

Language Production and Comprehension in Bilingual SLI: Evidence from Complex Morphosyntactic Structures

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The last decade has seen an increase in the number of published studies in bilingual children with Specific Language Impairment (SLI) but the latter have focused mainly on language production. A substantially smaller body of research on comprehension primarily addresses the question whether children with SLI show a similar profile to bilingual typically developing (TD) children. However, research comparing bilingual and monolingual children with SLI remains comparatively limited. Moreover, this is also the case with research into language comprehension in bilingual children with SLI in isolation or compared to production within the same population. This paper outlines the background to Specific Language Impairment within a bilingual setting and the rationale for studying bilingual children with SLI as evidence for/against theories of language and language impairment. It further discusses directions for future research in order to bridge the gaps in the existing literature and a presentation of a series of morphosyntactic structures which have been described as “complex”.

1. Introduction

Specific Language Impairment (SLI) is a developmental language disorder whose hallmark characteristic is impaired morphosyntax or formal grammar. A further defining feature of SLI is that the language impairment is observed in absentia of factors which could otherwise be considered the cause of the deficit in language. SLI is defined as a pure language disorder where all other capacities appear to have been left intact. SLI is hence diagnosed on the basis primarily of exclusion (Leonard, 2000). A child may not have a non-verbal IQ score of below 85, a history of neurological disorder, a diagnosis of autism, otitis media, hearing impairment or behavioural disorder. The 5th revision of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5: American Psychiatric Association, 2013) no longer makes reference to non-verbal IQ (henceforth NVIQ) as a criterion for developmental language disorder unless there is no intellectual disability (NVIQ <70). Evidence in support for this decision can be drawn from the finding that children with average NVIQ (>85) and below average NVIQ (70-84) who have language impairment do not differ in terms of language scores or social and educational difficulties (Norbury et al. 2016). The studies reviewed in this paper however, include children with average NVIQ in the samples in line with typical practice in research so far. Inclusionary criteria for SLI are essentially related to performance in language; a child needs to score either 2 standard deviations below the expected average for their age on a single measure of language or 1.25 standard deviations on a minimum of two respective measures (Tomblin, et al., 1997). In other words, SLI is a language disorder placing a child approximately in the lowest decile in terms of specific aspects of language performance but within typical range on other measures. Tomblin and colleagues estimate the prevalence of SLI at around 7% of the child population. A more recent study finds similar frequencies for children in the UK (Norbury, et al., 2016: 1254). However the frequencies varied substantially depending on the criteria assumed (Norbury, et al. 2016: ,1251).

SLI is diagnosed on the basis of linguistic behaviour and not on the basis of some biomarker although there is evidence for the hereditary nature of the disorder as well as neural differences between SLI and typical populations (Fisher, 2005). Common features in the morphosyntactic development of English speaking children with SLI are the use of simplified structures where tense marking is omitted rather than substituted (Rice & Wexler, 1996), limited productive and receptive vocabulary as well as the difficulty in comprehending complex language (Bishop, 2006). The exact linguistic manifestation inherently varies across languages, as the properties of formal grammar differ cross linguistically. Impairments in other domains of language are also commonplace but not consistent across the majority of the impaired population. Children with similar linguistic manifestations but who do show signs of other impairments shown to have an impact on language development are considered to have non-specific language impairment (sometimes referred to NLI). Whilst the latter distinction may not be crucial for clinical intervention, it has been essential for theoretical linguistics and psycholinguists in an attempt to demonstrate signs of the modular nature of language. Consequently the scope of this paper is specifically SLI and claims are not made regarding other types of language impairment.

Two major findings on children with SLI are of crucial significance to this paper. The first one has been a consistent finding in the literature over the last two decades: children with the impairment have deficits in short term and working memory (see Baddeley (2003) for an overview) but also in executive functioning. Following the proposal by Baddeley and Hitch (1974), working memory can be defined as a particular form of short term memory where information is not merely stored but crucially manipulated/processed. The aforementioned deficit has been demonstrated in atypical populations' weaker performance in non-word repetition tasks. This suggests that children with SLI may have difficulty either forming linguistic representations or maintaining them over a short period of time.

A longstanding finding in the literature is a pervasive weakness in phonological short-term and working memory for children with SLI (see Montgomery, et al. (2010) for a review). A considerably more recent finding is that children with SLI have deficits in executive functions in comparison to typically developing age-matched counterparts (Henry, et al. 2012). These are considered a set of higher level cognitive functions related among others to planning, attention, shifting, control, inhibition and cognitive flexibility. The notion of attention is pivotal in working memory, as it is assumed to be a form of short term memory, where information is not only stored but also manipulated. In this sense, executive functions should be expected to be associated with working memory (Bialystok, 2009: 6). Crucially, there is longstanding evidence to suggest working memory capacity impacts language comprehension even in typically developed populations with low-span participants underperforming high-span ones on comprehension tasks (Daneman & Carpenter, 1983; King & Just, 1991; Roberts, et al., 2007). More recent evidence suggests it may be more general executive function capacities which have an impact on language comprehension (Vuong & Martin, 2014). This impact of working memory and broader executive functions appears to be more prevalent in complex languages structures as they are postulated in linguistic theory.

2. Bilingualism and SLI

2.1 Why Study Bilingual SLI?

The motivation for research into bilingual children with SLI originates from questions that arise from different empirical observations into bilinguals and populations with language impairment independently, broader theoretical issues and considerations as well as diagnostic and clinical considerations.

A first motivation for investigating bilingual children with SLI relates to the role of input in language acquisition. Bilingual children are exposed to two languages in a timespan during which monolingual children will be exposed to only one. This means that the quantity of input for each language will be reduced although total exposure in both languages will remain the same. Furthermore, the cues from each linguistic system may be conflicting. What is grammatical in one language might be ungrammatical in the other language acquired (e.g. subject drop). The above increases the probability of initially delayed or slowed language acquisition for bilinguals relative to monolinguals. The aforementioned challenge observed in typically developing (TD) bilingual children is expected to also be the case for bilingual children with SLI. Accounts in the literature have suggested that children with SLI require a higher quantity of input in order to acquire language (Marchman & Bates, 1994).

Moreover, findings from the literature regarding the cognitive capacities of the two populations also motivate research into bilingual children with SLI. Crucially bilinguals have been found to largely outperform monolinguals in executive function tasks (Carlson & Meltzoff, 2008; Bialystok, 1999; Costa, et al. 2008; 2009; Bialystok, 2009) when other variables are controlled for (Calvo & Bialystok, 2014). Essentially the area of weakness for the one group is an area of strength for the other. This gives rise to the question as to what is the case with individuals who belong to both groups. Bilingual children with SLI have been found to underperform compared to TD bilingual children in non-word repetition which has been considered a measure of verbal/phonological short-term memory (Girbau & Schwartz, 2008). This is the same discrepancy between TD monolinguals and children with SLI.

A further motivation for research into bilingual SLI is a longstanding issue in theoretical linguistics and psycholinguistics concerning the question if and to what extent language is an autonomous faculty of the human mind or part of the more general cognitive capacities. Accounts for SLI can be described under two general umbrella terms with a considerable degree of heterogeneity within them. These two involve opposite assumptions about the nature of language and the impairment. On the one end of the spectrum, domain-specific accounts postulate language-specific deficits in linguistic representation. On the other end, domain-general accounts postulate processing deficits that are not limited to the verbal domain that causes language deficits. Furthermore, under language-specific accounts, input functions as a trigger for those capacities we are genetically endowed with. Under processing-based accounts however, only input and the (impaired) processing thereof are paramount for language acquisition.

This difference leads to specific predictions in language development in bilingual children with SLI. Domain/language-specific accounts predict that bilingual children with SLI will overcome the initial delay due to bilingualism and reach performance similar to monolingual children with SLI because with increasing exposure bilingual children with SLI will be able to acquire language. Contrary to this, domain-general accounts locate the source of impairment in processing deficits. Limitations in processing will become more manifest when the input is more difficult to process and will result in an increase quantity of input need for language development. Children acquiring two languages will receive less input per language over a given period of time that may contain contradictory information. As a consequence, bilingual children are predicted to experience a prolonged “double delay” in both languages in the early years (for a review of the above rationale, see Paradis (2007; 2010)).

A final motivation for a better understanding of SLI rests in the diagnosis and intervention. Bilingual children may show an initial lag in the development of either one or both languages. Clinicians and educators may hence overdiagnose or underdiagnose SLI in bilingual children on the basis of this delay (Kohnert, 2010). A better understanding of SLI within a bilingual context may lead to a more accurate diagnosis of the disorder and consequent intervention. Furthermore, the potential of a language disorder in bilingual families frequently causes concern for parents who may opt to use only one of the two

languages spoken in the family, i.e. the language of the majority, exclusively. A better evidence base can lead to better understanding and inform choices within health services, educators and families.

2.2 Research in Bilingualism and SLI

Research into bilingual children with SLI is sparse compared to monolingual children with SLI. In fact research into bilingualism and SLI has not always focused on bilingual SLI but attempted to compare monolingual children with SLI to typically developing bilinguals. Some studies have investigated qualitative differences between TD and SLI bilingual children while some have compared monolingual and bilingual impaired children.

Studies have shown that bilingual children with SLI underperform compared to bilingual TD controls in the same way as monolingual impaired children do with respective controls; Jacobson & Schwartz found this for Spanish-English bilinguals with accusative clitics (Jacobson & Schwartz, 2002) and English past tense (Jacobson & Schwartz, 2005). More recent research into English past tense in children with L2 English children has confirmed an advantage for the TD children as opposed to the children with SLI (Blom & Paradis, 2013). Håkansson, et al. (2003) found bilingual Swedish-Arabic children with SLI to be placed lower than typically developing peers on a grad point classification. Salameh, et al. (2004) found for the same population a slower rate of development for impaired children.

The majority of studies have examined either spontaneous or elicited production. Studies examining online comprehension in SLI compared monolingual children with SLI to TD L2 learners and find substantial differences (Chondrogianni, et al., 2014; Marinis & Chondrogianni, 2011). The results of such studies suggest that monolingual children with SLI perform similarly to TD L2 learners only partially as performance is similar in production tasks. This, however, was not found to be the case with real-time comprehension tasks suggesting substantial differences between the two groups. In these monolingual children with SLI were found to have a distinctively lower performance than TD L2 learners.

More recent research suggests that even in terms of language production bilingual children with typical language development did not show a similar profile to monolingual children with SLI (Hamann, et al., 2017). Similar results were found for a sentence repetition task used with Arabic-French bilingual TD children and monolingual children with SLI (Tuller, et al., 2015). Further evidence from sentence repetition tasks demonstrated that frequency of identical repetition differentiated between monolingual children with SLI and bilingual TD children irrespective of other factors which may have an impact on bilingual language development, e.g. age of onset, length of exposure etc. (Fleckstein, et al., 2016). The aforementioned studies used complex syntactic structures that are discussed as potential future directions and showed a difference in accuracy scores between monolingual TD and monolingual children with SLI as well as their counterparts. These findings have been replicated for Russian-Hebrew TD bilinguals and Russian or Hebrew monolingual children with SLI (Armon-Lotem & Meir., 2016). Nevertheless, it is proposed that the sensitivity and specificity of the various repetition tasks used improved as a diagnostic for bilingual children with SLI when the monolingual norms were adjusted to overall lower accuracy.

Research comparing monolingual and bilingual populations with SLI has focused on production and has yielded conflicting results. Grammatical features tested are often those that typically constitute an area of weakness in populations with SLI for the respective language. Studies on French-English bilinguals in Canada (Paradis, et al., 2005/2006; Paradis, et al., 2003) found no significant differences between monolingual and bilingual children with SLI. These studies examined tense morphology in English and object clitics in French. Error types were similar and accuracy was low in both groups. Similar results were obtained for verb morphology in Spanish-English bilinguals (Gutierrez-Clellen, et al., 2008).

Another study found no increased risk of language impairment in bilingual Swedish-Finnish populations compared to monolingual Finnish-speaking children (Westman, et al., 2008). Finally, a study using language and cognitive measures as well as questionnaires found an effect of language impairment across a range of measures with a similar profile for children with SLI irrespective for both English L1 and L2 (Paradis, et al., 2013). The latest research also suggests that bilingual children with SLI do not underperform in relation to their monolingual counterparts. In a sentence repetition task, Hamann, et al. (2015) found that, while both bilingual and monolingual children with SLI underperform their TD peers, they did not differ from one another. The task in question was created using complex structures such as object wh-questions, subject and object relative clauses, complement clauses, passives and topicalisation. Some of these are identified as areas in need of further research and are discussed in greater detail as potential future directions. Tuller, et al. (2015) also demonstrated a substantial overlap in repetition accuracy between monolingual and bilingual children with SLI.

On the other hand, contradicting results indicating a double delay for bilingual children with SLI have been found by studies on early sequential bilinguals in the Netherlands examining mainly gender agreement in noun phrases (Orgassa & Weerman, 2008; Steenge, 2006). A number of reasons may account for the discrepancy in the findings. To an extent the discrepancy may be attributed to the populations tested and the context of the acquisition of the second language. The studies showing a double delay were conducted in the Netherlands and tested immigrant children. The children were first exposed to Dutch at a later age and received limited input in Dutch. Studies showing no double delay tested simultaneous or early sequential bilinguals in the context of societal bilingualism (Canada for French-English bilinguals, and some regions of the US for Spanish-English bilinguals). Moreover, as the onset of the acquisition of the other language was early in life, the children have had more years of exposure to it than the (late) sequential bilinguals who are within the same age range at the time of testing. This allows the bilinguals from the first group of studies time and quantity of input to overcome any initial delay caused by bilingualism. An additional factor may be related to the language properties *per se* investigated. Studies that do suggest an additional burden have found this in gender agreement (determiner-adjective-noun). The latter is highly difficult as there is an overlap of forms, a high degree of inconsistency and lexical idiosyncrasy in gender assignment in Germanic languages, rendering the need for an adequate quantity of input considerably more fundamental for attainment for those structures tested in the Canadian context. Orgassa and de Jong (2008) do not find this additive effect for subject-verb agreement for the same populations where there is not this high degree of inconsistency/ low degree of certainty.

In sum, the research in bilingual SLI has focused on performance of bilingual children with SLI in comparison to TD controls. Studies comparing bilingual and monolingual children with SLI have focused largely on production. Studies testing online comprehension have compared children with SLI to TD L2 learners. So far, no studies have tested bilingual and monolingual populations with SLI in terms of language comprehension or on structures that may be considered grammatically more complex.

3. Future Directions

Structural complexity in bilingual children with SLI has so far been addressed in long-distance dependencies, i.e. wh-questions and relative clauses (Deevy & Leonard, 2004; Friedmann & Novogrodsky, 2011; Marinis & van de Lely, 2007). However syntactic complexity is also attested in other domains of language, such as argument structure and structures involving syntactic ambiguity. It is important to address the effect of syntactic complexity not only in long distance dependencies but across a larger range of structures. In

this section we propose three phenomena require further investigation in bilingual children with SLI: ditransitive verbs, temporary syntactic ambiguity (garden-path sentences), and filler-gap dependences. We outline below the linguistic properties of these three structures as an explanation for why they are expected to be problematic for children with SLI. Subsequently we review some empirical evidence for each indicating that they constitute an area of weakness for young TD children and/or children with SLI.

Ditransitive verbs are verbs with two objects; a direct and an indirect one. Ditransitive verbs hence have three thematic roles. The increased complexity of ditransitives can be attributed to the number of arguments while for the unaccusatives it can be explained by the non-canonical origin of the subject. Ditransitive verbs may be expressed in two grammatical structures; the double object construction, abbreviated as DO or NP1 NP2 and the prepositional object construction, noted as PO or NP PP in the literature. Primary examples of ditransitive verbs are “give” and “offer” as examples (1) and (2) demonstrate.

- (1) John gave/offered Mary a book.
- (2) John gave/offered a book to Mary.

From a perspective of theoretical linguistics, these two alternations are claimed to have approximately the same semantic meaning but largely different pragmatic use, assign different discourse to theme and recipient and have numerous lexical restrictions with verb-specific preferences for each structure (see Krifka (2003) for a review). From a perspective of experimental linguistics, they have been treated in syntactic priming studies as broadly equivalent (Bock 1986; Thothathiri & Snedeker, 2008). Nevertheless, they differ in their frequency and complexity. The predominant account in theoretical linguistics is that of Larson (1988) who considers the NP PP to be the original structure; the DO emerges as a result of syntactic computation. Under this account, the preposition is absorbed into the verb and the second noun phrase is moved before the first object or raised to a syntactic position in order to be assigned case by the verb. As a result, the DO construction may be argued to be syntactically more complex than the PO counterpart, as it is the result of syntactic computation. Although this is perceived to be the more complex structure, it is more frequent in the English language (Snyder & Stromswold, 1997). The increased number of arguments may be a further factor contributing to the complexity of these verbs (Spoelman & Bol, 2012).

Furthermore, the literature suggests that ditransitive verbs as well as other verbs with complex argument structures constitute an area of weakness for children with SLI. Grela and Leonard (1997) have found a higher number of subject omission with ditransitive but also unaccusative verbs in relation to transitive ones. In another study, while a ditransitive advantage was observed, this was consistent for both TD and SLI populations (Grela & Leonard, 2000). This lack of between-subject discrepancy has also been reported in Thordardottir and Ellis Weismer (2002). In spontaneous speech, children with SLI produced fewer ditransitive verbs and verbs with structural alternations than TD control children and also omitted obligatory arguments more often, in particular subjects. This was interpreted as a weakness in the computation of syntactic movement rather than memory limitations in processing the increased number of arguments.

The second phenomenon is temporary syntactic ambiguity or garden-path sentences. Basic principles of sentence processing in natural language is that parsing (the building of syntactic structure and the assignment of thematic roles) is incremental and begins early on; this means listeners or readers do not wait until they have heard or read the entire sentence before they begin to build a representation of its structure and compute its meaning (Altmann & Kamide, 1999). This may result in an initially erroneous structure being built as a representation. Garden path sentences are temporarily ambiguous sentences (Eysenck & Keane, 2005).

Examples of a garden path sentences are (3) and (4)

- (3) The boy put the frog on the napkin on the table
- (4) While she dressed the baby was on the floor playing

These are sentences with potentially two syntactic structures until a disambiguation point; beyond the disambiguating material only one structure/interpretation can be maintained. Typically, the preferred interpretation of the parser is not the one ultimately allowed. At the point of disambiguation, the parser must abandon the initial structure/interpretation and construct a novel syntactic structure for the sentence (Trueswell, et al., 1999). The latter is taxing on working memory resources as the input needs to be maintained longer in order for the parsing to be complete.

The garden path effect lies in that the phrase “on the napkin” is interpreted as an NP expressing the destination of movement but the NP “on the table” forces the parser to reanalyse it as a modifier of the NP “the frog”. Likewise in (3) the NP “the baby” is initially considered an object to the verb but then forcibly reanalysed as a subject to a new clause. Evidence for the reanalysis comes from eye-tracking studies which have shown eye-movement to regress to previous segments in the sentence or to pictures indicating a now accurate interpretation of the structure which is more difficult at younger ages (Trueswell, et al., 1999). Garden path sentences differ from globally ambiguous sentences where there is no point of disambiguation such, as (5) and (6).

- (5) He saw the man with a telescope.
- (6) The assistance of the actress on the balcony.

In globally ambiguous sentences, experimental evidence (Ferreira & Henderson, 1991) suggests a processing difficulty; this arises from the need to reanalyse and not from the ambiguity *per se*. This is claimed on the basis of the finding that reaction times in self-paced reading/listening¹ studies have been shown to increase not at the point of disambiguation but at the subsequent segment. Increased difficulty may be due to purely the structural properties of the construction in question. It may also be the increased working memory workload needed to maintain and process a representation for it as well as an additional tax on broader executive control required to suppress the previous representation and/or switch to a novel one. Vuong and Martin (2014) have demonstrated that performance in processing garden path sentences is correlated with (non-)verbal measures of executive control both when measuring accuracy and speed. SLI children are a population with working memory deficits, and as such, they are expected to perform less accurately on this structure and show a different (less regressive) eye-movement behaviour.

Filler-gap dependencies in wh-questions are the last complex structure to be assessed. Wh-questions are formed by wh-fronting which is a form of movement. When there is movement, a syntactic element is moved from its initial position in the sentence and placed in a new position, the landing site (see Hawkins (1999) for a review). When this happens, the moved element maintains a phonologically void trace in the original position. The element in the landing site is known as the filler in the literature and is assumed to co-indexed to the trace in the original position known as the gap. There is hence a dependency between filler and gap. The syntactic complexity of wh-questions arises not only from the fact the questions are assumed to be the result of syntactic transformation/computation but also from the need to maintain the dependency between the filler and the gap in working memory for purposes of comprehension. The more long-distance the dependency is, i.e. the greater the intervening material between filler and gap, the more complex and more taxing on working memory resources the structure becomes.

¹ Studies where participants are exposed to a spoken or written sentence incrementally and need to press a key to proceed to the next segment (Marinis, Blom & Unsworth 2010)

This complexity in the asymmetry has been accounted for on the basis of a greater distance in the linear word order between filler and gap. Object wh-questions are thus assumed to be more complex than subject wh-questions in English. Alternative accounts see the source of the discrepancy between the two structures not in the linear distance between the two elements but in properties of the tree structures of the two constructions. Under Relativized Minimality (Rizzi, 1990), the increased complexity for object wh-questions lies in the fact they are located at a lower level on the syntactic tree, they are more deeply embedded in the structure, and hence, there is a greater number of intervening structural elements between the original position and the landing position. For languages where the linear order and distance is reversed between fillers and gaps, Relativized Minimality and long-distance dependency accounts make contradictory predictions but for English both accounts make converging predictions which are widely confirmed in the experimental literature (object disadvantage; for a study testing a language where predictions diverge see Hsiao & Gibson, 2003). Following the idea of filler-gap dependencies, the distance between filler and gap is demonstrated below:

- (7) Who_j e_j read the book?
- (8) Which book_j did Mary read e_j?

Experimental evidence suggests that children with SLI have difficulty processing sentences involving long distance dependencies. Van der Lely and Battell (2003) showed that children with SLI have difficulty with wh-questions in production with object-questions being an area of pronounced weakness. Using a cross-modal priming task, Marinis and van der Lely (2007) found that children with SLI fail to establish this relationship in comprehension and rely to a greater extent on lexical and/or thematic information as indexed by priming effects at the verb but not the trace position.

4. Questions and Predictions

The aforementioned grammatical phenomena are needed to effectively investigate the performance of bilingual children with SLI in relation to monolingual children with SLI and TD bilingual children matched for chronological age or language abilities. This would contribute to the understanding of bilingual SLI in general but also to researchers' knowledge about how children with SLI perform on these particular grammatical phenomena that have been investigated in TD populations. If processing theories of SLI can successfully account for the disorder, then the performance of bilingual children with SLI will lag behind those of monolingual children with SLI. If there is no double delay, then the findings should be interpreted as evidence against processing theories but only tentatively in favour of representational accounts of SLI.

A second issue regards the role of working memory and executive control in language processing, in particular in the case of garden-path sentences filler-gap dependencies. If the bilingual advantage in executive functions provides an offset, the bilingual children with SLI will outperform monolingual children with SLI in working memory and other executive functions. This is the case with monolingual and bilingual TD children. If working memory and executive control are needed in the processing of the morphosyntactic structures in question then the bilingual children with SLI will perform similar or better than monolingual children with SLI on tasks testing garden-path sentences and filler-gap dependencies but not ditransitives verbs. Crucial to answering this question is the assessment of working memory and executive control in bilingual children with SLI.

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