

Specific Language Impairment (SLI) is not specific enough: Sub-types of SLI and their implications for the theory of the disorder

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1. Introduction

It is agreed that SLI is a heterogeneous deficit, with difficulties in various aspects of language: phonology, morphology, syntax, semantics, word finding and pragmatics. The diagnosis of the deficit is by exclusion (Leonard, 1998, among others). In both the clinical and research fields, a child is diagnosed with SLI if he/she presents a delay in the development of language and this delay cannot be explained by sensory-motor deficit (such as hearing impairment, or recent history of otitis media), impairment in cognitive development, another diagnosed syndrome, insufficient exposure to language, or a psychiatric diagnosis (Conti-Ramsden & Botting, 2006; Leonard, 1998). Standardized tests and naturalistic language data are used for diagnosis and they discriminate between typical and atypical acquisition using production and comprehension scores compared to the norms of age-matched children.

Leonard (2010) suggested that it is time to explore language deficits in the frame of content, structure and use¹, rather than receptive (comprehension) versus expressive (production) impairments. In the current paper, I follow this idea, suggesting that there is enough evidence to

¹ In the current paper the linguistic terms are used: pragmatic for use, lexical retrieval for content and phonology, morpho-syntax and semantics for structure.

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forward this direction using boundaries adopted from the linguistic theory. This paper will first discuss the idea of specific markers of SLI, followed by additional evidence suggesting that these markers should be used to identify subtypes of SLI. It will then address the same subtypes of SLI in autism and will conclude by presenting new assessment tools that utilize a subtype diagnosis.

2. Many markers for SLI

Being a heterogamous impairment, many markers of SLI are presented in the literature (Bishop, North, & Donlan, 1996; Conti-Ramsden, Botting, & Faragher, 2001; Conti-Ramsden, & Hesketh, 2003; Friedmann, Aram, & Novogrodsky, 2011, among others) depending on the linguistic aspect that is targeted, the language being tested, the age of the children in the different studies and the theoretical perspective of the study. For example, Conti-Ramsden, et al. (2001) tested 160 English speaking children, aged 11 years, with a definite history of SLI. Out of four tasks that were used: third person singular, past tense, nonword repetition and a sentence repetition, the latter was the most accurate marker. It showed a high level of sensitivity (90%) and specificity (85%), as well as being able to identify most of the children whose current language status falls in the normal range despite a history of SLI. In contrast, Rice and Wexler (1996) tested younger children with SLI (ages 52-67 months) and showed that tense marking is the sensitive marker of SLI². The two studies argue for different markers for SLI, which could lead to a conclusion that at different ages different markers are sensitive for diagnosing SLI as a group. However, both studies target the morpho-syntactic domain of language. Studies that

² The importance of tense marking as a sensitive marker for SLI is further discussed in Oetting & Horohov (1997) and Rice (1994).

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targeted the morpho-syntactic domain in languages other than English showed different morpho-syntactic markers, for example: object clitic omissions in French (Paradis, Crago, & Genesee, 2003), definite singular articles and third-person plural inflections in Italian (Bortolini, Caselli, Deevy, & Leonard, 2002), and wh-movement in Hebrew (Novogrodsky & Friedmann, 2010 and in Greek, Stavrakaki, 2001).

But morpho-syntactic markers are not the only markers suggested in the literature. Other studies suggest that a nonword repetition task is a sensitive marker for SLI as a group (Bishop, North & Donlan, 1996; Conti-Ramsden, & Hesketh, 2003; Gathercole, & Baddeley 1990; Girbau, & Schwartz, 2007). For example, Bishop, et al. (1996) showed that twins with SLI were significantly impaired on a nonword repetition task and that comparisons of monozygotic twins and dizygotic twins indicated significant heritability of the deficit. Coady and Evans (2008) argue that because repetition accuracy depends on many language processes it is a powerful tool that can be used to identify children with language impairments.

The idea that difficulty in repeating nonwords can be a marker for SLI is expanded in the field of SLI in two directions: testing infants on a discrimination task (Weber, Hahne, Friedrich, & Friederici, 2005) and testing children who use sign languages (Marshall, Denmark, & Morgan, 2006). Weber, et al. (2005) tested infants at the age of 5 months on their ability to discriminate different stress patterns of bisyllabic nonwords. The infants were grouped retrospectively based on their production performance at the ages of 12 and 24 months. The results showed that infants with very low word production presented impaired prosodic processing of nonword stress during early development. The authors suggest that it may be taken as an early marker of risk for SLI. Difficulty in nonword repetition is also adopted as a marker for SLI in signed languages.

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Marshall, et al. (2006) reported on a non-signed repetition task in British sign language. Results from deaf children showed that the task is sensitive to age and revealed systematic error patterns as a function of phonological complexity. The authors suggest that a difficulty in repeating signed nonwords can be a marker for SLI in British sign language. In summary, the evidence is well established in the literature that nonword repetition is a sensitive marker for SLI as a group.

As seen above, markers for syntactic and phonological deficits are often discussed in the literature of SLI. However, there is recent evidence suggesting that children with SLI may have deficits also in sentence-level semantics (de Villiers, 2004; Schulz & Roeper, 2011). Schulz and Roeper (2011) tested children with SLI on subject questions with a picture task: single-wh-questions (e.g. who has all the soccer balls?), and paired wh-questions (e.g.: who is eating what?). The results showed that for both single wh-questions and paired wh-questions the responses did not include lists of subjects or objects, nor plural responses. The authors suggest a parallel feature of exhaustivity for wh-words and other quantifiers (e.g., every). Knowledge of quantifiers represents sentence-level semantic knowledge and therefore, the authors suggest, this knowledge is lacking in children with SLI.

Two components of the deficit of SLI are not considered to be markers: Lexical retrieval deficit and pragmatic deficit. Lexical retrieval deficit is also referred to as Word Finding Difficulty (WFD) (Dockrell, Messer, George, & Wilson, 1998) or Lexical-SLI (Le-SLI) (Friedmann & Novogrodsky, 2011). This deficit is argued to be present in one-quarter of the children with SLI during spontaneous speech and structured tasks (Messer & Dockrell, 2006). The second component is the pragmatic deficit which is a dominant characteristic of children with autism and is further discussed in section 4. Why are these components not considered to be

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markers? The appearance of these two deficits differs from the phonological and syntactic features present in children with SLI which led the clinical field to see them as separate impairments. Another explanation relies on Leonard's (2010) assumption of structure, content and use for diagnosing SLI. Following this assumption, word finding difficulties represent deficits in content; pragmatic deficits (with or without the diagnosis of autism) represent deficits in use; and morpho-syntax, phonology and semantic deficits represent deficits in structure. However, as will be discussed below, each of the structural deficits can also appear in isolation with some children with SLI showing various combinations of the deficits.

3. Dissociation between language domains

One of the arguments for using sub-types of SLI is found in data showing dissociation between language components (Ebbels, Dockrell, & van der Lely, 2012; Friedmann & Novogrodsky, 2008; van der Lely, 2004, among others). Different sub-groups of children with SLI can present deficits in one of the language domains while another domain is preserved. The dissociation may be present in any of the language domains. Some studies have found lexical retrieval deficit with preserved syntax (Dockrell, Messer & Murphy, 2005; Friedmann & Novogrodsky, 2008), and others have found syntactic deficit with preserved lexical retrieval (Novogrodsky & Friedmann, 2006; van der Lely, 2005). For the purpose of the current discussion it would be more important to examine dissociations within the component of structure, for example, between phonology and syntax. Van der Lely (1997; 1998; 2004; 2005)

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was the first to suggest a subtype of SLI, Grammatical SLI (G-SLI) which includes phonological and syntactic deficits. In a recent study van der Lely presents a further dissociation between syntax and phonology (Ebbels, Dockrell, & van der Lely, 2012). In their study, while all the participants with SLI showed syntactic impairment, only half showed a deficit in phonology.

In a detailed assessment study, Friedmann & Novogrodsky (2008) showed results from 43 children with SLI who present different combinations of the deficit. Each of the language domains was evaluated using a set of tests in order for the child to be considered as having deficit in a specific domain. Eleven children presented only syntactic deficit, six children presented only phonological deficit, seven children presented only pragmatic deficit, eight children presented only lexical-retrieval deficit, while the remaining eleven children presented mixed profiles (e.g. three children presented both syntactic and phonological deficits). The authors did not argue that any of these deficits is more common than others, but rather that “The claim here is existential... selective impairments in one module of language, and not in the others, do exist, and it is possible to identify subgroups within SLI with selective deficits in various language modules: syntax, lexicon, phonology, and pragmatics” (Friedmann & Novogrodsky, 2008, p. 214). The different patterns shown in the Friedmann & Novogrodsky study (2008) are in line with previous results demonstrating similar combinations of impaired language components (Bishop, 2006; Conti-Ramsden & Botting, 1999, 2006; Conti-Ramsden, Crutchley, & Botting, 1997; Conti-Ramsden et al., 2001; Korkman & Hakkinen-Rihu, 1994; Rapin & Allen, 1983; van Daal, Verhoeven, & van Balkom, 2004, among others). It is important to note that the same tests that are used as markers for children with SLI are used in the above studies to demonstrate SLI sub-types. Many of the children present mixed profiles. For example,

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nonword repetition tasks, claimed to be sensitive markers for SLI as a group, are used as for assessment phonological SLI under the view of subtypes of SLI. However, the idea of sub-types of SLI suggests that each child with SLI has a specific profile that includes her strength and weakness in each of the linguistic components, or within her age norm versus below age norm on each of these components. Furthermore, the idea of subtypes of SLI is that there are different groups of SLI with different language profiles.

Studies which examine children with SLI as a group, rather than by subtype, demonstrate the complexity of the picture of SLI. Stokes, Wong, Fletcher, & Leonard (2006) presented results of 14 Cantonese-speaking children with SLI who had impaired syntax and intact phonology. Hansson, Nettelbladt, & Nilholm (2000) tested 10 Swedish-speaking children with SLI, five of whom had impaired phonology with intact syntax, while the other five had deficits in both syntax and phonology. These results show the array of deficits in children with SLI. Combining the results from these two studies with Friedman and Novogrodsky's (2008) results, two explanations are still available for SLI: one general explanation for a deficit in both phonology and syntax, or two impairments presenting a comorbid deficit. To date, this question is still unanswered. One needs to explore the fine-grain linguistic characteristics of the deficits presented in children with different subtypes of SLI, within the same language and across languages, to further understand the nuances of SLI.

Correlational data support the assumption of subtypes from another angle. These studies show correlations between tests representing the same domain (e.g. syntax). Conti-Ramsden et al. (2001) used four standardized language tests representing vocabulary and syntax in

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production and comprehension. In addition they used four marker tasks that represent syntax (past tense; third person singular; recalling sentences) and phonology (nonword repetition). The authors showed only moderate correlations between the marker tasks and suggested that these tasks did not measure entirely overlapping skills. However, they found high correlation between tests that measured similar aspects of the language, e.g. the TROG (Bishop, 1982) and the past tense task, and not between production and comprehension (Conti-Ramsden, et al., 2001). Similar results were found in Bishop, Adams, & Norbury's (2006) study. In their twins' study the correlation between syntactic measures and phonological STM, although significant, was weak (<.3). It is thus suggested that the heterogeneity within the SLI diagnosis is not between deficits in production versus comprehension but rather between selective impaired language components in line with the linguistic boundaries of phonology, morpho-syntax, syntax, semantics, and pragmatics.

4. Same sub-types of SLI and autism

Studies of children with Autism Spectrum Disorder (ASD) support the dissociation assumption by presenting dissociation between pragmatics and other linguistic domains. The group of children with ASD is by definition excluded from the diagnosis of SLI as it falls under the umbrella of psychiatric disorders. There is also the debate of whether children with ASD and Pragmatic Language Impairment (PLI) share the same characteristics (Bishop, 2003), which is beyond the focus of the current paper's discussion. However, if we accept that children with ASD present pragmatic deficits (as shown in Novogrodsky, 2012; Bishop & Rosenbloom, 1987;

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Botting, 1999; Tager-Flusberg, 2004) and only look at the other linguistic skills of these children, we can explore this population for a dissociation deficit between impaired pragmatics compared to other linguistic domains. In a detailed language assessment of 44 children with ASD, Tager-Flusberg (2004) presented different linguistic profiles. Phonological skills were measured by a nonword repetition task, lexical-semantic skills were measured by the PPVT test (Dunn & Dunn, 1981) and syntactic skills were measured by the CELF test (Semel, Wiig, & Secord, 1989). Eleven children from the ASD group performed within the normal range in all three tests, suggesting that the language deficit in children with ASD can be specific to the pragmatic domain for certain children (also see Bishop, 1998; Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008; Conti-Ramsden et al., 1997; Friedmann & Novogrodsky, 2008). Other studies present mixed profiles of children with ASD: poor performance on both syntax and pragmatics (Bishop, 2000), and dissociation between poor versus intact phonology (Whitehouse, Barry & Bishop, 2008). Bishop (2000) claimed that “There are children who have a mixed picture of problems with language structure and pragmatics” (Bishop, 2000, p. 111). It follows from these studies that in the population of children with ASD, in addition to the pragmatic deficit, each of the language modules can be separately impaired (van der Lely & Marshall, 2011). The fact that linguistic modules can be individually impaired in one population supports the dissociation approach to examining children with SLI.

5. Summary and implications for the theory of SLI

Pearson, de Villiers and Jackson (submitted) argued that using a specific test that examines only a narrow range of skills, may lead to a failure to diagnose children with different types of SLI. The authors offer an example of diagnosing SLI using morpho-syntax as in the Test of Early Grammatical Impairment (TEGI, Rice & Wexler, 2001). In the current paper, I suggest that we need specific tests (the TEGI, for example) to assess the different language domains of children with SLI. Rather than arguing which is the best marker of SLI, we need to move forward with a diagnosis strategy and identify subtypes and mixed deficits within the group of children who exhibit SLI. This is an observational claim, which still leaves the theoretical question of modularity within the language domain open. There is a move in the diagnostic field and new tests are developed with specific sub tests that focus on specific language modules (Aravind, et al., 2013; de Villiers, 2004; de Villiers & de Villiers, 2010; Seymour, Roeper, & de Villiers, 2005). For example, the Diagnostic Evaluation of Language Variation Norm-Referenced test (DELV-NR) consists of four subtests: syntax, semantics, pragmatics and phonology, which are scored separately. The idea of exploring each language feature is relevant also for mixed deficits. If a child has deficits in syntax and phonology, the intervention program should focus on both of these aspects. However, if the child shows deficit only in syntax and her phonological facilities are intact (see for example, Ebbels, Dockrell, & van der Lely, 2012), intervention should focus only on syntax. The precise assessment of the language skills of children with subtypes of SLI is an important step in understanding the nature of the deficit/s. It can also provide a more precise method of therapy in which speech and

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language pathologists focus on specific impairment or impairments of a child and develop specific intervention programs. This would also allow a proper assessment of improvement over time in the specific language domain that is treated.

Many questions still remain open, including can we identify a single approach that will address all subtypes of SLI? Do children with different types of SLI use the same mechanisms to acquire language? What sub tests would be the best to assess each of the language domains? For example, is the nonword repetition task indeed the most sensitive test for phonological deficit and to what age ranges can it best apply? And finally, can we use similar tests across languages?

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