

The relation between phonological perception and production and vocabulary development in Specific Language Impairment

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Abstract

The present study is an investigation of the phonology and the lexical development of a child with Specific Language Impairment (SLI). The participants of the study were one child with SLI, one child of the same chronological age as the child with SLI (CA child) and finally one typically developing child of younger age (LD child). These children were evaluated with regard to their phonological and lexical skills with the use of three different types of tests: The Athina test diagnosis of learning difficulties, the Assessment of phonetic and phonological development and the Diagnostic Verbal IQ test. The results of the study show that the child with SLI as well as the L(D) child, presented the most phonological and lexical deficits. Moreover there is relation between the phonology and vocabulary development of the child with SLI and the L(D) child, a fact that is also reported in the relevant literature.

Keywords: phonology, lexical skills, vocabulary, language impairment, phonetic development, specific learning difficulties

1. Theoretical background

In chapter 1 an introduction about what specifically language impairment (SLI) is will be carried out. Afterwards, a reference to the diagnostic criteria of this language impairment as well as the prevalence, the causes and the language characteristics both in comprehension and production will be presented. Finally, this chapter will concentrate on the phonological perception and production in SLI as well as in the relation of them with the lexical development.

1.1. Specific Language Impairment (SLI)

Specific language impairment can be defined as a developmental language disorder where there appears to be no neurological damage, hearing loss, mental retardation or cognitive deficits. Thus, children with specific language impairment are those who exhibit marked difficulties in the acquisition of linguistic ability (23).

In order to define this disorder there are a lot of terms that have been used in the literature such as “congenital aphasia”, “hearing mutism”, “delayed speech development”, “congenital word deafness”, “developmental dysphasia” and “delayed speech” (19). Despite the fact that the most commonly term used is “specific language impairment”, there is a lot of disagreement regarding its definition as there are still differences between the terms that are used (19, 23). For instance, the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (1) refers to two different types of disorders, the “expressive language disorder” and the “expressive-receptive language disorder”. The main characteristic of children with SLI is a slow language development in comparison with typically developing children. There is a weakness in the five levels of language, including production as well as comprehension (23).

1.2. Diagnostic criteria

There are a lot of exclusionary criteria so as to distinguish SLI from other types of language disorders (35). These criteria are the basis of diagnosis and differential diagnosis of SLI. According to Leonard (19), the presence of deficits in language abili-

ty and more specifically in production as well as in perception is necessary. Moreover, a determinant of diagnosing children with SLI is the level of non verbal IQ. Children with SLI should have a higher than 85 score on non verbal IQ measurements (19, 23). Another significant criterion is the absence of hearing impairments which can affect the language ability. A pathological disease that is related to hearing impairments is Otitis media with effusion (OME). OME can cause hearing impairments which can impact on language learning. Thus, the absence of OME is necessary when there are language problems regarding a diagnosis of SLI (19, 35). Additionally, it is very important that language problems do not co-exist with neurological dysfunctions (19). Conditions such as cerebral palsy, traumatic brain injury, seizure disorders or brain lesions should be excluded. Moreover, children that present dysfunction in the articulation mechanism that can cause production problems can not be included in the category of children with SLI (35). Finally, another significant criterion is that children with SLI interact normally with people and participate in activities. There should be an absence of psychological problems and autistic elements (19).

1.3. Prevalence

Concerning the prevalence of SLI there has not been a clear determination yet. According to the American Psychiatric Association's DSM-IV (1), there is a percentage of 5% of children with SLI that presented production deficits, whereas children with SLI with both comprehension and production deficits are about 3%. A lot of research also has been conducted in order to qualify the prevalence of this type of disorder. Tomblin (45), using linguistic and non-linguistic tests in five-year-old children estimated the prevalence of SLI to be 7, 4 %. However, Tallal (43) estimated a percentage of about 1, 5 %.

It is generally considered that SLI is more frequent in males than in females with a ratio of approximately 2.8:1, while other studies estimate a higher ratio of 4.8:1 (32). Finally, it has been observed that children with a family history of language disorders are more prone to present SLI (19). Additionally, it has been observed that there is a high percentage of SLI in monozygotic twins (45).

1.4. Causes of SLI

A lot of studies have tried to provide evidence regarding the factors that cause SLI. It is suggested that the basis of this disorder can be detected in prenatal or perinatal factors (3, 46). For instance, some researchers argue that there is a connection between the mother's illness during pregnancy and SLI (19). Moreover, there are hereditary factors that should not be neglected. There is a high percentage of 30%, of children with SLI with a family history of language problems (47).

Neuroanatomic differences and dysfunctions are also related to SLI, despite the fact that SLI is characterized by the absence of neurological disorders (19). Some irregularities in the brain structure have been observed which can cause difficulties in language learning (15). These irregularities have been detected through the use of magnetic resonance techniques, metabolic neuroimaging and post-mortem brain examinations (4). These results have shown that there is symmetry between the right and the left temporal planes and the two hemispheres, contrary to the perisylvian area where the left side is smaller than the right one (19, 45). Dysfunctions have also presented in the frontal cortex and the basal ganglia. Thus, it is very important to study the family background and the brain structure of these children in order to understand deeply the factors that can cause difficulty in language acquisition (19, 43).

1.5. Accounts of specific language impairment

A number of theories have tried to explain the language deficits of children with SLI (9). There are two main theoretical perspectives: the linguistic and the non-linguistic ones. According to the linguistic theories, it is suggested that language difficulties in SLI children are primary and caused by a disorganized language system. On the other hand, non-linguistic perspectives suggest language difficulties are secondary and they are caused by general processing deficits such as an impaired cognitive mechanism or limited capacity on processing (5).

1.5.1. Non linguistic theories

According to the "information processing deficit affecting phonology" (11) the deficits of SLI are due to an impaired pho-

nological working memory. This can cause difficulties in language comprehension and in learning of new words.

Other researchers mention the "temporal processing deficit hypothesis", where the language difficulties of children with SLI are due to a perceptual processing impairment. More specifically, they present weaknesses in the discrimination of phonemes and in tasks related to the representation of items (43, 44).

According to the "surface hypothesis" (18) children with SLI present a limited use of grammatical morphemes and this limitation can affect the perception of grammatical morphemes. This hypothesis argues that the language difficulties in children with SLI are due their grammatical dysfunction.

Leonard, McGregor & Allen (18), in a discussion of the "auditory perceptual hypothesis" argue that the language difficulties in children with SLI are due to a perceptual deficit where a difficulty in the discrimination of 'low-phonetic substance' or non-salient morphemes.

1.5.2. Linguistic theories

According to the "missing feature-blindness hypothesis" (12), children with SLI exhibit difficulty in the acquisition of grammatical rules and in the relations between grammatical and lexical morphemes. Thus, it affects the syntactic structure of language and the grammatical system (47).

Rice and Wexler (31), in a discussion of the "extended optional infinitive account" argue that children of typical language development remain in a phase during which they do not use frequently the mark tense in main clauses despite the fact that they know the grammatical rules. Children with SLI persist in this developmental phase by using more infinitive constructions for a longer period than typically developing children and thus they present language deficits that are more serious in grammar.

1.6. Language characteristics

1.6.1. Language production

Children with SLI present expression problems and combine receptive and expressive difficulties (19). These difficulties can occur in different areas of communication such as phonology, lexicon, morphology or syntax (35). More particularly, in the phonological production of children with SLI, reversals, omissions, cluster simplifications, substitutions, stoppings and voicings are observed (19) whereas the lexicon is characterized by generalizations, semantic substitutions and production of inappropriate words. Finally in the morphosyntax they present difficulty in the use of grammatical morphemes such as substitutions, transformations or omissions that can affect the use of syntactic rules (47), limited use in main syntactic categories such as nouns, pronouns or verbs (28) and difficulties in the use of definitive articles, passive voice, wh words and in the formulation of past time (17).

1.6.2. Language comprehension

A lot of studies have been conducted concerning the language comprehension ability of children with SLI. Many of them argue that children with SLI often perform poorly in the auditory-processing ability including sequencing, auditory discrimination, serial memory and synthesis (19). This can cause comprehension problems and difficulties in the discrimination of grammatical morphemes, phonemes and acoustic information (8, 19).

Moreover, it is suggested that there is a relation between phonological working memory and language perception (28). Gathercole & Baddeley (11), through the use of a non-word repetition test in children with SLI, detected that children with SLI had an impaired working memory with a limited capacity. Also, according to Montgomery (28) it has been observed that these children present difficulties in the phonological encoding of words and have a limited capacity to store information.

1.7. Phonology in SLI children

A part of language where children with SLI present significant impairment is phonology. Many researchers argue that the phonological deficits of these children are the main cause of deficits in other areas of language such as in the lexicon, the syntax, the morphology and the expressive vocabulary (22). Some of the theories that have been presented above such as the “temporal processing deficit hypothesis” and the “information processing deficit affecting phonology” can explain the nature of these phonological problems. However, the phonological ability of SLI children is a scientific field that has been researched for a considerable period of time and there are a lot of different hypotheses trying to explain the nature and the profile of this impairment. There can be deficits either of phonology perception or phonology production (10, 16). A detailed description of both of them will be presented below, in order to gain an in depth understanding of this impairment and to detect any relation between them.

1.7.1. Phonological production

According to many researchers, the phonological production of children is the result of perceptual-encoding rules and do not differ from the production of younger typically developing children (25, 19, 26, 22). It has been observed that children with SLI acquire at a later stage the segments of language contrary to the typically developing children (19). Children initially acquire the phonemes with the less discriminated characteristics such as /b/, /m/ and /n/ and with the most obvious contrasts for instance labial-palatal (13, 21). However, the acquisition of segments such as /s/ and /v/ can be more difficult (10, 13). Moreover, there is a delay in the acquisition of complex syllabic structures (22). Studies by Bortolini and Leonard (6), have found that children with SLI simplify consonant clusters with CCV frame to CV frame. However, it is not clear yet if this phonological process is caused by the complex structure of the syllables or by the characteristics of the consonants (22).

In a research by Orsolini (29) children with SLI presented a lot of consonant substitutions in the segments acquired later. For instance, they were replacing /r/ with /l/, /v/ with /d/ or /f/ and

/s/ with /t/. Also, children with SLI seem to have difficulty in the use of the distinctive features of segments with similarities (19). For instance, they hold up to acquire the [+strident] and that is why they produce [tol] for hall. Additionally, they make prevocalic substitutions which are not so frequent such as [-voice] for [-voice] (2, 6, 21).

A research by Bortolini & Leonard (7), where the phonological production of nine English-speaking SLI children were compared, showed that these children were omitting both the weak syllable in the initial position of the word and the final consonants of words (27).

It has been observed that a lot of unusual errors are committed by children with SLI (19). For instance, they add nasal segments to the initial or to the final position of the word, or they produce sounds with unusual characteristics such as alveolar affricates, lateral fricatives, ingressive lateral fricatives and ingressive alveolar (16, 21).

1.7.2. Phonological perception

Tallal (42), by using repetition tasks concluded that children with SLI performed poorly on auditory processing. It is argued that this deficit can be the root of phonological and language impairments (34). In a study using discrimination tasks, it has been observed that children with SLI do not present a difficulty in the discrimination of words that differ by one phoneme (29, 48). However, there were difficulties in discriminating words where the two syllables differed in the way and the place of articulation (18, 29). For instance, they were failing in the discrimination between syllables with stopping segments or in the discrimination between distributive phones that were phonetically highly similar (29).

Furthermore, children with SLI exhibit difficulty in developing phonological representations of words in their long-term memory (28). This fact is due to a limitation of the phonological information that is stored in the phonological and serial memory (28). Gathercole and Baddelay (11) by the use of a non-word repetition task detected that there was a great difficulty in children with SLI to repeat three or four syllable non-words

contrary to normal language developing children, because of a limited capacity of phonological working memory. According to research by Sutherland & Gillon (41) and Joanisse & Seidenberg (14), children with SLI have a great difficulty in the phonological hierarchy of words because of an inability to manage the storage and the processing functions of phonological working memory. Thus, they present difficulty in learning new words with their phonological and morphological characteristics and consequently they simplify their speech content.

1.8. Vocabulary-Lexical development

It is suggested that children with SLI present a significant delay in the acquisition of new words (33). In comparison to normally developing children, children with SLI exhibit difficulty in using the name of new objects that have been learned or to associate the new knowledge of words with the previous one (37). This kind of delay, affects the expressive vocabulary that children with SLI should have as opposed to normally developing children. Thus, deficits in phonological skills may be presented because of this lexical inability (19, 39). Additionally, it is very frequent that children with SLI present “word-finding” problems. This can cause generalizations, semantic substitutions such as “trousers” for “shorts”, use of inappropriate words or circumlocutions (24).

1.8.1. Phonology and the lexicon

It has also been suggested that there is a relation between the phonological abilities of SLI children and the number of words in their vocabulary (19). More specifically, according to a research by Shelley (36), a limited phonological memory may cause difficulties in the comprehension and the acquisition of new words. When a child has a limited phonological memory is difficult to store a word with unfamiliar phonological representation. Difficulties with phonological representation also may affect the creation of semantic representation (40). It has also been discovered that SLI children present difficulty in the fast mapping ability, according to this a child hears a word, creates a phonological representation and a phonological link with semantic representations (36, 40).

1.9. Hypotheses/Research questions

The present study aims to describe the phonological system of a child with SLI by analyzing the deficits of the speech production and the difficulties in the phonological perception as well as the lexical development with the use of tests. It also aims to show that the child with SLI is in the same developmental stage with a child of a younger chronological age regarding their phonological and lexical skills. At the end of this procedure, a comparison between our results and those of other studies will be carried out. In this way, it is hoped that more evidence regarding the phonological processes of this group of the population will arise, which will possibly lead to a better understanding of the disorder and its treatment.

According to the above, our hypothesis is that phonological perception and phonological production share a connection between them and so does phonology with vocabulary development. We expect the impaired phonological production to be caused by deficits in phonological perception. Moreover, we expect the phonological as well as the lexical skills of children with SLI to differ from those of children of the same age and of a typical language development but to be similar with children of younger chronological age. So, the following research questions will be arising: Is there any relation between the phonological perception and the phonological production of children with SLI? Is there any relation between the phonology and the vocabulary development of children with SLI? Is there any difference between the children with SLI and their unimpaired peers as far as their phonological skills and lexical skills are concerned? Are children with SLI and those of a younger chronological age at the same developmental stage regarding their phonological and lexical skills? There is lot of research on which the above hypotheses are based. However, it would be a great field for further study if any different results, according to these hypotheses, could be presented.

2. Methodology

2.1. Participants

For the purpose of this study three children participated. The first child having been diagnosed with specific language impairment (SLI child), the second one was of the same chronological age as the child with SLI (CA child) and finally the third child had typical language development and matches the child with SLI in respect of language ability (LD child). All participants were male. Moreover, they were Greek native speakers and belonged to families of the same socioeconomic status. Each child was met two times by the researcher of a 45 minutes session at their homes, in order to assess and analyze their phonological and lexical skills. Moreover, the parents of each child were interviewed about the medical, the developmental, the educational and the social history of their child.

2.1.1. Child with SLI

The name of this child is G. and had been diagnosed with specific language impairment according to the diagnostic criteria of Leonard (19). The age of G., is 6;5 and he goes to the first class of elementary school. G. also, has been attending a program of speech and language therapy for 2 years in a center of Athens. Additionally, he did not have any hearing impairment, neurological disorder, problems in social interaction or otitis media.

2.1.2. Chronological age matched child, C (A)

This child has typical language development and is of the same age as the child with specific language impairment. Specifically, his name is J., his age is 6;8 and he attends the first class of elementary school. Furthermore, he did not present any neurological, psychological, developmental or cognitive disorder such as mental retardation, learning difficulties, syndromes, hyperactivity and attention deficit disorder (HADD). Also, his language abilities were assessed by the use of the Diagnostic Verbal IQ test (39). This test assesses the production and the perception of morphology and syntax as well as the lexical skills of Greek native speakers. According to the results of the DVIQ test, he had normally developed language skills and he did not exhibit any language disorder or delay.

2.1.3. Typically Language Development child, L (D)

This child has a lower chronological age but is at the same language developmental stage as the child with SLI. The matching was done based on his DVIQ scores. The name of this child is T., is 4;8 years old and he attends kindergarten. Finally, he does not present any neurological, psychological, developmental or cognitive disorders.

2.2. Materials

For the purposes of the study three assessment/experimental tools were used, corresponding to the three variables investigated (phonological perception, phonological production and lexical development). As a first tool, two sections of The Athina test diagnosis of learning difficulties (Translated by Doulou Aikaterini: The Athina test diagnosis diskolion mathisis) (30) were used, which evaluate the phonological perception of each child. The second tool used was the Assessment of phonetic and phonological development (Translated by Doulou Aikaterini: Dokimasia Fonitikis kai Fonologikis Ekseliksisis) (20), which is designed to assess phonological production. Finally as a third tool, the production of vocabulary section of the Diagnostic Verbal IQ test (39) was used in order to evaluate the lexical skills of each child. In order to record this procedure a tape recorder was used. Specific information on each of the experimental materials follows in the next sections.

2.2.1. The Athina test diagnosis of learning difficulties (30)

The Athina test consists of 14 main diagnostic procedures which assess motor, perceptive, cognitive and psycholinguistic processes in children between 5 and 9 years old. The Athina test, comprises of forms, books and leaflets such as the “examiner’s guide” and the “examination leaflet”, cards with subjects and geometrical shapes and objects such as a pencil sharpener. However, in this case, a selective administration of the test was preferred rather than a complete one, in order to investigate the phonological perception of the children. More specifically, two scales were selected, the “synthesis of phonemes” and the

“discrimination of phonemes”.

The “synthesis of phonemes” scale assesses abilities such as blending phonemes and formulating words. It consists of 32 words that include the phonemes of the Greek language in a lot of combinations.

(1) Target: m-o-l-i-v-i

(2) Target: s-a-l-o-n-i

It also contains a block of 12 cards, each of which has 4 pictures with words having phonological similarities.

(3) Example: [psi.´ji.o] - [´pli.o] - [vi.´li.o] - [θra.´ni.o]

The “discrimination of phonemes” scale evaluates the ability of a child to distinguish between phonemes. It consists of 32 pairs of false words, some of which are the same, and some of them are different because a phoneme may have been replaced, omitted or transposed.

(4) Example: [yar.ða.´θos] - [yar.ða.´θos]

(5) Example: [´vo.la]-[´yo.la]

2.2.2. Assessment of phonetic and phonological development (APPD) (20)

The APPD tool records and analyzes the phonological system of a child and also evaluates whether the phonemes that acquired by a child correspond to his/her age. Additionally, it compares the phonological system and the phonotactic abilities of a child with language impairment to those of children of the same age. This test consists of a book containing 60 simple pictures such as a cow, a shoe or a swan and two complex pictures concerning the description of a playground and a kitchen. Moreover, there is an answer sheet where the phonetic transcription and the phonological analysis are noted. It consists of two-syllable words with a simple syllabic structure (cvcv) as well as of multi-syllable words with more complex syllabic structure.

(6) Target: [ˈzo.ni]

(7) Target: [er.yo.ˈsta.si.o]

2.2.3. Diagnostic Verbal IQ test (DVIQ) (39)

DVIQ evaluates language abilities in preschool children (2;5-5 years). More specifically, it assesses the understanding of basic language concepts such as size, quantity or attribute as well as the acquisition of language concepts such as subjects or more abstract concepts. Moreover, it assesses the production and the perception of morphology and syntax as well as the lexical skills of Greek native speakers. More specifically, DVIQ consists of three sections. The first section evaluates the morphosyntactic as well as the lexical production, whereas in the second section the comprehension of morphosyntax and metalinguistic concepts are evaluated. Finally, the third section evaluates the ability of a child to recall syntactic structures. The section that was used assesses the lexical skills and consists of 27 pictures and 27 questions where the use of 14 verbs, 23 nouns and 7 articles were assessed.

(8) Question: Ti ine afto? Target: Tetradia

(9) Question: Ti kanei o antras? Target : Sideronei ta rouxa

2.3. Procedure

The researcher had two individual 45-minute meetings with each child, which took place in their homes. In the first session, the children's phonological perception was assessed by applying the Athina test, as well as their lexical skills through the DVIQ test. The second session took place one week later, when the APPD was administered.

Concerning the "Synthesis of phonemes" scale, the researcher pronounced the phones of each word one by one in a natural way and with the rhythm of two phonemes per second. The first 10 questions were administered by the use of pictures, without the researcher naming them. More specifically, the researcher pronounced a word and asked the child to show the

corresponding picture by naming it. Questions 11 to 32 were administered in the same way, but without the use of pictures. The researcher pronounced each word, phoneme by phoneme, and asked the child to recognize the word. In the examination answersheet, the researcher checked either "right" or "wrong" according to the answer of the child. The maximum score for this part of the test is again 32 right answers.

The procedure of the tests was the following: In, the "discrimination of phonemes" scale of the Athina test, the researcher asked the child to turn his/her back so as to avoid lip-reading. Then, he would read the pairs of false words one by one in a natural way, and would then ask the child if the words were the same or different. Depending on the child's answers, the researcher checked in the column of the examination answersheet either "Different" or "Same". The maximum score that someone can achieve is 32 right answers.

In the APPD, the researcher showed the child pictures from a book one by one and asked him to name them. Then, the answers of the child were recorded on the answer sheet. The researcher noted the phonetic and the phonotactic transcription of the word and any phonological procedures that had been carried out. In the event where the child did not answer, the researcher measured it as a false answer.

Concerning the DVIQ test, the researcher showed each child pictures from a book one by one and asked them questions such as "What are these?" or "What are the children doing?" in order to evaluate the use of subjects and actions. For each picture there was only one answer. The researcher noted "1" for each right answer, "0" for each wrong answer and "no answer" if the child did not answer. At the end of this procedure the sum of right answers was calculated.

2.4. Measurements

The results of the research were produced by calculating the right and wrong answers from each test, as those were provided by all the children participating. At first, the analysis focused on the relationship between the two variables, namely the phonological perception and the phonological production of each child. More specifically, it was considered whether the dif-

difficulties in the phonological perception affect the phonological production and vice-versa, by comparing the right answers from each test. Secondly, the relationship between the phonological system and the lexical skills of each child was analyzed. It was queried, by calculating the false and right answers from each test, whether the phonological difficulties of children with SLI can affect lexical development. Following this, a comparison was made between the children with SLI and those in the control groups. This comparative approach was used in order to measure how the phonology and the lexical skills of children with SLI differed to those of children of the same age and how they were the same with those of children of a lower chronological age.

3. Results

In chapter 3 the results and the measurements from the study of the phonology and the lexical skills of the child with SLI, of the child with the typical language development and of the same age - Chronological age matched control (CA) - as well as of the child with the lower chronological age (LD) are presented. More specifically, the children's error percentages were examined in all three types of tests that were used.

3.1. Phonological production

The full results regarding the number and the percentage of correct answers of each child in naming simple pictures as well as describing complex pictures are provided in Table 1.

Table 1: Correct answers in simple picture naming and complex picture description

Groups	Simple pictures		Complex pictures	
	Correct	%	Correct	%
	N	%	N	%
SLI	47/70	67,1	19/31	61,3
C(A)	66/70	94,3	31/31	100
L(D)	51/70	72,9	24/31	77,4

Table 1 shows that based on the correct answers of the three participants there are distinct differences. More specifically, in simple picture naming the child with SLI gave the fewest number of correct answers (47/70) compared to the C(A) child and the L(D) child. Moreover, there was only a marginal difference between the SLI and L(D) children (47 and 51 correct answers respectively). Regarding the description of complex pictures, the child with SLI provided the fewest correct answers (19/31) with a marginal difference from L(D) who had 24 right answers. C(A) did not give any wrong answer in this task.

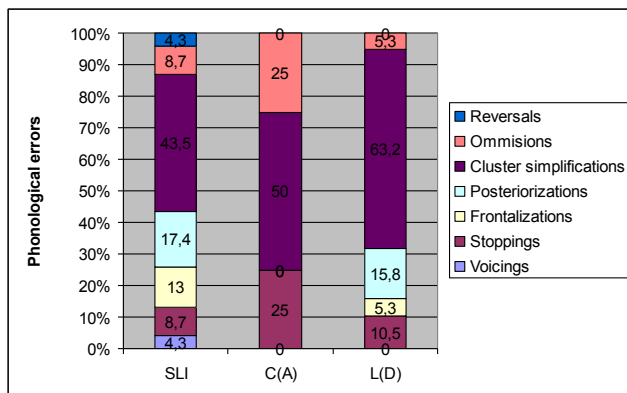
Table 2 presents the types of phonological errors that were produced by the SLI, C(A) and L(D) children in the naming of simple pictures.

Table 2: Phonological errors in simple picture naming

Phonological errors	SLI		C(A)		L(D)	
	N	%	N	%	N	%
Voicings	1	4,3	0	0	0	0
Stoppings	2	8,7	1	25	2	10,5
Frontalizations	3	13	0	0	1	5,3
Posteriorizations	4	17,4	0	0	3	15,8
Cluster simplifications	10	43,5	2	50	12	63,2
Omissions	2	8,7	1	25	1	5,3
Reversals	1	4,3	0	0	0	0
Total number	23	32,9	4	5,7	19	27,1

Figure 1 presents a comparison between the phonological errors that were observed in each child.

Figure 1: Comparison of phonological errors in simple picture naming



From Figure 1 it can be deduced that some of the phonological errors are common between the SLI child and the L(D) child. More specifically, the highest percentage of the SLI child's phonological errors, as well as of the other two children, concern the cluster simplifications (43,5%), whereas there is a small percentage of 8,7% concerning the omissions of phonemes and stoppings.

(10) SLI child: [ˈvi.si] Target: [ˈvri.si]

(11) L(D) child: [fi.ˈtza.ni] Target: [fli.ˈtza.ni]

Reversals and voicings are also observed in the child with SLI while with the L(D) child they do not exist. Moreover, the L(D) child presents a high percentage of 63,2% of cluster simplifications but fewer phonological errors are omissions and frontalizations (5,3%). The L(D) child also presented other phonological errors such as posteriorizations and stoppings (15,8% and 10,5% respectively).

(12) L(D) child: [tu.ˈla.pa] Target: [du.ˈla.pa]

(13) L(D) child: [sfi.ˈrik.stra] Target: [sfi.ˈrix.tra]

The C(A) child presented the smaller number of phonological errors, compared to the other children, characterized only by cluster simplifications (50%), omissions (25%) and stoppings (25%). More specifically, he did not present other types of phonological errors such as reversals, posteriorizations, frontaliza-

tions and voicings.

(14) C(A) child: [sko.ˈli.o] Target: [sxo.ˈli.o]

(15) C(A) child: [ska.ˈni] Target: [skam.ˈni]

(16) C(A) child: [a.ro.ˈpla.no] Target: [a.e.ro.ˈp-la.no]

Table 3 presents the types of phonological errors that were produced by the SLI, C(A) and L(D) children in the naming of complex pictures.

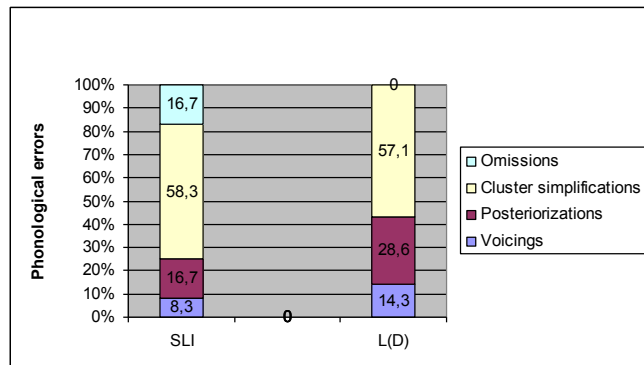
Table 3: Data about the types of phonological errors in complex picture description

Phonological errors	SLI	C(A)	L(D)				
	N	%	N	%	N	%	
Voicings	1	8,3	0	0	1	14,3	
Posteriorizations	2	16,7	0	0	2	28,6	
Consonant simplifications	7	58,3	0	0	4	57,1	
Omissions	2	16,7	0	0	0	0	
Total number	12	38,7	0	0	7	22,6	

In Table 3 it can be seen that the SLI child and the L(D) one made the same type of phonological errors, despite the omissions that did not present in L(D). More specifically, voicings, posteriorizations as well as consonant simplifications were observed. Consonant simplifications was the type of error that was observed to occur more frequently as opposed to voicings and posteriorizations that did not occur with the 2 children that often. C(A) did not present any phonological error in this task.

Figure 2 presents a comparison between the phonological errors that were observed in each child.

Figure 2: Comparison of phonological errors in complex picture description



In Figure 2 it can be noticed that there was no notable difference concerning the cluster simplifications presented by the child with SLI and L(D) (58,3% and 57,1% respectively). Additionally, voicings were presented by the two children with a lower percentage (8,3% and 14,3% respectively) whereas posteriorizations were observed more often in L(D) with a percentage of 28,6%, contrary to the child with SLI where a percentage of 16,7% is presented.

(17) SLI child: [su. 'li.θra] Target: [tsu. 'li.θra]

(18) SLI child: ['ca.nta] Target: ['tsa. nta]

(19) L(D) child: [ka. 'ro.ci] Target: [ka. 'ro.tsi]

(20) L(D) child: ['fu.ces] Target: ['fu.skəs]

3.2. Phonological perception

In Table 4 the total number of right answers of each child concerning the tasks of discrimination and synthesis of phonemes are presented.

Table 4: Total number of answers in phoneme discrimination and synthesis

Groups	Discrimination of phonemes	Synthesis of phonemes		
			Correct	Correct
	N	%	N	%
SLI	21/32	65,6	12/32	37,5
C(A)	30/32	93,8	25/32	78,1
L(D)	17/32	53,1	8/32	25,0

From Table 4 it can be noticed that in the discrimination of phonemes the child with SLI presented a significant difficulty in answering correctly in 65,6% of words. Like the child with SLI, L (D) also presented great difficulty (53,1% of correct answers). On the other hand, C (A) performed well in this task by answering correctly with a success rate of 93,8%.

(21) SLI child: ['ma.la]-['ma.la] Different Target: Same

(22) L(D) child: ['a.fa.li]-['a.θa.li] Same Target: Different

(23) C(A) child [na. 'ða.fa]-[na. 'va.fa] Same Target: Different

Concerning the synthesis of phonemes, the child with SLI and L(D) performed poorly with a percentage of correct answers of 37,5% and 25% respectively. It is noteworthy that there is a difference between them while the L(D) child presented greater difficulty than the child with SLI. In contrast, C(A) gave the highest number of correct answers with a percentage of 78,1%. The following are some examples of words that children presented difficulty:

(24) SLI child: [b.u.k.a.l.i]

(25) L(D) child: [tz.a.m.i]

(26) C(A) child: [δ.a.k.t.i.l.o]

3.3. Lexical skills

In Table 5 the total number of right answers of each child concerning the assessment of lexical skills is presented.

Table 5: Total number of answers in the assessment of lexical skills

Group	Correct	Incor- rect	No an- swer			
	N	%	N	%	N	%
SLI	15/27	55,6	12	44,4	0	0
C(A)	22/27	81,5	5	18,5	0	0
L(D)	18/27	66,7	9	33,3	3	11,1

In table 5 it can be seen that the child with SLI and L(D) gave the shortest correct answers (55,6% and 66,7% respectively) indicating that between them there is a difference, whereas C(A) answered correctly with a percentage of 81,5%. It is worth noting here that there is a percentage of 11, 1% where L(D) did not answer.

(27) SLI child: "Kani pisw ta fila" Target: Skalizi ton kipo

(28) L(D) child: "Sfougarizei ta fila" Target: Skalizi ton kipo

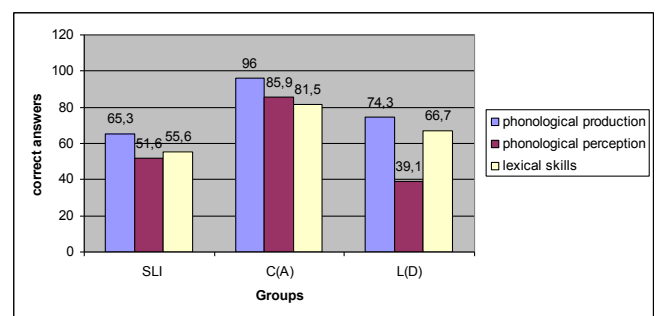
(29) C(A) child: "Skoupizi to xoma" Target: Skalizi ton kipo

In Table 6 the total number of right answers of each child concerning the assessment of phonological production, phonological perception and lexical skills are presented.

Table 6: Total number of answers in the three types of tests

Groups	Phono- logical					
produc- tion	Phono- logical percep- tion	Lexical skills				
	Correct	Correct	Correct			
	N	%	N	%	N	%
SLI	66/101	65,3	33/64	51,6	15/27	55,6
L(D)	75/101	74,3	25/64	39,1	18/27	66,7
C(A)	97/101	96	55/64	85,9	22/27	81,5

In Figure 3 a comparative presentation of the correct answers in tasks concerning the assessment of phonological production, phonological perception and lexical skills of each child has been carried out.

Figure 3: Comparison of three children concerning their skills in phonology and vocabulary

In Figure 3 it can be observed that the C(A) child has the highest percentage of correct answers. Additionally, the phonological perception of the SLI and L(D) children is at lower level than that of phonological production. More specifically, regarding the child with SLI there is a percentage of 65,3% concerning the right answers in the assessment of phonological production whereas the percentage of correct answers in phonological perception's tasks is 56,6%. It deserves to be mentioned also, that contrary to the other two children, the L(D) child presents the lowest percentage of the correct answers concerning the phonological perception's tasks (39,1%). Another observation is that there is a relation between the vocabulary and the phonology of each child. However, it is noticeable that the percentage of correct answers of the child with SLI in the assessment of lexical skills was 55,6% while the correct answers in phonological perception tasks was only 51%. Finally, it is observed that the L(D) child gave more correct answers, contrary to the child with SLI, in tasks concerning the phonological production (74,3% and 65,3% respectively) and the lexical skills (66,7% and 55,6% respectively), while the child with SLI gave more correct answers in tasks concerning the phonological perception (51,6%).

On the whole, it is should be reported that the child with SLI

presents the highest level of difficulty in phonological production as well as in lexical skills. In comparison to the other two children, these difficulties of the child with SLI seem to bear similarities to those presented by L(D), who has a lower chronological age but the same language development stage. On the other hand, C(A) performed better in all tasks by committing considerably less phonological errors and by providing a larger number of correct responses in tasks concerning phonology and lexical skills.

4. Discussion of results

In Chapter 4 the results of the study of the SLI child's phonological and lexical difficulties will be discussed. In the beginning, an overview concerning the aims of the study will be presented and thereafter the results of the study will be discussed in comparison to those of recent research.

4.1. Overview

The present study describes the phonological system as well as the lexical skills of a child with SLI and compares them to those of a child of the same age as well as those of a child of a younger chronological age. The first aim of the study is to ascertain that the child with SLI differs from the child of the same age regarding the phonological and lexical skills, however when it comes to the child of a younger chronological age the difficulties are almost the same. The second aim of the study is to demonstrate that the phonological perception and production of the child with SLI are linked and that the phonological deficits are due to an impaired phonological perception. Finally, the third aim of the study is to show whether the small number of words in the SLI child's expressive vocabulary is due to an impaired phonological system.

4.2. Discussion of results

4.2.1. Phonology

According to many researchers, the phonological skills of children with SLI do not differ from those of younger typically developing children (25, 19, 26, 22). More specifically, a lot of phonological errors that have been observed in the present study were common between the SLI child and the (LD) child such as omissions, reversals, cluster simplifications, substitutions, stoppings and voicings. Regarding the total number of

correct answers in the study of the phonological production, it was established that the child with SLI has a marginal difference with the (LD) child. According to Leonard (19), children with SLI acquire later the segments of language contrary to the typically developing children. Additionally, children with SLI hold up to acquire the complex syllabic structures (22) and it has been found that they simplify consonant clusters very often (6). Orsolini (29) also, argues that children with SLI present a lot of consonant substitutions in the segments acquired later on. More specifically, the highest percentage of the SLI child's phonological errors as well as of L(D) child's in the naming of simple pictures concern the cluster simplifications.

According to Leonard (19), children with SLI also present difficulty in acquiring distinctive features such as the [+strident] and [+voice]. In accordance to the results of the study, there is a small percentage concerning the stoppings and the voicings in the naming of simple pictures, whereas in the description of complex pictures a small percentage of voicings is also presented. Finally, Bortolini and Leonard (7) argue that children with SLI omit the phonemes in the initial or in the final position of words. These findings are also observed in the results of the present study, where the child with SLI in the naming of simple picture as well as in the complex picture description presented a small percentage concerning the omissions.

Concerning the phonological perception of children with SLI, it is argued that there are difficulties in the discrimination of words where the two syllables differ in the way and the place of articulation (18, 29). As it can be noticed in the results of the present study, in the discrimination of phonemes the child with SLI demonstrated a significant difficulty in answering correctly like the L(D) child. Furthermore, children with SLI present difficulty in the phonological hierarchy of words (41, 14) as well as in the phonological representations due to an impaired serial memory (28). The results of the study showcase that the SLI and the L(D) children face difficulty in the synthesis of phonemes. More specifically, the L(D) child performed more poorly in comparison to the child with SLI in this task, and the reason for this may be the fact that L(D) because of his age has not yet developed his phonological awareness, contrary to the child

with SLI who attends the first class of elementary school and knows all the letters of the Greek alphabet and their combinations. It has been also noticed that the child with SLI faces difficulties in both the phonological production and phonological perception. Rosen (34), argues that the deficits in phonological perception can be the root of phonological impairment. Concerning the results of the study, the phonological perception of the L(D) and SLI children is at a lower level than that of phonological production.

4.2.2. *Lexicon*

Regarding the total number of correct answers in the study of lexical skills, it has been observed that the child with SLI and the L(D) child gave the shortest correct answers. According to Sommers (37), SLI children present a delay in the acquisition of words as well as a difficulty in naming new objects that they have been recently introduced to. In accordance to the above, the results of our study show that the child with SLI presents difficulty both in phonology and in lexical skills. Many researchers also argue, that the deficits in lexical skills may be presented because of the phonological inability (19, 39). According to a research by Shelley (36), a limited phonological memory, difficulties with phonological representation and fast mapping may affect the ability of word learning.

5.1. *Summary and conclusion*

A first conclusion that can be drawn from this study is that the phonological deficits as well as the limited vocabulary of the child with SLI were the main features of its expressive language. Moreover, it has been observed that the phonological and the lexical abilities of SLI and L(D) children have some similarities and some differences as well. Generally, the language development between these two children is not identical. This leads us to the conclusion that SLI is not a language delay but a language disorder characterized by its symptoms. Additionally, both SLI and L(D) children present difficulties in tasks concerning the synthesis and discrimination of phonemes, commit a lot of phonological errors such as omissions, reversals, cluster simplifications, substitutions, stoppings and voicings and face

a lot of difficulties when it comes to the process of word learning. Additionally, it should be mentioned that the child with SLI present difficulty both in phonological perception and in phonological production. There is an important link between them as an impaired phonological perception can be the root of the phonological impairment. Finally, it can be observed that there is a great relation between the phonology and lexical skills in SLI and L(D) children, a fact that is also reported in the relevant literature.

The above findings will hopefully help speech and language pathologists in their ongoing efforts to diagnose and treat difficulties in phonological processing and word learning which can lead to specific language impairment. Finally it could be also useful for differential diagnosis between SLI and language delay.

5.2. *Future research*

For the purpose of the study only three children were used: one with SLI, one with the same age and one with a younger chronological age but with the same language development. Therefore, because of the limited number of the participants, the results of the present study cannot be generalized. It is essential that further research is carried out with a larger number of participants in order to understand in more depth the phonological deficits and the vocabulary acquisition of SLI children. The results of the present study can be the starting point of theoretical accounts concerning the relation between the phonology and the lexicon. Generally, there is a combination of interesting reasons as to why study SLI. First of all, it is very important to gain a deeper understanding of this type of language disorder, in order for new methods of assessment to be found and secondly some characteristics of SLI could be used in order to better understand other types of language disorders (19).

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I declare that this dissertation is all my own work and that all sources quoted are indicated and acknowledged by lists of references.

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