-QUESTIONS TASKS

Production of wh-questions
Who-object questions

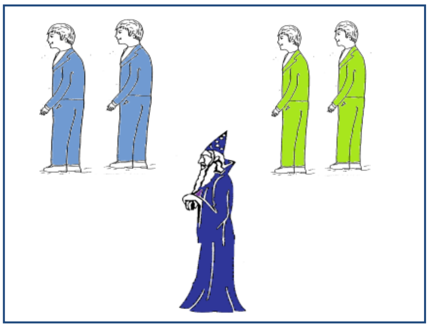


(IT)- I ricci svegliano qualcuno. Luis a chi. Domandagli chi.

(GR)- I skatzochiri ksipnoun kapjon. Aftos kseri pjon. Rota ton pjon.

The hedgehocks are waking up some. He knows who. Ask him who.

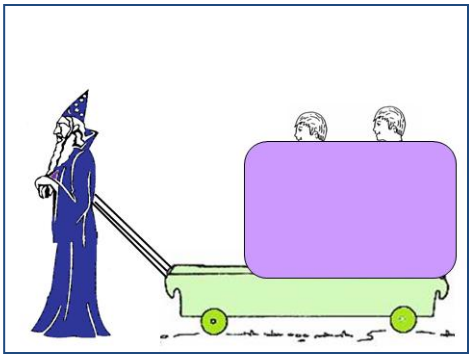
Which-object questions



(IT)-In questa storia ci sono due signori con l' abito verde, due signori con l' abito blu e un mago.

(GR)-Se afti tin istoria ine dio kirii me prasino kostoumi, dio kirii me mple kostoumi kai enas magos.

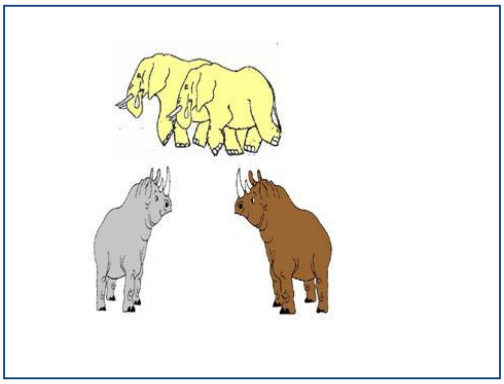
In this story there are two gentlemen with green suit, two gentlemen with blue suit and a wizard.



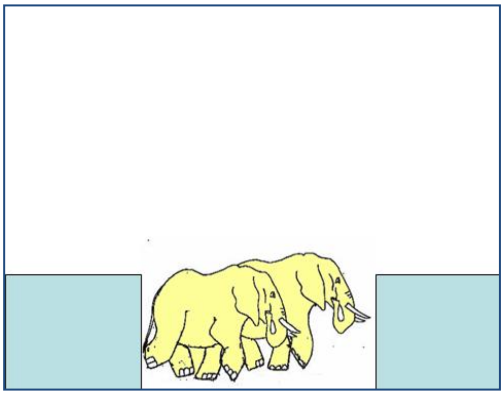
(IT) Il mago tira due dei signori. Lui sa quali. Domandagli quali signori.
(GR) O magos travai dio apo tous kirious. Aftos kseri pjous. Rota ton pjous kirious.
The wizard is pulling two of the gentlemen. He knows which. Ask him which gentlemen.

<u>Comprehension of wh-questions-picture samples</u>

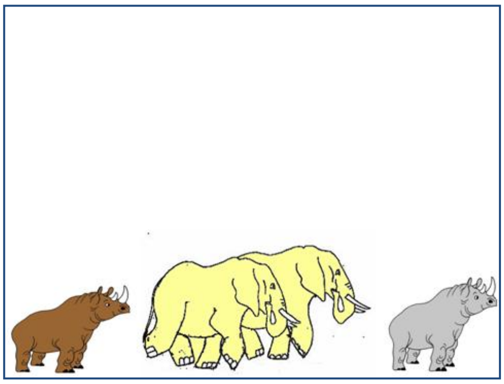
<u>Which-object questions</u>



(IT)-Qui ci sono due elefanti, un rinoceronte grigio e un rinoceronte marrone
(GR)-Edo ine dio elefades, enas gkrizos rinokeros ke enas kafetis rinokeros
Here there are two elefants, one grey rhino and one brown rhino



(IT)-Gli elefanti guardano uno dei rinoceronti
(GR)-I elefades kitazoun enan apo tous rinokerous
The elephants are looking at one of the rhinos



(IT) Quale rinoceronte guardano gli elefanti?
(GR) Pjon rinokero kitazoun i elefades?
Which rhino are the elephants looking at?

APPENDIX V
Italian DD and TD children-Individual Performance of the children of the DD group

ITALIAN DD GROUP

ITALIAN DG	Gender	CA (Y;M)	CA (M)	TROG-2 Z-score	NVIQ Z-score
S1	F	9;5	113	-1,2	+0,93
S2	F	9;1	109	+0,73	+1,04
S3	M	9;2	110	-0,86	+1.44
S4	M	9;2	110	-0,53	+1.06
S5	F	9;0	108	+0,73	+1.85
S6	M	8;4	100	-0,53	+0,4
S7	M	9;2	110	-0,2	+1.45
S8	M	10;3	123	+0,13	-0.24
S9	M	8;2	98	+0,13	+1,6
S10	M	8;2	98	-0,53	-0,13

ITALIAN CONTROL GROUP

ITALIAN CG	Gender	CA (Y;M)	CA (M)	TROG-2 Z-score	NVIQ Z-score
S1	F	9;8	116	+1,4	+1,74
S2	F	8;8	105	+1,4	+1,48
S3	M	9;2	110	+1,06	+1,65
S4	M	9;4	113	+1,06	+1,44
S5	F	9;4	112	+1,4	+1,04
S6	M	8;3	99	+0,73	+0,96
S7	M	9;6	115	+0,73	+1,85
S8	M	10	120	+1,4	+1,66
S9	M	8	96	+0,73	+0,96
S10	M	7;8	93	+1,46	+0,16

Individual accuracy scores (%) of the children of the Italian DG across tasks (grey colour indicates low z-score)

Task	Direct Object Clitics Production	Direct Object Clitics Comprehension -grammaticality judgment task of omissions	Definite Articles Production	Definite Articles Grammaticality Judgment task of omissions	Definite Articles Grammaticality Judgment Task- ungrammatical conditions	Indirect Object Clitics Production	Indirect Object Clitics Comprehension	Wh- questions Production (Total Correct responses)	Wh-questions Comprehension
S1	62,5	70,83	97,91	95,83	97,91 (only one error)	91,67	91,67	87,5	100
S2	79,16	91,67	97,91	100	97,91 (only one error)	50	100	75	87,5
S3	83,33	100	100	85,41	89,58	91,67	100	66,67	87,5
S4	95,83	20,83	97,91	100	97,91 (only one error)	83,33	91,67	87,5	95,83
S5	87,5 (equal to the lowest score of the CG)	91,67	85,41	95,83	95,83	100	100	95,83	100
S6	41,66	100	93,74	95,83	100	33,33	91,67	70,83	100
S7	87,5 (equal to the lowest score of the CG)	100	93,74	95,83	100	91,67	91,67	87,5	95,83
S8	75	12,49	91,66	100	100	66,66	100	58,33	100
S9	66,67	100	97,91	97,91	97,91 (only one error)	83,33	100	91,67	91,67
S10	66,67	54,16	83,33	66,66	56,24	83,33	100	62,5	100

APPENDIX VI

Greek DD and TD groups-Individual Performance of the Greek DD children

GREEK DD GROUP

GREEK DD GROUP	**Gender**	**CA (Y;M)**	**CA (M)**	**TROG-2 blocks**	**NVIQ Z-score**
S1	M	10;3	123	12	+1,66
S2	F	11,5	137	14	-0,3
S3	M	9;10	118	13	-0,3
S4	M	8;4	100	12	+1,09
S5	M	10;6	126	18	-0,48
S6	F	10;3	123	18	-0,004
S7	M	10;5	125	15	+0,23
S8	F	9;11	119	16	+0,26
S9	M	8;2	98	14	+1,33

GREEK CA GROUP (CG)

GREEK CA GROUP (CG)	**Gender**	**CA (Y;M)**	**CA (M)**	**TROG-2 blocks**	**NVIQ Z-score**
S1	M	10;3	123	18	+1,66
S2	F	11;6	138	20	+1,66
S3	M	9;10	118	18	+1,32
S4	M	8;4	100	16	+1,33
S5	M	10;4	124	19	+1,66
S6	F	10;7	127	18	+2
S7	M	10;6	126	19	+1,66
S8	F	9;10	118	18	+1,11
S9	M	8;3	99	17	+1,51

GREEK YOUNGER CONTROL GROUP (CG2)	**Gender**	**CA (Y;M)**	**CA (M)**	**TROG-2 blocks**	**NVIQ Z-score**
S1	M	5;2	62	13	+1,44
S2	M	5;7	67	13	+1,23
S3	M	5;5	65	14	+1,18
S4	M	5;3	63	11	+1,44
S5	M	5;3	63	14	+0,65
S6	F	6;1	73	15	+1,71
S7	M	6;2	74	14	+2
S8	M	7;4	88	16	+0,68
S9	M	7;4	88	17	1,97

Individual accuracy scores (%) of the children of the Greek DG across tasks (grey colour indicates low z-score)

Task	Direct Object Clitics Production (ceiling performance of the CG)	Direct Object Clitics Comprehension	Definite Articles Production	Definite Articles Omissions Task	Definite Articles Grammaticality Judgment Task (ceiling performance of the CG)	Indirect Object Clitics Production	Indirect Object Clitics Comprehension	Wh-questions Production (Total Correct Responses)	Wh-questions Comprehension
S1	95,83	100	91,67	95,83	91,67	8,33	100	95,83	95,83
S2	83,33	83,33	91,67	97,91	97,91	50	91,67	87,5	91,67
S3	79,17	100	95,83	77,08	87,5	41,67	91,67	70,83	100
S4	95,83	83,33	91,67	66,67	93,75	100	91,67	87,5	100
S5	100	100	97,91	81,25	97,91	91,67	83,33	100	100
S6	95,83	100	93,75	77,08	100	100	91,67	95,83	100
S7	95,83	100	83,33	100	97,91	100	100	100	100
S8	91,67	100	95,83	93,75 (equal to the lowest score of the CG)	97,91	100	91,67	87,5	100
S9	79,17	100	91,67	93,75 (equal to the lowest score of the CG)	95,83	41,67	91,67	95,83	100

APPENDIX VII

<u>Wh-questions production in Italian and Greek</u>

In both languages subject and object questions share the same order of elements (WhVNP). We provide relevant examples for both subject (1) and object (2) questions in both languages as follows:

(1) IT - Chi segue i cani ?
Who follow3SG the dogs?

GR - Pjos akolouthi tous skilous?
Who-nom. follow3SG the dogs-acc.?

Who follows the dogs ?

(2) IT - Chi seguono i cani ?
Who follow3PL the dogs?

GR - Pjon akolouthoun i skili?
Who-acc. follow3PL the dogs-nom.?

Who do the dogs follow ?

Therefore, questions with singular overt NPs in Italian, result into ambiguous questions as in (3)[25] , since the question can be interpreted both as subject and object question.

(3) IT- Chi segue il cane?
Who hit3SG the dog?

In both languages, other strategies in the formation of wh-questions are shared. The first is the one in which the NP is preposed to a preverbal position, as in (4) for

[25] is comparable to questions with neuter nouns in *which* questions in Greek.

object questions and (5) for subject questions. In the case of subject questions, a resumptive clitic is necessary:

(4) IT- I cani, chi seguono?
the dogs, who followPL?

GR- I skili, pjon akolouthoun ?
the dogs-nom., who-acc followPL
The dogs, who do they follow?

(5) IT- I cani, chi li segue?
The dogs, who themCLIT followS?

GR- Tous skilous, pjos tous akolouthi?
The dogs-acc., who-nom. themCLIT follows

The dogs, who follows them?

Another common strategy between the two languages is the one of the Argument drop, for object (6) and subject (7) questions. In subject questions however, a clitic pronoun is necessary:

(6) IT-Chi seguono ?
Who follow3PL

GR-Pjon akolouthoun?
Who-acc. follow3PL

(7) IT- Chi li segue?
Who themCLIT follow3S

GR-Pjos tous akolouthi ?
Who-nom. themCLIT follow3S

Detailed Classification of responses in the wh-production task in Italian

Correct responses for who questions:

-WhVNP: when a question with a relevant structure was produced correctly without errors on the Wh element, the verb or the NP, as in the following examples:

- **WhoS:** Chi tira i draghi ?
- **WhoO:** Chi tirano i draghi ?

-NP-Topicalization: when the subject or object were moved to a preverbal position. In the case of subject questions, a clitic must additionally be produced:

- **WhoS:** I draghi, chi li tira ?
- **WhoO:** I draghi, chi tirano ?

-Clefts: these are very common structures in every day language and are as follows:

- **WHoS:** Chi è che tira i draghi ?
- **WhoO:** a) Chi è che tirano i draghi ? or b) Chi è che i draghi tirano ?

Although it is also common to have both alternatives for object clefts in Italian, in our data there were only structures following (a).

-Argument Drop: these are grammatical structures in Italian and pragmatically acceptable for the context of the specific task. In the case of subject questions, however, a clitic is necessary to substitute the lexical NP:

- **WhoS:** Chi li tira ?
- **WhoO:** Chi tirano ?

Erroneous Responses for who questions:

Reversed: In this error category we included instances of transformation of a subject to object question and vice versa:

- **WhoS:** * *Chi tirano i draghi?, I draghi, chi tirano?*, instead of *Chi tira i draghi?*
- **WhoO:** **Chi tira i draghi ?, *Chi è che tira i due draghi?* instead of *Chi tirano i draghi ?*

All structures (WhVNP, NPTop, Clefts) that resulted into the transformation of a WhoS to a WhoO question and vice versa were included in this category. This category included most of the errors for Who questions.

-Wh-element error: when the wh-element produced was erroneous, i.e. *che* instead of *chi*, without any other errors on the sentence

-Other: all other errors that could not be classified among the aforementioned categories

Correct Responses for Which Questions:

-WhVNP: when a question with a relevant structure was produced correctly without errors on the Wh element, the verb or the NP, as in the following examples:

- **WhichS:** Quali signori tirano il mago?
- **WhichO:** Quali signori tira il mago?

-NP-Topicalization: this structure accounts mainly for object questions, when the object were moved to a preverbal position. In the case of subject questions, passivization is needed:

- **WhichS:** Il mago, da quali signori viene tirato ?
- **WhichO:** Il mago, quali signori tira ?

In the case of Which questions in Italian, a resumptive clitic results in an ungrammatical question.

-Argument Drop: these are grammatical structures in Italian and pragmatically acceptable for the context of the specific task. In the case of subject questions, however, a clitic is necessary to substitute the lexical NP:

- **WhichS:** Quali signori lo tirano ?
- **WhichO:** Quali signori tira ?

-Wh-transform: when *che* was produced instead of *quale*, something that was not frequent but is legitimate in Italian.

Erroneous Responses for Which questions:

-Reversed: In this error category we included instances of transformation of a which subject to object question and vice versa:

- **WhichS:** *Quali signori tira il mago ?* instead of *Quali signori tirano il mago?*
- **WhichO:** *Quali signori tirano il mago ?* instead of Quali signori tira il mago?

-Chi instead of quale: when a WhoS question was produced instead of a WhichS question and a WhoO question was produced instead of a WhichO question

- **WhichS:** *Chi spaventa i cani ?* instead of *Quale coniglio spaventa i cani ?*
- **WhichO:** *Chi spaventano i cani* instead of *Quale coniglio spaventano i cani ?*

-Ambiguous questions: when a Who or Which ambiguous question was produced instead of a WhichS or a WhichO question:

- **WhichS:** Chi tira il mago ? instead of Quali signori tirano il mago ?
- **WhichO:** *Quale coccodrillo lava l' asino ?* instead of *Quale asino lavano i coccodrilli ?*
- **Wh-element errors:** when quale was substituted with *chi* i.e. *Chi maghi bagnano il signore ? instead of Quali maghi bagnano il signore ? or agreement errors, i.e. *Qual**e** cign**i** sta inseguendo? instead of Quali cigni sta inseguendo?*

-Other: when the question produced could be classified among the aforementioned categories. We provide relevant examples:

- Errors on the wh-element: *Chi maghi bagnano il signore ? instead of Quali maghi bagnano il signore?
- WhoO instead of WhichS: Chi guardano? instead of Quale lupo guardano i galli?
- Who instead of Which question with agreement errors: Chi tirano il mago ? instead of Quali signori tirano il mago?
- Agreement errors: Chi è che accarezzano ***il*** conigli instead of Chi è che accarezzano ***i*** conigli ?
- Lexical errors: Chi è che seguono i ricci instead of Chi svegliano i ricci ?

Detailed Classification of responses in the wh-production task in Greek

Correct responses for who questions:

-WhVNP: when a question with a relevant structure was produced correctly without errors on the Wh element, the verb or the NP, as in the following examples:

- **WhoS:** Pjos travai tous δrakous ?
- **WhoO:** Pjon travoun i δraki ?

-NP-Topicalization: when the subject or object were moved to a preverbal position. In the case of subject questions, a clitic must be additionally produced :

- **WhoS:** Tous δrakous, pjos tous travai ?
- **WhoO:** I δraki, pjon travoun ?

Erroneous Responses for who questions:

-Reversed: In this error category we included instances of transformation of a subject to object question and vice versa:

- **WhoS:** Pjon travoun i δraki , instead of Pjos travai tous δrakous*?*
- **WhoO:** Pjos travai tous δrakous *?* instead of Pjon travoun i δraki*?*

Other structures (*WhVNP*, *NPTop*) that resulted into the transformation of a *WhoS* to a *WhoO* question and vice versa were included in this category.

-**Case Errors:** when the NP was erroneously marked for case, i.e.: *Pjon travoun tous δrakous, instead of Pjon travoun i δraki?

-**Agreement Errors:** When there was an agreement error between the verb and the NP, i.e. *Pjon chaidevi oi laγi ? instead of Pjon chaidevoun i laγi ?

-**Other:** all other errors that could not be classified among the aforementioned categories

Correct Responses for Which Questions:

-WhVNP: when a question with a relevant structure was produced correctly without errors on the Wh element, the verb or the NP, as in the following examples:

- **WhichS:** Pji kirii travoun to(n) maγo?
- **WhichO:** Pjous kirious travai o maγos ?

-NP-Topicalization: this structure accounts mainly for object questions, when the object were moved to a preverbal position. In the case of subject questions, a direct object clitic is necessary :

- **WhichS:** Ton maγo, pji kirii ton travoun?
- **WhichO:** O maγos, pjous kirious travai?

-Argument Drop: these are grammatical structures in Italian and pragmatically acceptable for the context of the specific task. In the case of subject questions, however, a clitic is necessary to substitute the lexical NP:

- **WhichS:** Pji kirii ton travoun ?
- **WhichO:** Pjus kirious travai ?

Erroneous Responses for Which Questions

-Who instead of which: when a Who question was produced instead of a Which:

WhichO: Pjous vrechi o kirios? instead of Pjous magous vrechi o kirios?

-**Other**: when the question produced could be classified among the aforementioned categories. We provide relevant examples:

- Errors on the wh-element: what instead of who question
- Lexical errors: Pji kikni **kitazoun** to skilo? instead of Pji kikni **kiniγoun** to skilo
- Agreement error: Pjon liko kitazoun i koko**ri**? instead of Pjon liko kitazoun i kokor**es** ?
- Phonetic error (resulting into gender alteration): Pji maghi vrechoun **to** kirio ? instead of Pji maghi vrechoun **ton** kirio

APPENDIX VIII
Greek SLI and TD children

GREEK SLI CHILDREN

GREEK SLI CHILDREN	Gender	CA (Y;M)	CA (M)	DVIQ Production of Morphology and syntax (raw)	Expressive Vocabulary (raw)	NVIQ Z-score
S1	M	5;4	64	10	27	+0,13
S2	M	6;4	76	5	23	+0,11
S3	M	5;7	67	13	31	-0,53
S4	M	5;0	60	2	24	-0,2
S5	M	7;7	91	4	18	-0,7
S6	M	5;4	64	8	40	+2,49
S7	M	7;4	88	5	27	+0,33
S8	F	6;2	74	10	31	+0,36
S9	M	7;4	88	10	20	-0,28
S10	F	8;6	102	7	19	-0,08
S11	F	7;4	88	23	28	-0,006
S12	F	8;10	106	23	38	+0,86
S13	F	7;10	94	14	26	+0,33
S14	F	6;3	75	20	43	+0,36

CONTROL GROUP (CA)

GREEK CA CONTROL GROUP	Gender	CA (Y;M)	CA (M)	DVIQ Prod. of Morphology and syntax (raw)	Expressive Vocabulary (raw)	NVIQ Z-score	TROG-2 blocks
S1	M	5;5	65	15	34	+1,18	14
S2	M	6;3	75	18	39	+2	14
S3	M	5;7	67	15	26	+1,23	13
S4	M	5;2	62	15	36	+1,44	13
S5	M	7;4	88	20	47	+1,97	17
S6	M	5;3	63	15	31	+0,65	14
S7	M	7;4	88	20	40	+0,68	16
S8	F	6;1	73	22	40	+1,71	15
S9	M	7;2	86	18	43	+0,52	16
S10	F	8;4	100	21	44	+0,59	19
S11	F	7;8	92	23	43	+1,37	17
S12	F	8;9	105	22	42	+1,48	17
S13	F	7;8	92	23	45	+1,37	17
S14	F	5;9	69	20	29	+1,98	16

Individual accuracy scores (%) of Greek SLI children across tasks (grey colour indicates that the child was not tested/ did not complete or failed (Failure) the test)

Task	Direct Object Clitics Production	Direct Object Clitics Comprehension	Definite Articles Omissions Task	Definite Articles (Case) Grammaticality Judgment Task	Indirect Object Clitics Production	Indirect Object Clitics Comprehension	Wh-questions Production (Total Correct)	Wh-questions Comprehension
S1	54,17	0	62,5	79,17	0	33,33	16,67	83,33
S2	25	75	29,16	27,08	0	58,33	Failure	58,33
S3	45,83	62,5			25	66,67		100
S4	4,17	50	Failure	Failure	0	50	Failure	70,83
S5	29,17	100	60,41	64,58	0	58,33	33,33	87,5
S6	54,17	91,67	Failure	Failure	50	66,67	20,83	
S7	50	0			25	75	54,16	
S8	20,83	0	52,08	52,08	0	58,33	54,16	75
S9	79,16	100	91,67	97,91	58,33	75	75	79,16
S10	79,17	54,17	47,91	87,5	100	58,33	0 (Failure)	70,83
S11	95,83	100	52,08	89,58	50	91,67	91,7	100
S12	70,83	100	35,41	60,41	75	100	62,5	95,83
S13	87,5	100	89,6	100	16,66	91,67	66,67	100
S14	87,5	100	25	68,74	83,33	50	45,83	100