A final version of this paper has appeared in *Journal of Communication Disorders* 2017; 66, 22-39. DOI: 10.1016/j.jcomdis.2017.03.002

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Specific language impairment in a morphologically complex agglutinative Indian language – Kannada

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Abstract

Specific Language Impairment (SLI) remains an underinvestigated disorder in morphologically complex agglutinative languages such as Kannada. Currently, only a few case reports are available on SLI in Dravidian languages. The morphological complexity inherent to Dravidian languages such as Kannada provides a potential avenue to verify one of the two prevailing accounts of SLI: the morphological richness theory and CGC (Computational Grammatical Complexity) hypothesis. While the previous theory predicts the relatively spared performance of children with SLI (CwSLI) on syntactic morphology in morphologically complex languages, the latter predicts a diametrically opposite performance. Data from a group of 15 Kannada-speaking CwSLI supported the morphological richness theory, and further revealed five distinct profiles of SLI. The results of this study reflected that CwSLI learning the agglutinative language (Kannada) as compared with language-matched children without SLI, displayed some shared deficits (e.g., in phonological processing on a non-word repetition task) with CwSLI learning English. However, CwSLI learning the morphosyntactically rich language Kannada differed remarkably from English-learning CwSLI by not showing deficits in syntactic morphology relative to language-matched peers (e.g., PNG, verb, tense, case, and pronoun).

Keywords: SLI, Morphosyntax, Kannada, Agglutinative

1. Introduction

Specific Language Impairment (SLI) refers to a condition in which children present marked deficits in language development despite adequate prerequisite skills for language acquisition. These children exhibit language delays in the absence of any identifiable cause. Most definitions of SLI, therefore, include a single inclusionary criterion – i.e., marked deficit in language – with several exclusionary criteria such as intellectual, sensory, physical, and neurological impairments. Despite several decades of research, there exists an apparent dearth of concrete definitions of SLI (Aram, 1991; Bishop, 1994; Johnston, 1991). This is possibly due to the wide range of impairments in this population, including deficits in any or combination of various linguistic components such as phonology, morphology, syntax, semantics, and pragmatics. There is growing evidence that majority of children with SLI (CwSLI) show impairment in grammatical morphology, making this linguistic domain a vulnerable area in SLI (Rice & Wexler, 1996).

Nevertheless, the current concepts and explanatory hypotheses of SLI are primarily derived from English and similar languages from the Indo-European family. Based on the morphology, languages may be classified into four types (on a continuum). The first type is characterized by isolated morphology and marked by a few affixes, where the grammatical relationship is primarily encoded by the relative position of words (e.g., Chinese). The second type is featured by fusional morphology (e.gs. Italian, Russian, Arabic, & English), with the rich use of affixes that represent several functions (e.g., in "he walks," the ‘–s’ affix represents third person singular present tense). The third type is the agglutinative morphology (such as in Turkish, Hungarian, Finnish, & Dravidian languages like Kannada), where words are composed of multiple affixes, with each affix being distinct and having a unique syntactic or semantic function. Finally, the fourth type of languages (e.g., polysynthetic Inuit languages) are characterized by chaining the content and function words into long sequences to form complex word forms that constitute the entire sentence (Nemeth, Janacsek, Turi, Lukacs, Peckham, Szanka, et al., 2015).

In the context of such linguistic diversities, we provide novel evidence on the linguistic profiles of SLI from a largely unexplored, morphologically complex Dravidian language – Kannada, spoken in Karnataka, a southwest state of India.

English and Kannada belong to different language families and their linguistic (morphological) typology differs drastically from each other. Kannada has an agglutinative morphology, where several morphemes are placed together to form a word (Torres, & Rutland, 2012). In contrast, English morphology is predominantly an isolation type, although it shares feature(s) of both agglutination and fusion. In the following section, a brief explanation of the linguistic profiles of CwSLI who speak morphologically sparse languages (e.g., English) is presented. It is followed by the prevailing theories and accounts of SLI. Finally, a brief overview of the morphological features of Kannada and the relevance of investigations on SLI in such languages are presented.

1.1 Linguistic profile of SLI

Children with SLI exhibit delayed emergence of the first word as well as an extended period of lexical development. Further, they show a delay in mastering word combinations. In general, these children experience marked deficits in language production than in comprehension, although the latter ability is below their age level (Leonard, 2014). Besides these deficits, documented profiles of English-speaking CwSLI show marked impairments in morphological inflections compared to younger, typically developing (TD) children matched on the mean length of utterance (MLU). English-speaking CwSLI experience considerable difficulty with various morphemes including third person singular (–s), past tense (–ed), copula forms (is & are), auxiliaries (is, do, & does), possessive (–'s), and articles (a, an, & the) (Roberts & Leonard, 1997). Likewise, evidence from the non-English European languages has revealed deficits in tense-related grammatical morphology and aspect, a feature that could serve as the clinical marker of SLI (Bishop, 2014; Leonard, 2015).

While some classification systems of SLI rely heavily on the morphosyntactic deficits, many others depend either on the linguistic or non-linguistic factors. For

instance, CwSLI have been classified based on etiology, language use (repetition, comprehension, & production), neuropsychological, neurolinguistic, linguistic (i.e., phonology, syntax, & semantics) or a combination of these profiles. Some classification systems are based on the performance patterns of these children on a battery of language tests (Stromswold, 1997). An early attempt to classify SLI was to separate the deficits in morphosyntax and phonology from deficits in semantics and pragmatics (Leonard, 1998; Schwartz, 2009). None of these classification systems gained widespread acceptance in the clinical or research community. Consequently, many researchers continued to follow the DSM-IV (American Psychiatric Association, 1994) classification system of SLI. According to this system, SLI is divided into three subtypes: viz., the expressive language disorder, mixed expressive-receptive language disorder, and phonological disorder, reflecting the predominant area(s) of deficits. Nevertheless, a majority of the scholars agree that morphosyntactic errors (particularly with free and bound morphemes) in language production constitute the most prevalent subtype of SLI, commonly referred to as the 'typical SLI' group (Bishop, 2004). On the other hand, Van der Lely (1998, 2004) recognized a subtype of Grammatical SLI (G-SLI) children in English who exhibited specific difficulties with relative clauses or WH-questions. However, there is only limited evidence for this subtype of SLI in other languages. In essence, it may be noted that the current classification systems rely primarily on the underlying theoretical constructs of SLI. In this context, a brief overview of various accounts of SLI is presented in the following section.

1.2 Accounts of SLI

Several explanatory accounts of SLI have been proposed based on the experimental and empirical evidence. Some accounts propose that SLI arises from the limited processing of sensory inputs, whereas others attribute it to the underlying linguistic deficits. A brief overview of the major theoretical accounts of SLI is given in the following section.

1.2.1 Perceptual deficit account

Tallal and colleagues (Tallal, Stark, Kallman, & Mellits, 1981) argued that children with language impairment exhibit a general auditory perceptual deficit (i.e., perceptual deficit account) that leads to impaired discrimination and sequencing of rapid acoustic events from the incoming speech stream. Following this argument, Leonard (1989, 1994) attributed SLI to a general processing deficit influenced by the morphology of language (i.e., the surface hypothesis). According to Leonard, CwSLI experience marked difficulty in producing unstressed, non-salient grammatical morphemes (e.g.,*–s*), as these markers are difficult to perceive phonetically. Consistent with the surface hypothesis, Rice (1994) showed that CwSLI experience notable difficulty with unstressed morphological markers (e.g., plurals & verb agreement markers) compared to their language-matched peers.

Another account that relies on the limited processing is the morphological richness theory. According to this theory, CwSLI apply their 'limited' processing resources to the central features of the language they are acquiring (Leonard, Sabbadini, Leonard, & Volterra, 1987; Leonard, 1989). However, this theory emphasizes on the limitation in processing capacity rather than the speed of processing. The authors proposed that languages with rich morphology provide more frequent and consistent input (with inflections of nouns, verbs, and adjectives) and, are thus easier to learn. Hence, CwSLI experience less difficulty acquiring native grammar in languages with rich morphological inflections. In other words, the differences between CwSLI and their TD language-matched peers in the use of grammatical morphology are lesser in morphologically rich languages than in morphologically sparse languages.

1.2.2 Normal distribution account

Leonard (1987, 1991) further proposed that CwSLI are mostly not impaired, but equipped with insufficient skills in their language abilities than their healthy peers. That is, CwSLI fall on the left end of the normal distribution of language ability (i.e., the normal distribution account), indicating slower development, and poorer asymptotic performance. According to the normal distribution account, the language ability can be conceptualized as an aggregate skill based on many sub-skills that vary across individuals. These sub-skills are controlled by various brain mechanisms. The

suboptimal performance on these fundamental skills that affect the language processing is, hence, linked to the neurological (dys)function in CwSLI. In this sense, the normal distribution account of SLI provides a viable explanation for the variable profile of linguistic deficits in CwSLI.

1.2.3 Linguistic accounts

Several accounts have attempted to explain SLI from the perspective of either the properties of the language or the deficits in linguistic processing. For instance, many researchers believe that SLI results from missing or aberrant elements of the Universal Grammar in the child's linguistic system that influence the acquisition of morphological markers of number, tense, or gender (Clahsen, 1989, 1991; Gopnik, 1990; Gopnik & Crago, 1991; Rice, 1994). Ullman and Gopnik (1994) claim that CwSLI exhibit certain (linguistic) feature blindness arising from the genetic predisposition that leads to an inability to develop automatic, implicit grammatical markers of number, person, and tense. On the other hand, Rice and co-workers (1995) and Rice and Wexler (1996) offered another linguistic account – the 'Extended Optional Infinitive' theory – to explain the linguistic deficits in CwSLI. According to this theory, CwSLI use tense (finiteness) markers in an optional rather than in an obligatory manner during the developmental stage. Further, these children use such optional tense markers for an extended period, compared to TD children. Later, Rice (2003, 2004) argued that CwSLI exhibited a delay in global language development, along with subtle disruptions in individual linguistic structures that go beyond what is predicted by their general delay in the language development (the Disruption-within-Delay Hypothesis).

Van der Lely (1996, 1998), on the other hand, proposed a specific theory (the Representational Deficit of Dependency Relations (RDDR)) to account for the grammatical deficits in a subgroup of CwSLI (i.e., the Grammatical-SLI). She claimed that the language difficulties in this subgroup originate from the deficiencies in the computational syntactic system. Children with G-SLI often fail to move the elements to correct syntactic domain, making their use optional rather than obligatory, leading to the optional phonological awareness of morphosyntactic markers. Later, Van der Lely (2004; 2005) expanded the RDDR theory to the Computational Grammatical Complexity

(CGC) hypothesis that rests on specific deficits in certain aspects of grammar, which would either manifest as SLI in the early years or remain unnoticeable until fully revealed in the adulthood. The CGC hypothesis explains that deficits in deriving hierarchically structural complexity in syntax, morphology, and phonology affect language processing in CwSLI. Syntactic complexity corresponds to the structural 'syntactic dependencies,' such as those found in a question (e.g., Who did Joe see ___?), between the words (who and the gap). Here, the gap refers to the determiner phrase and forms a non-local dependency in syntax. Hence, in syntax, other than marking tense, all other structures that require syntactic dependencies (e.gs. passive sentences and pronominal reference) are predicted to be difficult. Morphological complexity is explained based on Pinker's Words and Rules model (Pinker, 1999). According to this model, TD children store the irregular verb forms as wholes in monomorphic forms, while they compute the morphologically regular forms by using symbolic rules, and thereby, suffixation leads to hierarchical branching structure. Thus, in CwSLI with morphological deficits, regularly inflected verbs are stored better and subjected to the frequency effect, which otherwise is observed only for irregular forms. Phonological complexity is defined by the parameters that influence the stress pattern and syllable structure of words, thereby increasing the hierarchical structure. Thus, those CwSLI exhibiting phonological impairments would experience marked difficulties on inflected words with a phonologically complex structure (e.g., rolled) than on words with simpler phonological structure (e.g., rowed). Here, the final sound (i.e. liquid 'l') makes the syllabic structure of the word 'rolled' more complex compared to the final sound in 'rowed'. Thus, the CGC hypothesis predicts that CwSLI exhibit deficit on structure-dependent relationships, like those in subject-verb agreement, tense marking, case marking, and movement (Van der Lely, 2005).

As most of the work in SLI is largely from languages using fusional (or sparse) morphology, the aforesaid accounts are applicable for such languages. In the recent past, there have been some attempts to verify these accounts in languages with rich (or agglutinative) morphology. One of the accounts of SLI (i.e., morphological richness theory) has specific predictions for languages with rich morphology. Morphological richness theory (a processing limitation account), predicts that in morphologically rich

languages (where the word order is not rigid), resources are applied first to grammatical morphology. Thus, the differences between CwSLI and their TD peers in the use of grammatical morphology will be lesser in morphologically rich languages than in morphologically sparse languages. Another assumption of this account is that the errors often approximate the target form (or near misses) and they differ from the target form by only a single feature (Bedore & Leonard, 2001; Lukács, Leonard, Kas, & Pléh, 2009). Another account of SLI with relevance to morphology is the CGC hypothesis, which by principle, does not have any specific prediction for agglutinative languages and it emphasizes on the structural complexity of syntax, extending to morphology and phonology. Since agglutinative languages (e.g., Kannada) are structurally composite and use hierarchically complex computations of morphosyntax, the predictions of the CGC hypothesis might be extended to these languages. The CGC hypothesis holds that impairments in syntax, specifically in tense, agreement marking, and case assignment, would be difficult for CwSLI compared to their TD counterparts.

It is apparent from the foregoing section that several theories/accounts have been proposed to explain the clinical profile of SLI. While some theories attribute the core deficits in SLI to the impaired linguistic processing, others emphasize on the impaired non-linguistic processing. However, most of this evidence is drawn from English and similar languages with sparse (fusional) or relatively simple morphology. Of particular interest are the seemingly contradictory predictions of the two accounts of SLI, i.e., the morphological richness theory (Leonard, 1989; Leonard et al., 1987) and the CGC hypothesis (Van der Lely, 2004; 2005). However, these accounts are not adequately investigated in morphologically complex (agglutinative) languages (e.g., Kannada). Before discussing the Kannada morphosyntax, a brief overview of the clinical profiles of SLI in agglutinative languages is presented below.

1.3 SLI in Agglutinative Languages

Agglutinative languages are morphologically complex (as described above), where the words are formed by combining stem and affixes. Yet each morpheme remains unchanged after the combination, making it easier to derive word meaning. (e.gs. Japanese, Korean, Turkish, Hungarian, and the Dravidian language family).

While deficits in verb morphology (tense and agreement markers) are central to SLI in English-speaking children, several investigators report that it is not the case in languages with rich morphology (e.gs. Spanish: Bedore & Leonard, 2001, Italian: Bortolini, Caselli, & Leonard, 1997; Leonard, Caselli, & Devescovi, 2002; Leonard & Dromi, 1994, Hungarian: Lukács, et al., 2009). Studies on monolingual and bilingual Turkish-speaking CwSLI suggest that the noun morphology is at more risk than the verb morphology (Çavuş, 2009; de Jong, Çavuş, & Baker, 2010), particularly the case markers (Rothweiler, Chilla, & Babur, 2010). Studies on Hungarian-speaking CwSLI did not reveal any significant impairment on noun morphology (e.gs. accusative forms & plurals: Lukács, Leonard, & Kas, 2010; case marking: Lukács, Kas & Leonard, 2013). Korean-speaking CwSLI showed quantitative rather than qualitative difference with TD children in the production of case markers (Lee, Choi, & Hwang, 2014). Japanese CwSLI, on the other hand, experienced problems similar to English CwSLI on several morphological markers of tense and aspect (Fukuda & Fukuda, 1999). A few case studies in two Dravidian languages (Kannada & Malayalam) revealed morphosyntactic impairments in the use of tense, plural, adjective, negatives, verb agreement, and wh-questions (Prema, Prasitha, Savitha, Purushothaman, Chitra, & Balaji, 2010; Prasitha & Prema, 2008; Raman & Amritavalli, 2007). Thus, unlike in English, the clinical profile of SLI in agglutinative languages has shown mixed deficits in noun and verb morphology. These findings imply that several morphosyntactic markers contribute to the production deficits in agglutinative languages, unlike in English, where certain markers escalate the deficits disproportionately compared to other markers.

Despite such differences in the linguistic profiles of CwSLI between morphologically rich and sparse languages, in general, the quantum of investigations in the former languages is apparently small. This gap is more evident in Dravidian languages. Although a couple of studies have also reported the deficits in morphosyntax and verbal expression in groups of CwSLI in Dravidian languages such as Kannada and Malayalam, their results are limited to comparisons with language-age or chronological age-matched controls on a single or a limited morphosyntactic markers (Chakravarthi, 2012; Raman & Amritavalli, 2007; Prasitha & Prema, 2008). This gap in research necessitates in-depth explorations of morphosyntactic deficits in these languages, the

primary purpose of this study. Before discussing the specifics of the current study, a brief overview of the morphosyntactic complexity in Kannada is provided below.

1.4 Morphosyntax in Kannada

Kannada generally employs a subject-object-verb word order. However, due to its rich morphology and subject-verb agreement, the word order is relatively free, and omission of the subject is common, as the agreement features of the verb indicate the sentence subject.

The morphology of Kannada is agglutinative with the predominant use of suffixes compared to prefixes. Nouns in this language comprise of proper names, common nouns, pronouns, and other forms like adjectives. They mark the case, number, and gender. There are seven cases that indicate a variety of grammatical relations within the clause: nominative, accusative, genitive, dative, locative, source (that combine instrumental and ablative functions) and vocative. Unmarked singulars contrast with marked plural numbers. Gender is marked in pronoun choice, declensional patterns and, secondarily, in certain derivational patterns. The basic gender categories include masculine, feminine, and neuter. Personal pronouns form a significant subset of nouns. These pronouns are used to mark first (self), second, and third person. The gender and number markers are also added onto these pronoun morphemes (e.g., *avanು* – [third person singular masculine]- vs. *avalು* [third person singular feminine]). Personal pronouns in Kannada do not make any distinction between first-person plural inclusive ("we and you") and exclusive ("we but not you") pronouns. Pronouns in Kannada include personal, reflexive, and interrogative pronouns. Additionally, Kannada has demonstrative pronouns that commonly function as third-person anaphoric pronouns. Kannada has a broad set of postpositions that supplement the case system representing more accurate semantic relations than the simple case forms do (Torres, & Rutland, 2012).

The verbs in Kannada mark categories as tense and mood. They consist of a lexical base and a set of suffixes (Steever, 1998; Ranganatha, 1982). The lexical base may contain a simple root, or a root plus a suffix, such as the causative marker (*–isu*).

Kannada has two basic conjugations. The first includes verbs whose stem ends in *–u* (e.g., *madu* ‘do, the work') and the second includes verbs whose stem ends in *-e* or *–i* (e.g., *kare* ‘call'; *kudi* ‘drink'). Further, there are a few irregular verbs in Kannada. The irregularity centers primarily on how they form their past tense stems. The verb forms in Kannada are finite or nonfinite. The finite forms mark tense/mood and subject-verb agreement (using PNG markers). Their distribution in Kannada sentence is strictly limited by rule (as they are not utilized in the spoken form) so that the majority of the forms are nonfinite. Kannada has five finite paradigms: past, present, future, contingent, and negative. The first three indicate the tense and the remaining two indicate moods. Besides these full paradigms, Kannada has other finite forms viz. the imperative, optative, and hortative. The nonfinite verbs include two sets of forms where one combines with the following verb and the other combines with the following nominal. The first set includes the conjunctive, infinitive, and conditional forms and the second set includes the adnominal forms and certain verbal nouns. The nonfinite verbs that combine with nouns help to generate relative clauses and similar structures. Quite distinct from English, Kannada lacks articles and all clitics in this language are post-positional.

Hence, unlike English, Kannada is an agglutinative language that employs grammatical morphemes leading to complex morphosyntactic constructions that are often affixed to the base morpheme. For instance, in this example, (e.g., baru-tt-a:yidda:Le: Come-PRS-CONT-3-SG-F-She; ‘She is coming.') a single word in Kannada represents three morphemes in English (i.e., /she is coming/), marking the tense, number, and gender (See Appendix C for the list of abbreviations used in the glosses of Kannada examples throughout the paper). Thus, owing to its agglutinative nature, Kannada morphology is syntagmatically rich. Kannada is also rich in paradigmatic dimension as it encompasses a variety of inflectional types and categories. However, unlike languages with fusional morphology (e.g., Hebrew), Kannada morphemes are distinct and easily distinguished from each other. Thus, Kannada is different from English in several dimensions (including the morphosyntax), thus necessitating validation of the prevailing accounts of SLI in this language. Further,

such investigations on SLI in Kannada is expected to provide a potential avenue to verify the predictions of morphological richness theory and the CGC hypothesis.

It may also be noted that none of the available studies in Kannada attempted to classify CwSLI based on their presenting linguistic deficits, considering the morphological distinctiveness of this language. Hence, the current study is aimed to explore the possible profiles of Kannada-speaking CwSLI based on the impairments in various components of language such as phonology, morphosyntax, and semantics. In addition, this study has attempted to investigate the influence of the complex syntactic morphology of Kannada in the manifestation of SLI. Specifically, it looked at verifying two prevailing accounts (i.e., morphological richness theory & CGC hypothesis) that bank on the morphological complexity of languages in the manifestation of SLI. The CGC hypothesis would predict substantially poor performance in CwSLI on structure-dependent relationships like tenses, case markers, agreement (i.e., PNG markers in Kannada) and pronouns in comparison to the language-matched TD children. In contrast, the morphological richness theory would predict comparable performance on syntactic morphology (especially the more frequent markers like tense, PNG, and verb in Kannada: following Prasad & Prema, 2013) in CwSLI and their language-matched peers. In the current study, thus, the focus has been on investigating the predictions of CGC hypothesis and morphological richness theory by comparing the morphosyntactic errors of a group of Kannada-speaking CwSLI with two sets of (chronological-age-matched & language-matched) control children.

2. Methods

2.1 Participants

Three groups of children (i.e., SLI & age-matched and language-matched control groups) served as participants in the current study. All of them were native speakers of Kannada who attended regular schools with Kannada as the medium of instruction. Each participant underwent a detailed evaluation of his/her language skills using the Linguistic Profile Test (LPT; Karanth, 1980), a norm-based assessment tool in Kannada comprising of three major subdivisions viz., phonology, semantics, and morphosyntax

(details provided in section 2.2.1). Participants in SLI and both control groups were recruited from the same school and belonged to similar (lower middle class) socio-economic backgrounds (Socio Economic Scale II on National Institute for the Mentally Handicapped socio-economic status scale; Venkatesan, 2006).

2.1.1 The SLI Group

The participants in this group were identified from the neighboring schools based on the teachers' and parents' reports. None of these participants had any sensory, intellectual, or motor deficits (assessed with a questionnaire, Shipley & MacAfee, 2009). Based on the prevailing diagnostic criteria of SLI (Leonard, 1987), 15 CwSLI (mean age = 9.8 years; language age = 7.7 years) served as participants in this group. As per the criteria, all children with a history of language delay obtained an overall mean score less than or equal to -1.25 SD on LPT. These children were further screened for their nonverbal IQ (cut off: ≥ 82), hearing, neurological dysfunction, oral structure and function, as well as the physical and social interaction based on the developmental norms.

All participants with SLI exhibited marked deficits in language based on their scores on LPT (see Table 1). Further, none of them received any remedial training for their language and reading-writing deficits. Although the parents of CwSLI were counseled to enroll their children for speech-language intervention, they either brought their children for a few sessions (3-4 sessions in the beginning) and then discontinued, or did not report for intervention.

Table 1: Demographic details, language age (using LPT Kannada) and MLU of participants with SLI

Sl. No.	Name	Actual Age (yrs.m	Gender	Grade	Phonology	Morphosyntax	Semantics	Overall Language Age	MLU

		ths)							
1	L	8.2	Male	3	8 yrs	7 yrs	8 yrs	7 yrs	2.6
2	S	9.1	Male	4	7 yrs	7 yrs	9 yrs	7 yrs	4
3	B	9.4	Female	4	9 yrs	7 yrs	9 yrs	8 yrs	3
4	C	9.1	Male	5	9 yrs	9 yrs	8 yrs	8 yrs	3
5	D	9.3	Male	4	9 yrs	9 yrs	7 yrs	7 yrs	2
6	L	9.3	Female	4	9 yrs	7yrs	9 yrs	8 yrs	3
7	Sh	9.1	Female	4	9 yrs	7 yrs	7 yrs	7 yrs	2.5
8	N	9.6	Female	5	7 yrs	7 yrs	7 yrs	7 yrs	2.2
9	N	10.3	Male	5	10 yrs	7 yrs	7 yrs	7yrs	2.8
10	S	10.1	Female	6	10 yrs	7 yrs	8 yrs	8 yrs	2.8
11	D	10.4	Male	5	10 yrs	7 yrs	9 yrs	8 yrs	3
12	K	11.7	Male	6	10 yrs	9 yrs	11 yrs	9 yrs	3
13	S	11.3	Female	6	9 yrs	7 yrs	8 yrs	7 yrs	2.8
14	S	12.8	Male	6	10 yrs	10 yrs	11 yrs	10 yrs	4.2
15	K	12.3	Male	6	7 yrs	7 yrs	9 yrs	8 yrs	2

2.1.2 Control groups

As mentioned earlier, two groups of typically developing (TD), control participants matched for: a) chronological age, and b) language skills were included. The age-matched control group included 17 children (mean age = 10.2; SD = 1.6 years) and the language-matched group, 15 children (mean age = 8.1; SD = 0.9 years). All participants in the control groups were screened for any sensory, intellectual, and motor deficits with the same questionnaire used for CwSLI (Shipley & MacAfee, 2009). We used the total scores on LPT (i.e., scores on phonology + morphosyntax + semantics) for matching the language. An independent sample *t*-test on scores of morphosyntactic comprehension (t (28) = -1.602, p = 0.120) and expression, i.e., MLU (t (28) = -1.408, p = 0.170) did not reveal any significant difference between the SLI and language-matched groups. Table 2 provides the LPT scores of the three groups of participants.

Table 2: Mean (SD) and range of scores of three groups of participants on LPT

	CwSLI	Age-matched controls	Language-matched controls
Age	9.8 (1.21)	10.2 (1.6)	8.1 (0.9)
Range	8 to 12	8 to 12	7 to 10
IQ	89.4 (6.2)	97.1 (4.4)	98.7 (8.2)
Range	82 to 99	90 to 104	90 to 106
Phonology	93.07 (4.04)	97.53 (2.83)	94.87 (2.20)
Range	86 to 98	92 to 100	91 to 99
Morphosyntax	57.53 (4.16)	73.53 (10.49)	61.13 (11.36)
Range	52 to 65	52 to 89	46 to 82
Semantics	67.07 (9.52)	80.76 (3.42)	72.20 (9.82)
Range	51 to 81	74 to 86	53 to 86
Overall language	217.67 (13.19)	251.82 (15.36)	228.20 (21.78)
Range	194 to 243	222 to 274	195 to 264
MLU	2.86 (0.62)	3.68 (0.87)	3.12 (0.36)
Range	2 to 4.2	2.7 to 5.5	2.4 to 3.7

2.2 Materials and Tasks

2.2.1 Linguistic Profile Test (LPT):

The LPT is a comprehensive, norm-referenced tool for language assessment in Kannada (Karanth, 1980). It consists of four sections, viz., phonology, morphosyntax, semantics, and discourse. The first section (Phonology) is divided into three subsections. The first one is phonemic discrimination that assesses children's to discriminate minimal pairs by pointing to the appropriate picture (e.g., /hu:vu – ha:vu/ i.e., 'flower – snake'). The second subsection – phonetic expression – examines the ability to repeat words after the clinician (e.g., /aane/, /ili/ i.e., 'elephant, mouse'). The third subsection (running speech) provides information about the children's ability to repeat and read aloud a given passage while the clinician pays attention to their

phoneme productions, including clusters. The second section, morphosyntax, has 11 subsections, viz., morphophonemic structures, plural forms, tenses, PNG markers, case markers, transitives, intransitives & causatives, sentence types, predicates, conjunctions, comparatives & quotatives, conditional clauses, and participial constructions. This section requires participants to indicate if the given words and sentences are syntactically correct or not, as shown below:

E.g., 1. niru-gaLu

Water-PL* wrong morphological marker, i.e., incorrect use of plural marker

E.g., 2. avaru na:Le ba-nḍ-ʌru

He-PRN-3-SG-M-HON tomorrow-ADV temporal come-PST#-3-SG-M-HON

‘He/she came# tomorrow' #incorrect use of tense marker

The third section on semantics, has two subsections: viz. semantic discrimination and semantic expression. The subsection on semantic discrimination assesses the ability to discriminate pictures through pointing to the correct items among the choices. The semantic expression, on the other hand, evaluates the naming ability through various tasks such as object naming, lexical category naming, synonymy, antonymy, homonymy, polar questions, semantic anomaly, paradigmatic relations, syntagmatic relations, semantic contiguity, and semantic similarity. The final section on discourse assesses the spontaneous speech skills through general conversation and picture description tasks. The responses obtained in this section are only descriptively recorded, but not scored. The normative data for LPT in Kannada are available for monolingual Kannada-speaking children between grades I and V (ages 6 to 10 yrs) (Suchithra & Karanth, 1990) and grades VI to X (ages 11 to 15 years) (Suchithra & Karanth, 2007). The scores on LPT were regarded as the primary measure of linguistic skills in the present study, as this test assesses phonology, morphosyntax, and semantics from 6 to 15 years of age. Each of these three section has a maximum score of 100 (Total score = 300). Test scores obtained on LPT were used to derive the

corresponding language age of the participants. The language scores (and language age) obtained on LPT were used to identify the language profile(s) of CwSLI.

2.2.2 Spontaneous speech task:

In addition to the overall scores on LPT as the primary measure of linguistic skills, the mean length of utterance (MLU) was employed as a precise measure of expressive language skills in this study. As the LPT consisted primarily of judgment tasks in the morphosyntax section, inclusion of the MLU provided a comparison of verbal expressive morphology across the participant groups. For this, spontaneous speech sample (8-minute duration) from each participant was collected through conversation and picture description tasks (4 minutes each). The participants were asked to talk about their family, school, friends, and previous vacation during the conversation task. For the picture description task, a series of pictures (‘boy late to school" taken from Test of Narrative Language, Gillam & Pearson, 2004) was used. The participants were provided with prompts during this task, whenever required. Only data from participants who produced a minimum of 50 utterances from both tasks were included. The MLU was computed from these samples following the guidelines of Lund and Duchan (1993). As per these guidelines, the structures like uninflected lexical morphemes and grammatical morphemes as whole words, irregular past tense, phrases, compound words, reduplicated words, which occur as inseparable linguistic units for the child were considered a single morpheme. However, inflected forms like plurals, possessive, tense, PNG, and pronouns were considered as more than one morpheme. In the case of tri-morphemic words, (e.g., ho:gʌ-t̪-a:Le[Go-FUT-3-SG-F]; ‘She will go.'), indicated the number of morphemes that corresponded to the root word and the grammatical function(s). In addition to the MLU, the participants' usage of morphological and syntactic structures was also evaluated from the spontaneous speech samples, to identify the types of errors and their distribution across the groups. The errors in each morphosyntactic category/type indicated either omission or substitution of that marker. For example, in the tense marker group, errors would show either dropping of tense markers

E.g., ho:gu for ho:gʌ-t̪t̪-id̪-a:ne

Go-VR Go-PRS-CONT-3-SG-M

‘Go' ‘He is going.'

Or, incorrect use of tense markers on the verb

E.g., yeḏḏdiḍa: for yeḏḏ-eLLʌ-ṯiḏ-a:ne

Wake-PST-3-SG-M Wake-PRS-CONT-3-SG-M

‘He woke up' ‘He is waking up'

All errors observed in the spontaneous language samples of the participants (including those of interest in light of the two hypotheses, i.e., morphological richness theory and CGC hypothesis being tested in this study), were identified under each morphosyntactic type with their respective distribution across the groups (see Table 4).

2.2.3 Phonological Awareness:

Apart from the LPT, a test of phonological awareness was also included, for it being a known area of deficit in CwSLI. Kannada writing, being alphasyllabic in nature (unlike English), is expected to show marked deficits in children with (specific) language impairment on syllable awareness, in comparison with the phoneme awareness task. Metaphonological test in Kannada (Karanth & Prakash, 1996) was used to assess the phonological awareness in our participants. The metaphonological test is a standardized test of phonological awareness in Kannada comprising six subsections [viz., rhyme recognition, syllable stripping, syllable oddity (words), syllable oddity (non-words), phoneme stripping, & phoneme oddity] designed to assess the phonological awareness at the syllable, rhyme, and phoneme levels. The stimuli were presented auditorily, and the participants were required to provide the verbal response (e.g., say ‘yes or no', or name the stimulus after the necessary manipulations such as deleting a syllable/phoneme or identify the odd stimulus from the choices given). Each of the six sections has 12 items, and every correct response is provided a score of one (Total score = 72).

2.2.4 Non-word Repetition Task:

The non-word repetition task is a valuable task in the assessment of SLI. This task specifically assesses the phonological short-term memory (STM). As impairment in non-word repetition task is a salient clinical marker of SLI, it was expected that CwSLI in the current study would perform poorly on this task. A list of 30 non-words in Kannada (10 each with 2-, 3-, & 4-syllable lengths) was generated from the true words by transposing, dropping, or adding syllables, adhering to the phonotactic rules of this language (see Appendix A). Two native Kannada speakers rated the non-words as low or very low on the 'word-likeness'. The participants were instructed to repeat each non-word after the experimenter. A score of one was given for each correctly repeated syllable. This scoring differed from the standard scoring of non-word repetition tasks (i.e., phoneme correct scoring), as Kannada is an alphasyllabary with a predominant syllabic structure.

2.3 Procedure

Informed consent was obtained from the parent(s) of each participant before the commencement of the language assessment. Each participant was tested individually in a quiet room within the school premises. All participants were initially screened for the presence of sensory, intellectual, or motor deficits followed by the administration of the LPT (Karanth, 1980), and recording of spontaneous speech samples using the picture description and conversation tasks. Subsequently, the metaphonological test and non-word repetition tasks were administered. Brief periods of break were provided after the completion of the test/task. The spontaneous speech samples were audio-recorded (Sony P-300) for later transcription and analyses of the MLU, as well as to explore the usage of various morphosyntactic structures. The entire data was collected in 1-2 sitting(s) within the same day for each participant, and the total duration of data collection ranged from 60 to 90 minutes. In general, the CwSLI took more time to complete all language tasks.

2.4 Data analyses

The scores of the SLI group from the three subsections of LPT were compiled to identify the language profiles in this group. The language profiles were identified based on the impairments in each or combination of the subsections in the LPT. To test the reliability of MLU calculation and the usage of morphosyntactic structures, two experienced Kannada-speaking speech-language pathologists, who were blind to the objectives of this study, re-transcribed 60% of the spontaneous speech sample. The intra-class correlation coefficient (ICC) showed high agreement (ICC = 0.892) between the transcribers on MLU calculation as well as the morphosyntactic markers. One-way ANOVA with Bonferroni adjustments ($p \leq 0.017$) was used to compare the performance (accuracy scores & errors) of the participant groups. In addition to the group comparisons, the language profiles of CwSLI were examined. All statistical analyses were carried out with SPSS (version 16) program for Windows.

3. Results

The CwSLI, in general, showed poorer performance compared to the control groups on most measures of language employed in the current study (see Table 3). The results of One-way ANOVA showed that each group of participants differed significantly from others on phonology, morphosyntax, semantics, and thus, on the overall language skills. Post-hoc (Tukey HSD) comparisons with Bonferroni corrections (adjusted *p*-value set at ≤ 0.017 for three comparisons) showed that the SLI group differed from the age-matched control group on all measures, but not from the language-matched control group. The two control groups, however, differed from each other on all measures of language except on phonology. Table 3 presents the results of One-way ANOVA of language measures across the participant groups.

Table 3: Mean scores (± standard deviation) and comparison of participant groups on various language measures using ANOVA (df =2, 44)

Language Measures	Children with SLI	Age-matched controls	Language-matched controls	*F*	*p*-value	Partial η^2
Phonology[a]	93.07 ± 4.04	97.53 ± 2.83	94.87 ± 2.20	8.39	0.001*	0.276

Morphosyntax[a,c]	57.53 ± 4.16	73.53 ± 10.49	61.13 ± 11.36	13.19	< 0.001*	0.375
Semantics[a,c]	67.07 ± 9.52	80.76 ± 3.42	72.20 ± 9.82	12.09	< 0.001*	0.355
Overall Language[a,c]	217.67 ± 13.19	251.82 ± 15.36	228.20 ± 21.78	16.93	< 0.001*	0.435
Phonological Awareness (PA)						
Rhyme Recognition[a]	6.87 ± 2.62	10.24 ± 2.49	8.07 ± 3.90	5.07	0.010*	0.187
Syllable Awareness[a,b]	7.13 ± 5.28	25.35 ± 8.82	16.47 ± 10.64	18.07	< 0.001*	0.451
Phoneme Awareness[a]	2.60 ± 1.81	10.35 ± 7.82	6.13 ± 7.55	5.83	0.006*	0.209
PA Total[a]	16.60 ± 8.76	45.94 ± 16.65	30.67 ± 18.50	14.7	< 0.001*	0.401
Nonword Repetition (NWR)						
2 syllables	19.33 ± 1.84	19.06 ± 1.03	18.67 ± 2.09			
3 syllables	30.53 ± 3.96	31.18 ± 2.58	30.80 ± 1.66			
4 syllables	34.40 ± 3.42	39.29 ± 1.21	38.80 ± 1.66			
NWR Total[a]	84.27 ± 8.25	89.53 ± 3.06	88.27 ± 2.74	(2, 132) 7.26	0.001*	0.099

a – indicates that the comparison between CwSLI and age-matched controls was statistically significant
b – indicates that the comparison between CwSLI and language-matched controls was statistically significant
c – indicates that the comparison between age- and language-matched controls was statistically significant
*significant at $p < 0.05$; adjusted p for comparisons among three groups is p≤0.017; NS – Not Significant

The performance of the participants across the three groups differed significantly on all subsections of the metaphonological test (i.e., rhyme recognition, syllable awareness, and phoneme awareness). Bonferroni-corrected post-hoc comparisons on phonological awareness subtests revealed that, the SLI group differed only from the age-matched, but not from the language-matched controls.

A repeated measures ANOVA was carried out to examine the influence of group and syllable-length on non-word repetition task performance. The results indicated that the mean non-word repetition score differed significantly as a function of group (see Table 3) and syllable length [$F(2, 132) = 758.61$, $p < 0.001$, partial $\eta^2 = 0.920$]. Further,

the interaction between the group and syllable length was significant [$F(4, 132) = 7.04$, $p < 0.001$, partial $\eta^2 = 0.176$]. Post-hoc comparisons (with Bonferroni correction) revealed that increase in syllable length elicited significant decrease in non-word repetition scores from 2 to 3 ($p < 0.017$) and from 3 to 4 ($p < 0.017$) syllables. Figure 1 depicts the performance of the participant groups on the non-word repetition task at each syllable length. It is apparent from the Figure that the participants in the SLI group performed on par with those of the control groups at 2- and 3-syllable lengths. However, at 4-syllable length, they performed considerably poorer to their age- as well as language-matched control participants.

In general, CwSLI obtained considerably poorer scores compared to their age-matched, but not the language-matched control group on most linguistic measures employed in the current study.

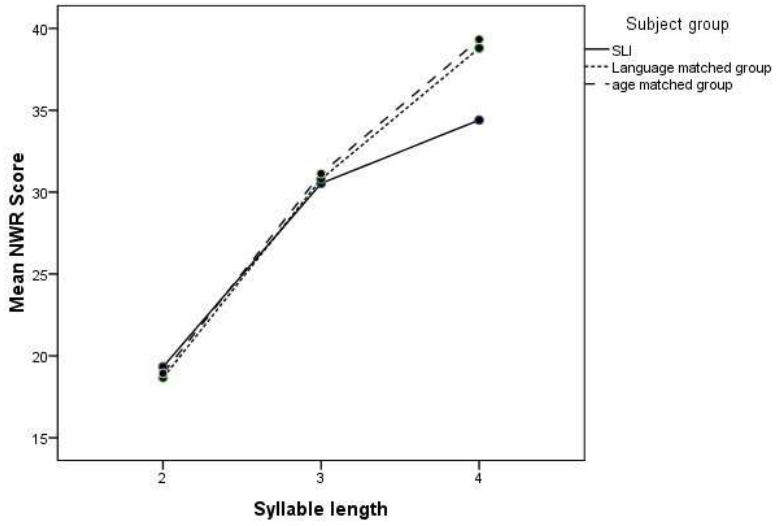

Figure 1: NWR performance at different syllable lengths across participant groups

3. 1 Spontaneous speech task

The spontaneous speech samples obtained from the SLI group were characterized by several morphosyntactic errors (see Appendix B). It was further observed that the participants from all the groups produced considerable substitution than omission errors on various morphosyntactic markers. Table 4 provides a comparison of the verbal output (i.e., MLU and the total number of utterances produced) along with various morphosyntactic errors and their distribution across the participants of the three groups. The results of ANOVA revealed that the three groups differed on the MLU but not on the total number of utterances produced. The post-hoc comparisons (with Bonferroni correction) showed that the participants in the SLI group differed only from the age-matched control group, but not from the language-matched control group on MLU. It may be noted that the two control group did not differ from each other on their MLU.

Table 4: Morphosyntactic output and errors means (SD) across CwSLI and control groups

Error(s)	CwSLI (n = 15)	Age-matched controls (n = 17)	Language-matched controls (n = 15)	*F*	*p*-value	Partial η^2
Total number of utterances produced	65.2 (27.02)	53.59 (10.01)	49.87 (12.25)	3.05	0.06^{NS}	0.122
MLU[a]	2.86 ± 0.62	3.68 ± 0.87	3.12 ± 0.36	6.44	0.004*	0.226
Total number of errors[a]	14.13 (7.69)	8.29 (2.64)	11.73 (6.69)	3.882	0.028^{*}	0.150
***Errors relevant to morphological richness* theory #**						
Incorrect use of PNG markers	3.25 (3.11)	1.92 (1.04)	3.92 (3.73)	1.648	0.209^{NS}	0.099
Incorrect Verb usage	3 (2.65)	2 (1.53)	2.43 (1.39)	0.382	0.689^{NS}	0.052
***Errors relevant to CGC hypothesis* ##**						
Incorrect use of Case markers	2.17 (1.33)	1.44 (0.73)	2.6 (1.65)	1.875	0.177^{NS}	0.146
Incorrect use of Pronouns	1	1	0	-	-	-
Error(s) relevant to both Morphological richness						

theory and CGC hypothesis						
Incorrect use of Tense and aspect markers	3 (1.55)	1.83 (0.72)	2.85 (2.41)	1.583	0.221^{NS}	0.088
Other error types						
Incomplete phrases/sentences[a,b]	4.77 (1.79)	2.75 (1.14)	2.91 (1.22)	7.705	0.002*	0.318
Repetition of words/utterances	3.27 (1.27)	2.69 (1.11)	2.46 (1.19)	1.443	0.25^{NS}	0.078
Monotypic sentences[a,b]	11.5 (4.95)	2.33 (0.58)	2.67 (0.58)	11.774	0.013*	0.825
Mazes/unclear productions	1.57 (0.79)	1	1	0.41	0.681^{NS}	0.12
Incorrect use of Adverb						
Incorrect use of Plural markers	1	0	0	-	-	-
Omission of Post position	1	1	1	-	-	-
Incorrect use of Negative markers	1.2 (0.45)	0	0	-	-	-
	1	0	0	-	-	-

a – indicates that the comparison between CwSLI and age-matched controls was statistically significant
b – indicates that the comparison between CwSLI and language-matched controls was statistically significant
*significant at $p < 0.05$; adjusted p for comparisons among three groups is $p \leq 0.017$; NS – Not significant

- Predicts no difference between error production of CwSLI and language-matched children

- Predicts significant difference between error production of CwSLI and language-matched children

The spontaneous speech samples were analyzed for the types of morphosyntactic errors across the participant groups. As depicted in Table 4, the total errors significantly differed among the groups. Further, post-hoc comparisons (with Bonferroni correction) showed that CwSLI differed only from the age-matched, but not from the language-matched control participants. The errors relevant to morphological richness theory, i.e., PNG and verb usage, did not differ among the groups and were found consistent with the prediction of the theory. Further, the errors relevant to the CGC hypothesis, i.e., case markers and pronoun usage did not show any difference between the groups, which was inconsistent regarding the prediction of the hypothesis.

Interestingly, the error on tense usage that was relevant to both morphological richness theory and CGC hypothesis did not show any difference between the groups, hence, supporting the prediction of the morphological richness theory. Among the other error types, only those of incomplete phrases/sentences and monotypic sentences showed a difference between the groups. The post-hoc comparisons (with Bonferroni correction) revealed that the SLI group differed from those in the age- and language-matched control groups on these errors. A few of the error types (e.g., pronouns, plurals, post-positions, and negative markers) could not be analyzed, as they were either rare in the groups or missing in one of the groups.

3. 2 Profiles of SLI in Kannada

The performance on the subsections of LPT (i.e., phonology, morphosyntax, and semantics) was used to derive the profiles of SLI in Kannada. Five distinct profiles of language deficits were identified in this group (see Figure 2). For instance, participants 1, 3, and 6 exhibited impaired morphosyntax with spared phonology and semantics (i.e., Profile 1). Participants 4 and 5 showed weak semantics with intact phonology and morphosyntax (Profile 2). Profile 3 was characterized by deficient morphosyntax and semantics with preserved phonology (i.e., Participants 7, 9, 10, 11, and 13). Impaired phonology and morphosyntax in the presence of preserved semantics was the salient feature of profile 4 (e.g., participants 2, 12, 14, and 15). Finally, the fifth profile was characterized by global deficits in all three domains of language investigated in the current study (e.g., Participant 8).

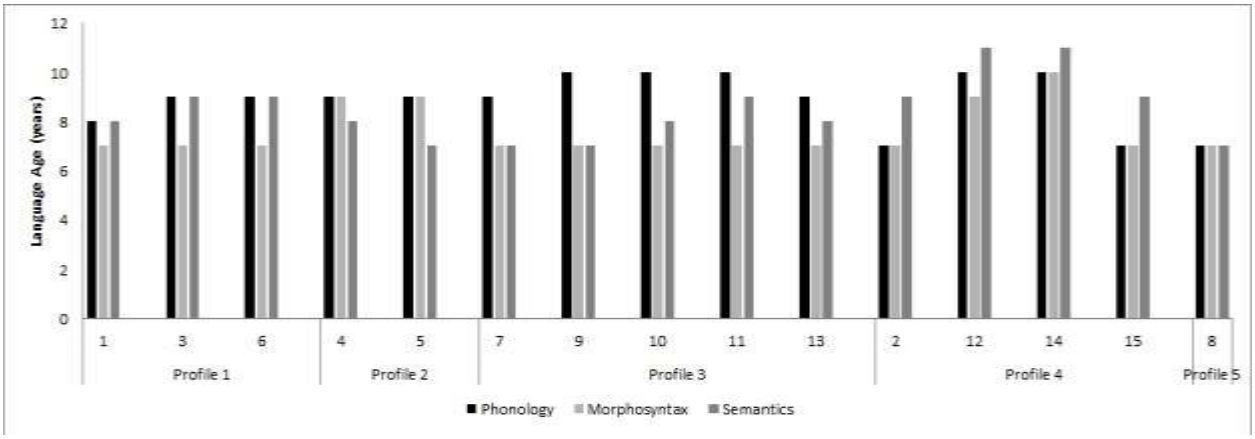

Figure 2: Individual language profiles of CwSLI in Kannada

Profile 1: Spared phonology and semantics, but impaired morphosyntax; **Profile 2**: Spared phonology and morphosyntax, but impaired semantics; **Profile 3**: Spared phonology, but impaired morphosyntax and semantics; **Profile 4**: Spared semantics, but impaired phonology and morphosyntax; **Profile 5**: Global impairment of phonology, morphosyntax and semantics

The findings of this study showed that the participants with SLI performed significantly poorer to their age-matched control group on most measures of language employed in the current study. However, they performed on par with their language-matched control group on most measures, except on syllable awareness and non-word repetition (at 4-syllable level) tasks. The analysis of spontaneous speech samples, further, showed that the morphosyntactic error comparison supported the predictions of morphological richness theory. Finally, five distinct profiles of SLI in Kannada, were identified. In the following section, the results are discussed in the relevance to the Indian and international contexts.

4. Discussion

The aim of the current study was two-fold. First, it explored the profiles of linguistic deficits in a group of CwSLI who speak a morphologically complex agglutinative language, Kannada. Second, the data from this study were used to evaluate the predictions of two prevailing, yet contradictory accounts of SLI, to explain the manifestation of this disorder in Kannada, a morphologically complex language. However, with this investigation being one of the studies to recruit a larger group of CwSLI in Kannada, a description of the linguistic deficits in Kannada-speaking CwSLI in light of the information from the English-speaking CwSLI is initiated. This, in turn, would be followed by a discussion on the distinct profiles of SLI in Kannada as well as on the validation of the morphology-based accounts of SLI.

4.1 Language deficits in Kannada-speaking CwSLI

The Kannada-speaking CwSLI, in this study, showed deficits in several domains of language, including phonology, semantics, morphosyntax, phonological awareness, as well as on the non-word repetition task. These linguistic deficits were apparent across various tasks like phonemic discrimination, morphophonemic structures, tenses, sentence types, synonyms, antonyms, and homonym judgment. Though CwSLI differed significantly from their age-matched control group on all language measures, their performance was on par with the language-matched control group on most measures, except on the syllable awareness and non-word repetition tasks.

It has been reported that under conditions of similar exposure and opportunities to learn a given language, CwSLI lag behind their age-matched controls (Leonard, 2014). The results of the current study supported this argument, as the SLI group of this study differed significantly from their age-matched control group on all language measures. Therefore, at the outset, the findings of this study are in agreement with that from the English-speaking CwSLI (Leonard, 1998). Further, reviewed literature shows that the English-speaking CwSLI are primarily deficient in grammatical morphology compared to younger MLU-matched children. In fact, the impaired grammatical morphology has been considered as the clinical marker of SLI in the linguistic domain (Rice & Wexler, 1996). In contrast to the observation from the English-speaking CwSLI on morphosyntactic tasks, the participants in the SLI group differed only from their age-matched, but not from the language-matched control group. It may be noted that the language-matched controls in the present study were different from the MLU-matched control children reported in the literature. Present study recruited children to the language-matched control group by matching their language age (using LPT) with the CwSLI. Although the MLU is regarded as an overall measure of expressive language (Gabig, 2013), the language age derived from the LPT represents the receptive and expressive linguistic skills, and thus a more suitable measure for matching the language age.

Another observation from this study was that the SLI group differed from the language-matched control group only on syllable awareness and the non-word repetition tasks. In other words, CwSLI were poorer on these tasks compared to both

control groups. This finding supported the initial assumption and, thus endorses studies reporting a broad range of difficulties with the phonological tasks, including phonological awareness (Briscoe, Bishop, & Norbury, 2001; Catts, 1993), and phonological memory in CwSLI (Bishop, North, & Donlan, 1996; Prema et al., 2010; Kuppuraj & Prema, 2012). Additionally, the poor performance on non-word repetition task is proposed to reflect the suboptimal functioning of phonological working memory, a known source of impairment in CwSLI (Gathercole & Baddeley, 1990). Hence, the impaired performance on non-word repetition tasks in Kannada-speaking CwSLI supports the deficient phonological working memory system, highlighting the cross-linguistic similarity in the clinical profile of SLI. The findings of this study supports the poor performance on the non-word repetition task as a clinical marker of SLI (Bishop et al., 1996; Conti-Ramsden, Botting, & Faragher, 2001).

The phonological awareness corresponds to children's implicit and explicit sub-lexical sensitivity to the phonemic structure of language. TD children, mastering English, develop implicit phonological awareness by two years of age (e.g., rhyme detection tasks; Chaney, 1992). However, they acquire highly specific levels of phonological sensitivity at the syllabic level (e.g., onset-rhyme distinction tasks) and phonemic level (e.g., phoneme blending and segmentation tasks) only between 4-7 years of age (Gillon, 2004). While the deficits in phonology are richly documented in CwSLI, the reason for such deficits in phonological representation and awareness is poorly understood. The quality of phonological representations in CwSLI is reportedly more holistic in nature, similar to that of the younger TD children (Befi-Lopes, Pereira, & Bento, 2010). Several studies have provided evidence for deficits in phonological representations (Maillart, Schelstraete, & Hupet, 2004; Befi-Lopes, et al., 2010) and phonological awareness (Bryant, Maclean, & Bradley, 1990; Byrne & Fielding-Barnsley, 1989; Lonigan, Burgess, Anthony, & Barker, 1998; Stahl & Murray, 1994) in CwSLI compared to TD counterparts. The current study also showed significant differences between the SLI group and their age-matched control group on the rhyme detection task as well as on the syllable and phoneme awareness measures. However, compared to the language-matched control group, the SLI group did not differ significantly on these measures. A plausible reason for the lack of difference between these two latter

groups could be the nature of the task itself. While the rhyme detection task appeared relatively straightforward, the phoneme awareness task was difficult for participants in all the groups (see Table 3). This may be attributed to the reason that the participants in this study belonged to intermediate grades (III to VI), where the development of syllable awareness is nearly completed. This explanation is supported by the evidence from a few recent studies in the same (or similar) Indian languages investigating reading acquisition in TD children (Tiwari, Nair & Krishnan, 2011) as well as in those with the reading impairments (Nag, 2007; Tiwari, Krishnan, Chengappa & Rajashekar, 2012). These studies showed that the development of phoneme awareness and *akshara* (the written symbol in alphasyllabary) knowledge extend up to Grade IV and higher. The alphasyllabary is a writing system that combines properties of both alphabetic and syllabic writing systems. This orthography is used in the South Asian scripts, mainly in Indian scripts. In alphasyllabary, the basic unit of writing (i.e., *akshara*) maps on either to a phoneme or to a syllable. The script-to-sound mapping is largely consistent in this orthography. A characteristic feature of this orthography is that the vowels are represented in the primary form in word-initial position. Barring this position, they are represented with diacritic markers attached to the base consonant. Thus, children learning this orthography need to master several ligaturing rules to decode the script. Syllable-level processing plays a greater role in literacy development in alphasyllabic writing (Kim & Petscher, 2011). This, in turn, results in longer learning phases of symbol sets and the gradual emergence of phoneme awareness (Nag, 2007; Nag & Snowling, 2011) in alphasyllabary.

Additionally, the findings of the current study are in accordance with the results of Kang and Kim's (2007) study in Korean language, highlighting the significant difference in phonological awareness between CwSLI and their age-matched control group. However, unlike in the study by Kang and Kim (2007), the difference between the age- and language-matched control groups on phonological awareness task were not observed.

4.2 Morphological richness versus CGC account? Evidence from spontaneous speech task in Kannada

One of the major aims of this study was to verify the two prevailing accounts (the morphological richness theory and the CGC hypothesis) that predict distinct outcomes in languages with complex morphological constructions. The morphological richness theory predicts that CwSLI would perform on par with their language-matched peers in morphologically rich languages due to the frequent and consistent occurrence of features that map the morphological markers (particularly on agreement, i.e., PNG, verb and noun markers). On the other hand, the CGC hypothesis attributes the core deficit in SLI to the central grammatical deficits. According to this hypothesis, CwSLI would perform markedly poorer than TD language-matched children on structurally and hierarchically complex constructions of grammar like tense, case markers, PNG, and pronouns. The two markers - PNG and tense - were of special relevance in the context of the two accounts tested in this study. While both the accounts had implications for these two markers, the morphological richness theory predicts similar or comparable performance between CwSLI and TD children on these markers, whereas, the CGC hypothesis predicts that the former group would perform markedly poorer compared to TD language-matched children. The validity of these two incongruent arguments were examined using the spontaneous speech data (particularly, the error types) from Kannada with an evidently complex morphology. The findings of the study showed that CwSLI did not significantly differ from the language- and age-matched peers on most errors including those specific to the two accounts (like PNG, verb, tense, case, and pronouns) investigated in this study. The findings of this study, therefore, indicated that CwSLI were on par with the language-matched children in terms of the production of morphosyntactic markers. This finding supported the prediction of the morphological richness theory. In other words, Kannada-speaking CwSLI did not exhibit marked deficits in syntactic morphology as compared to their language-matched (younger) children, a finding remarkably different from the English-speaking CwSLI (Rice & Wexler, 1996). This difference is attributed to the morphological complexity of Kannada compared to English, which, in turn, supports the morphological richness theory (Leonard, 1989; Leonard et al., 1987). It is evident from Table 4 that the errors on relevant morphosyntactic markers were similar in the SLI and the language-matched

control groups. This observation, therefore, testifies the morphological richness theory in Kannada.

The findings of the current study did not support the CGC hypothesis as the production skills of the SLI group did not differ from the two control groups on morphosyntactic structures like tense, case markers, agreement, and pronouns. The overall error production, however, was found to be significantly higher in CwSLI as compared to the age-matched peers, which is in agreement with the literature (Leonard, 2014). Further, CwSLI also differed from the two control groups on a few error types like incomplete phrases/sentences and monotypic sentences. Taken together, the findings from our study indicate that Kannada-speaking CwSLI showed deficits in morphosyntactic structures in spontaneous speech production task compared to their age-matched peers. However, the difference was not significant on critical structures (e.gs. tenses, case markers, agreement and pronouns), thus validating the assumptions of the morphological richness theory of SLI in Kannada.

4.3 Profiles of SLI in Kannada

The analysis of individual data in CwSLI revealed five distinct profiles of linguistic impairments (based on their performance on phonology, semantics, and morphosyntax sections of LPT: see Results and Figure 2). These profiles support the heterogeneity in SLI reported in the literature (e.gs. Aram, 1991; Johnston & Kamhi, 1984). Additionally, the comparison of these profiles with the known SLI types was remarkable. For instance, profiles 1, 3, 4, and 5 could be regarded as the typical SLI variety as they exhibited deficient morphosyntactic skills (Bishop, 2004). In fact, it is worth noting that, barring the second profile, all observed profiles of SLI in this study showed impaired comprehension of morphosyntactic skills. The second profile displayed deficits in semantics alone, a pattern similar to the lexical-semantic subtype proposed by Rapin (1996). The third profile exhibited deficits in morphosyntax and semantics with intact phonology that paralleled the lexical-syntactic deficit syndrome described by Rapin and Allen (1987). The fourth profile with deficits in phonology and morphosyntax and spared semantics may correspond to the phonologic-syntactic syndrome (Rapin & Allen, 1983). The last profile of SLI with deficits in all three areas (i.e., phonology, morphosyntax, &

semantics) fits the global subtype of SLI (Korkman & Hakkinen-Rihu, 1994; Wilson & Risucci, 1986). However, it may be noted that these profiles were derived from the performance on individual sections of LPT (formal language test in Kannada).

Surprisingly, this study did not show an SLI profile with isolated phonological deficits - the phonological subtype of SLI (DSM-IV - APA, 1994) - a commonly reported type in English. Rather, this finding draws attention to the fundamental differences between the language typology and the orthography of Kannada and English. Kannada orthography (an alphasyllabary; Karanth, 2003) is predominantly syllabic, unlike English, which employs phonemic (alphabetic) orthography. The absence of the phonological type of SLI in the participants is possibly an indication of the reliance on syllabic than the phonemic level of processing in Kannada. In other words, children learning to speak Kannada may not require phonemic knowledge (or awareness) as much as children learning alphabetic languages (e.g., English). This claim receives support from a few studies on literacy development in alphasyllabary (e.gs. Nag, 2007; Nag & Snowling, 2011; Tiwari et al., 2012). Further, the differential existence of phonological SLI in English, but not in Kannada, possibly suggests the influence of morphological complexity of languages in the manifestation of SLI. Thus, the findings from the current study warrant investigation on the nature of literacy deficits in CwSLI learning to read and write morphologically complex alphasyllabaries like Kannada.

4.4 General Discussion

This study aimed to investigate the language deficits in a group of CwSLI speaking Kannada, a morphologically complex agglutinative language. For this purpose, we compared their performance on a set of language measures with that of an age- and language-matched TD control group. The results of the study showed that the Kannada-speaking CwSLI differed from their age-matched peers but not from the language-matched peers on several language measures (except on the syllable awareness and non-word repetition tasks). Thus, the results of this study support the literature by revealing findings similar to languages of different typologies, (e.g., CwSLI performed poorer to age-matched control participants on language aspects like phonology, morphosyntax, semantics, overall language, phonological awareness, non-word

repetition, and MLU). Additionally, this study also revealed certain unique findings in Kannada, perhaps applicable to other agglutinative languages (e.g., similar performance between CwSLI and the language-matched control children, except on the syllable awareness and non-word repetition tasks). Furthermore, the analysis of spontaneous speech errors distinctly supported the predictions of the morphological richness theory, where the SLI group and the language-matched control groups did not differ in error productions on a few frequently occurring morphosyntactic markers in Kannada. Finally, this study revealed five linguistic profiles in Kannada-speaking CwSLI that are broadly analogous to the profiles reported in the literature in English. Taken together, the findings of this study indicate that the language typology influences the manifestation of SLI. The findings of the study, therefore, suggest that the tense morphology may not be markedly impaired in Kannada-speaking CwSLI, unlike in English-speaking CwSLI. Like in English, the non-word repetition deficits were found in Kannada-speaking CwSLI. Future research is required to validate the findings of this study in other agglutinative languages.

5. Conclusion

This study provided several novel insights on SLI in Kannada, a morphologically complex agglutinative language. While Kannada-speaking CwSLI showed deficits similar to that of their English-speaking counterparts such as poor phonological processing, they differed considerably from the latter group on the production of certain morphosyntactic structures like tense and agreement. Kannada-speaking CwSLI produced these morphosyntactic structures on par with their language-matched control participants, an observation radically different from English-speaking CwSLI. This substantial difference, in turn, offered support for the morphological richness theory and provided counterevidence for the CGC hypothesis. Further, this study revealed five distinct profiles of SLI in Kannada.

Acknowledgments

The authors are grateful to the participants of the study and the teachers for their kind cooperation. The authors acknowledge Dr. Gopee Krishnan for peer reviewing and providing several potential suggestions to improve the content and clarity of the manuscript. Finally, they thank the anonymous reviewers for their valuable inputs to refine this paper.

Financial and Non-financial disclosures

The authors have no financial or nonfinancial relationships to disclose

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Appendix A. Non-word repetition items list

Bi-syllabic	Tri-syllabic	Quadra-syllabic
/senu/	/maṯṯari/	/le:pa:ra:ya/
/ḏa:wi/	/hosale/	/bagina:lu/
/ṯekku/	/buḏaLu/	/nawibaNNu/
/lala:/	/soḏa:li/	/pariṯalpa/
/ma:me/	/ra:Dike/	/karemunḏe/
/ra:ji/	/ṯadige/	/hedza:raLu/
/wuku/	/ḏambuku/	/sa:gaṯane/
/ha:ṯu/	/hamatʃa/	/akkiḏaLu/
/na:ba/	/pagaḏa/	/ṯakkingalu/
/ṭaNe/	/ṯikaTi/	/mario:ḏu/

Appendix B. Examples of various morphosyntactic errors in CwSLI observed in spontaneous language task

Sl. No.	Error type	Example(s)
1	Incomplete sentences (either verb or object missing)	*haːl-inḍaː mosaru beṇṇe ̱tuppaː madʒdʒige* …… Milk-from-PP curd-CLN butter-CLN ghee-CLN buttermilk-CLN …… 'From milk (…missing) curd butter ghee buttermilk'
2	Repetition of words/utterances	*namma ʃaːle-yalli……namma ʃaːle-yalli* Ours-POSS-PRN school in-LOC……. Ours-POSS-PRN school in-LOC 'In our school'
3	Monotypic sentences (sentences comprising of only one type of structure)	*oṇḍu ḍina dzoru bisilu iraṯ-aṇṭe……oṇḍu kaːge-ge dzoru baːyarike aːgir-ṯaḍ-aṇṭe…..oṇḍu ḍina kaːge baṇḍ-ir-ṯ-aṇṭe….* One day very-ADJR hot it was-PST-3-SG-N…..one crow-DAT very-ADJR thirsty-ABSTR happen-PST-3-SG-N….one day crow come-PST-P(R)F-3-SG-M 'It was a very hot day….one crow was very thirsty…one crow had come….'
4	Omission of post position	*væːn oːḍ-iḍḍaː* instead of *væːn hiṇḍe oːḍ-iḍḍ-aː* van * run-PST-3-SG-M instead of van behind-PP run-PST-3-SG-M 'he ran van' instead of 'he ran after the van'
5	Incorrect use of PNG marker	*oːḍʌ-ṯaː-iḍ-ivi* instead of *oːḍʌ-ṯaː-iḍḍ-ini* Read(PRS-CONT-1-PL) instead of read(PRS-CONT-1-SG) We are reading instead of I am reading
6	Incorrect use of Plural marker	*ṯiṇḍi-gaḷ-annu* instead of *ṯiṇḍi-jannu* Snack-PL**-ACC-get instead of snack-ACC-get 'Get snacks'
7	Incorrect use of Genitive marker	*ʃaːle-ḍḍu* instead of *ʃaːle-jaː* School-GEN# 'School's/relating to school'

8	Incorrect use of Tense and Aspect marker	*yeḏḏ-iḏa:* instead of *yeḏḏ-eLLʌ-̱tiḏ-a:ne* Wake-PST-3-SG-M instead of Wake-PRS-CONT-3-SG-M 'He woke up' instead of 'He is waking up' *bhai-̱ṭ-a:re* instead of *bhai-̱ṭ-iḏ-a:re* Scold-PRS-3-HON instead of scold-PRS-CONT-3-SG-HON 'He/she scolds' instead of 'he/she is scolding'
9	Incorrect use of Honorofication	*no:ḍ-iḏ-aru* instead of *no:ḍ-i̱ṭṭ-u* See-PST-3-SG-N-HON instead of see-PST-3-SG-N 'He/she saw' instead of 'it saw'
10	Incorrect verb use	*amma aopʌreʃʌn ma:ḍu## alli ….alli maḏḏu yella koḍu̱ta:re* Mother operation do-VR(?)-PRS there-LOC medicine provides-PRS-3-HON 'Mother, where operations are done …. Provides medicines there'
11	Incorrect use of adverb	*be:ga:* instead of *̱taḍa:* 'quickly' instead of 'late'
12	Incorrect use of pronoun	*auu* instead of *auanu* 3-PRN instead of 2-PRN 'they' instead of 'he'
13	Incorrect use of negative	*na:nu ho:galla* instead of *na:nu ho:glilla* I-1-PRN go-FUT instead of I-1-PRN go-PST 'I will not go' instead of 'I didn't go'

*missing post position

**wrong insertion of plural marker

#dialectal variety is substituted

##incorrect verb use as well as missing verb marker

Appendix C. List of Abbreviations used in Kannada morphemic glosses

ADV – adverb

CONT – continuous aspect

PRS – present tense

P(R)F – perfect

PST – past tense

FUT – future tense

3 – 3rd person

SG – singular number

PL – plural number

F – feminine gender

M – masculine gender

N – neuter gender

POSS – possessive

PRN - pronoun

HON – honorofication

LOC – locative case

ADJR – adjectivizer

DAT – dative case

ABSTR – abstract noun

VR – verb, verbalizer

ACC – accusative case

GEN – genitive case

PP – Post position

CLN – Noun class