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Specific language impairment as a syntax-phonology (PF) interface problem: evidence from Afrikaans

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Abstract

A theoretical account of specific language impairment (SLI) – one which places the locus of the impairment at Spell-Out at the syntax-phonology interface – is proposed and then tested against utterances from Afrikaans-speaking children with SLI. Drawing on Minimalism, our account offers a unified explanation for the seemingly diverse phenomena found in the Afrikaans data: omission of certain lexical material, double articulation of other lexical material and word order deviations. Based on our data, we conclude that the language problem of children with SLI appears to lie neither in the mapping from lexicon to syntax (thus in the selection of a lexical item as a member of the numeration) nor in the computational system, but in the mapping of an adult-like syntactic representation onto a proper sound representation.

Keywords: Afrikaans; doubling; lexicon-syntax interface; SLI; syntax-PF interface

1. Introduction

Specific language impairment (SLI)¹ is a significant impairment in the spoken language ability of children in the absence of identifiable causal factors or obvious accompanying factors such as neurological deficits, mental challenges, hearing disabilities and emotional or behavioral problems (Leonard 1998: vi; Stark and Tallal 1981). It affects an estimated 7.4% of children (Tomblin, Records, Buckwalter, Zhang, Smith and O'Brien 1997) and is of a long-standing nature (see Brinton, Fujiki and Robinson 2005; Clegg, Hollis, Mawhood and Rutter 2005; Gopnik 1994). There are many linguistically based theories to account for the characteristics

¹ The following abbreviations are used in this paper: AdvP = Adverbial Phrase, ATOM = Agreement/Tense Omission Model, CP = Complementiser Phrase, DP = Determiner Phrase, LF = logical form, N = Noun, P = Preposition, PP = Prepositional Phrase, PF = phonetic form, PolP = Polarity Phrase, SLI = specific language impairment, T = Tense, TP = Tense Phrase, VP = Verb Phrase, vP = Light-verb Phrase.

of SLI as it presents itself in a variety of languages – see the accounts pertaining to deficits in, amongst others, grammatical agreement (e.g., Clahsen 1989, based on German data; Gopnik 1990, based on English); grammatical agreement and tense (e.g., Schütze and Wexler 1996 and Wexler, Schütze and Rice 1998, originally based on English and since tested against several other languages, including German, Dutch and Afrikaans); and movement (e.g., Friedmann, Gvion and Novogrodsky 2006 and Friedmann and Novogrodsky 2007 for Hebrew, and Van der Lely 2005 for English).

Some of the established theories – specifically the Agreement/Tense Omission Model (ATOM) of Wexler and colleagues (amongst others, Schütze and Wexler 1996; Wexler et al. 1998), the Feature Blindness Hypothesis (Gopnik 1990, 1994) and the Computational Grammatical Complexity Hypothesis (Van der Lely 1994, 1996, 2003, 2004) – have been tested against data obtained from Afrikaans-speaking children with SLI (see Southwood 2007; Southwood and Van Hout 2010), with the conclusion that these theories either do not account for the Afrikaans data or do so in a way that is not comprehensive. One of the features of the language of Afrikaans-speaking children with SLI which is not easily accounted for by many other accounts of SLI is the production of expressions which contain too much lexical material; more specifically, expressions in which lexical material is "duplicated" at the surface. We will demonstrate that an approach to SLI in terms of impairment at the level of externalisation (i.e., the mapping of syntax onto the phonetic form (PF); see Chomsky 2009, 2010)² provides a plausible explanation for doubling patterns. In addition to the doubling phenomena, we will discuss phenomena of omission and linearisation (i.e., word order) in Afrikaans linguistic expressions from children with SLI, arguing that these phenomena also hint at the syntax-phonology (PF) interface as the possible locus of SLI. Specifically, on our account, most of the errors made by Afrikaans-speaking children with SLI regarding grammatical morphemes and word order are related to grammatical features: We propose that the problem does not principally lie with the checking of grammatical features, that is, with the movement operations required for feature checking; these children do not experience a problem with the syntactic computation in terms of Move. The problem lies with spelling out these features at the syntax-PF interface and also with spelling out the correct copies that constitute a chain. Whereas the left-most copy is typically spelled out in the adult grammar and (usually) all lower copies deleted, these children sometimes delete left-most copies and spell out lower (intermediate or right-most) ones. In other words, we propose that movement operations occur as they should, rendering a fully grammatical (i.e., adult-like) derivation before the point of Spell-Out. However, at Spell-Out, some copies which are supposed to receive sound form do not and/or others which are supposed to be left phonologically empty are, in fact, spelled out.

Stated differently, we propose that the computational component of children with SLI is intact. There are several theorists who propose an **impaired** computational system (see, e.g., those referred to in the first paragraph of this section). Hamann, Tuller, Delage, Henry and Monjauze (2007), working with French data, also proposed an **intact** computational system. Whereas these authors attribute the language problems of children with SLI to constraints (specifically those related to limited working memory, which was not considered in our study) that do not pertain directly to the computational system but that are still sensitive to computational aspects

² According to Chomsky (2009, 2010), cross-linguistic diversity relates to the externalisation of syntactic structures: "The externalization systems are overwhelmingly – maybe, some day, we will discover *entirely* – where languages differ from one another. The wide variety of languages is almost entirely, maybe entirely if we know enough, in the externalisation process of getting it out into the sensory motor system" (Chomsky 2010:21).

of grammar, we attribute the problems to defective mapping of the syntactic information onto sound form – so-called "externalization". Furthermore, for the Afrikaans-speaking children with SLI, difficulties seem to arise specifically in contexts where there is more than one potential Spell-Out candidate available, i.e., where there is competition between sound forms that may realise a functional category, or competition between various copies for Spell-Out.

In the following sections, we discuss a number of phenomena attested in the utterances produced by Afrikaans-speaking children with SLI, namely doubling (section 3), omission (section 4) and word order (section 5). We compare these utterances to those obtained from typically developing Afrikaans-speaking children. Before doing so, we discuss, in section 2, the methods by which we obtained the Afrikaans utterances.

2. Data collection and methodology

2.1 Participants

The experimental group consisted of 15 Afrikaans-speaking children with SLI (eight girls, seven boys), who were referred to the study by their speech-language therapists. Eleven of these participants were in Grade R (kindergarten) or Grade 1 classes in mainstream schools (one of these children was about to be transferred to a school for children with learning difficulties); one was attending a mainstream daycare centre; two were in a language unit attached to a school for hearing-impaired children although their hearing was within normal limits; and one was in a school for children with general and language learning difficulties. The ages of the participants with SLI ranged from 6 years 0 months to 6 years 11 months ($M = 6$ years 5.3 months) and their mean lengths of utterance measured in words (MLUw) ranged from 3.54 to 5.79 ($M = 4.35$). Their hearing sensitivity was within normal limits bilaterally and their parents and classroom teachers reported age-appropriate socioemotional development and an absence of any visible neurological deficits. IQ testing was performed by psychologists; the children's nonverbal IQ scores were 85 (or the equivalent thereof) or above. All 15 children with SLI were reported by their speech-language therapists to demonstrate problems with morphosyntax (as determined by diagnostic tests), but not with pragmatics. Only one of the children in the SLI group possibly had a family history of SLI.

Fifteen typically developing Afrikaans-speaking 6-year-olds (nine girls, six boys) formed the age-matched (TD6) control group and 15 4-year-olds (eight girls, seven boys) the younger, language-matched (TD4) control group. Their ages ranged from 6 years 2 months to 6 years 11 months ($M = 6$ years 6.8 months) and from 4 years 0 months to 4 years 7 months ($M = 4$ years 2.3 months), respectively. The 6-year-olds had a mean MLUw of 5.92 (ranging from 5.12 to 7.10) and the 4-year-olds of 4.56 (ranging from 3.91 to 5.00). The MLUs of the children with SLI differed significantly from those of their age-matched peers – one-way analysis of variance, $F(1, 28) = 56.34$, $p = .00$ – but not from those of the 4-year-olds, $F(1, 28) = 1.87$, $p = .18$.

According to their parents and classroom teachers, the participants in the control groups were typically developing in all respects: Their language, intellectual and socioemotional development were seen as age-appropriate and there was no evidence of any visible neurological deficits. All 30 typically developing children exhibited hearing sensitivity within normal limits during hearing screening and none had previous referrals to or treatment by a speech-language therapist.

All parents were informed in writing of the aims of the project and gave written consent for the participation of their children in the study. The children themselves gave oral assent.

2.2 Experimental task

We used a sentence completion task to assess the production of past tense forms. The participant was shown a picture of a person or animal performing an action, was told that this action is performed every day and was requested to provide information on what the person or animal did the day before. For instance, the participant was shown a picture of a boy brushing his teeth and told *Hierdie kind borsel elke dag sy tande. Gister, net soos elke ander dag, ... (het hy sy tande geborsel)* "This child brushes his teeth every day. Yesterday, just like every other day, ... (he brushed his teeth)", where the target responses are given in parentheses. If the participant used the historic present tense (which resembles the infinitival form in Afrikaans and which would be appropriate due to the presence of the adverb *gister* "yesterday" which indicates past tense), the researcher provided the temporal auxiliary *het* "have", as in *Hierdie kind borsel elke dag sy tande. Gister, net soos elke ander dag, het ...*

The task consisted of 20 items of which the first two were practice items. The following types of verbs were included:

- (i) four main verbs which take the *ge-* prefix in the past participial form – as in the *borsel* "brushes" example given above.
- (ii) two main verbs which do not take the *ge-* prefix in the past participial form – e.g., *betaal* "pay" in *Hierdie vrou betaal elke dag die verwer. Gister, net soos elke ander dag, ... (het sy die verwer betaal)* "This woman pays the painter every day. Yesterday, just like every other day, ... (she paid the painter)".
- (iii) two *be* forms – e.g., *Hierdie katjie is elke dag hier. Gister, net soos elke ander dag, ... (was die katjie hier)* "This kitten is here every day. Yesterday, just like every other day, ... (the kitten was here)".
- (iv) two *have* forms – e.g., *Hierdie seun het elke dag 'n nuwe maatjie. Gister, net soos elke ander dag, ... (het hy 'n nuwe maatjie gehad)* "This boy has a new friend every day. Yesterday, just like every other day, ... (he had a new friend)".
- (v) six modal auxiliaries – e.g., *Hierdie eendjie wil elke dag swem. Gister, net soos elke ander dag, ... (wou hy geswem het / wou hy swem)* "This duckling wants to swim every day. Yesterday, just like every other day, ... (he wanted to swim)".
- (vi) two hendiadyses – e.g., *Hierdie man staan elke dag en wag vir die bus. Gister, net soos elke ander dag, ... (het hy vir die bus gestaan en wag)* "Every day, this man stands waiting for the bus. Yesterday, just like every other day, ... (he stood waiting for the bus)".

A similar procedure has been used with success to test the production of past tense structures in, amongst other languages, English (Loeb and Leonard 1991), French (Jakubowicz 2003) and Swedish (Hansson and Leonard 2003). The task was first performed with typically developing Afrikaans-speaking 3-, 4-, 5- and 6-year-olds during a pilot study, in order to ensure that the test items were appropriate and that the demands placed on the participants were realistic (see Southwood 2005, 2006). The second author administered the task to each participant individually. During one such administration, another child was present but did not take part: A girl with SLI did not want to participate unless her typically developing twin could accompany her to all data collection sessions.

2.3 Collection of spontaneous language

During language sample elicitation, the second author and the participant mostly played alone in a quiet room at the participant's school, care centre, or home, or in a quiet part of a room in which other people were also present. The sample of the above-mentioned girl and two further samples (both of typically developing 4-year-old boys) were collected with other children taking part in the conversation, at the request of the participants.

Language sample elicitation took the form of freeplay with toys that included little figurines with accessories such as radios, hats, mugs and brooms; wooden building blocks; and plastic kitchen furniture. The second author initiated the language sampling interaction by inviting the participant to join her in kitting out the dolls, building a house and/or assembling the kitchen. If the participant was quiet for extended periods, the author used a variety of techniques to encourage conversation, including parallel play, making statements and asking questions (both *wh* and *yes/no*-questions). These questions were asked about topics found to be suitable for discussion with South African preschool children, such as their families, pets and birthday celebrations (see Southwood and Russell 2004). Following Crystal, Fletcher and Garman (1976), the language samples collected in this study were at least 30 minutes long each. An audio-cassette recording was made of each language sample collection session, using an observable recorder.

2.4 Data transcription and scoring

2.4.1 Experimental task

All responses on the experimental tense production tasks were recorded on a scoresheet. Spontaneous self-corrections were allowed and recorded, but only the final response was scored.

2.4.2 Language sample

The utterances occurring in the first 30 minutes of each language sample were transcribed orthographically. Hereafter, the first 100 complete and fully intelligible utterances were identified. Following Hunt (1970:4), an utterance was considered to be a T-unit, i.e., "one main clause plus whatever subordinate clause and non-clausal expressions are attached to or embedded within it". Accordingly, *want* "because", *en toe* "and then" and *en dan* "and then" were each taken to introduce a new T-unit, as were *en* "and" and *maar* "but" if these two were followed by a clause containing a verb. The words in the first 100 complete and fully intelligible utterances were then counted and the mean determined, in order to calculate the MLUw.

Next, the instances of insertion of the following in the first 30 minutes of each sample were tallied separately: main verbs, hendiadyses, auxiliary verbs, pronouns, and negative elements. The instances of omission of the following were also tallied: past participles as a whole; the past participial morpheme *ge-*; verb particles, such as *uit* "out" of *uitgooi* "throw out"; particle verbs, such as the *gooi* part of *uitgooi*; negative elements; the possessive marker *se* "'s"; determiners; pronouns; possessive prepositions; and nouns, the latter from Noun Phrases (NPs) that would not have consisted of only the noun in the adult form of the utterance. For instance, *poppie* "doll-diminutive" would have been tallied in **die rooi Ø staan hier* "the red stands here" but not *Ø staan hier en eet haar pap* "stands here and eats her porridge" where the whole DP or possibly a pronoun was omitted. Lastly, all utterances with non-adult-like word order were placed in a database and classified according to the type of deviant word order.

3. Doubling phenomena in Afrikaans utterances

Recall that "doubling" here refers to the multiple appearances of a lexical item in a structural environment which, in non-SLI adult language, permits only a single occurrence of this same lexical item – in other words, the overrepresentation of a lexical item in the linguistic expression. This phenomenon has received little attention in studies on SLI: Van der Lely and Battell (2003:173-174) addressed it to a certain extent in *wh* question production in English.

What is notable in the Afrikaans data is that this doubling phenomenon occurred almost exclusively in the language of the children with SLI (see Table 1); many other instances of insertion of elements also occurred (such as that of determiners; see Southwood 2007), again mostly by the children with SLI, but here we focus on those instances leading to doubling.

Table 1. Frequency of Selected Apparent Insertions in the First 30 Minutes of Language Samples Collected from the Participants with SLI, the Typically Developing 4-Year-Olds(TD4) and the Typically Developing 6-Year-Olds(TD6)

Doubled element	Number of insertions made per group		
	SLI	TD4	TD6
Main verb	7	1	0
Hendiadys	1	1	0
Auxiliary verb	4	0	0
Pronoun	4	0	0
Negative element	2	0	0

As illustrated by the examples below, the doubling phenomenon occurred with a variety of elements: main verbs (1), hendiadyses (2) or auxiliaries (3)³, but also with pronouns (4), negative elements (5) and, in one instance, with the diminutive suffix (6).

	<i>Utterance by child with SLI:</i>	<i>Target:</i>
(1)	*nou reën hulle nat reën now rain they wet rain "Now they are getting wet in the rain"	nou reën hulle nat now rain they wet
(2)	*ons het gaan bietjie koffie gaan drink we have go a.little coffee go drink "We went to drink some coffee"	ons het bietjie koffie gaan drink we have a.little coffee go drink
(3)	*ons nie kan eet nie kan ons nie groot kan word nie we not can eat not can we not big can become not "If we cannot eat, we not cannot grow up"	as ons nie kan eet nie kan ons nie grootword nie if we not can eat not can we not big. become not

³Responses containing two (aspectual) auxiliaries were also given to some items of the sentence completion task assessing the production of tense, for example, **het eet het* 'have eat have' in response to *Hierdie beer kan elke dag heuning eet. Gister, net soos elke ander dag, ... (kon hy heuning geëet het / kon hy heuning eet)* 'This bear can eat honey every day. Yesterday, just like every other day, ... (he could eat honey)'. Other relevant responses to this task were **het sy alles staan het* 'have she everything (under)stand have' (instead of *het sy alles verstaan*) and **het sy 'n blom gepluk het* 'have she a flower pick-past.participle have' (instead of *het sy 'n blom gepluk*).

- | | | |
|-----|--|--|
| (4) | *ons ma leer ons saam ons
our mom learn us with us
"Our mom is learning with us" (i.e., she is in our class at school) | ons ma leer saam met ons
our mom learn together with us |
| (5) | *ja maar nie so nie my pa nie
yes but not like not my dad not
"Yes, but not like my dad" | ja maar nie soos my pa nie
yes but not like my dad not |
| (6) | *'n rooietjie hoedjie
a red-diminutive hat-diminutive
"A little red hat" | a rooi hoedjie
a red hat-diminutive |

The question arises as to how to account for these doubling patterns. An important observation here is that the two instances of the relevant lexical item do not both appear to contribute semantically to the "descriptive" meaning of the sentence. For example, the two instances of *reën* "rain" in (1) do not seem to separately add meaning to the utterance. They do not each introduce their own argument structure; *hulle* "they" seems to function as an argument of both instances of *reën*. One might speculate as to whether the doubling pattern introduces a layer of expressive or discourse-related (e.g., affective-emphatic or contrastive-emphatic) meaning.⁴ However, from the contexts in which these doubling patterns were produced by the Afrikaans-speaking children, doubling did not seem to correlate with emphatic meaning. For example, doubled *reën* in (1) was uttered in a context in which neither contrast (e.g., "to rain" versus "to snow") nor affect (e.g., exclamative meaning expressing surprise) was involved. Another interpretation could be that doubling patterns are the result of hesitation, insecurity or rephrasing. However, we did not observe any such signals in the utterance containing the doublings. The utterances were produced fluently, without particular pauses or breaks.

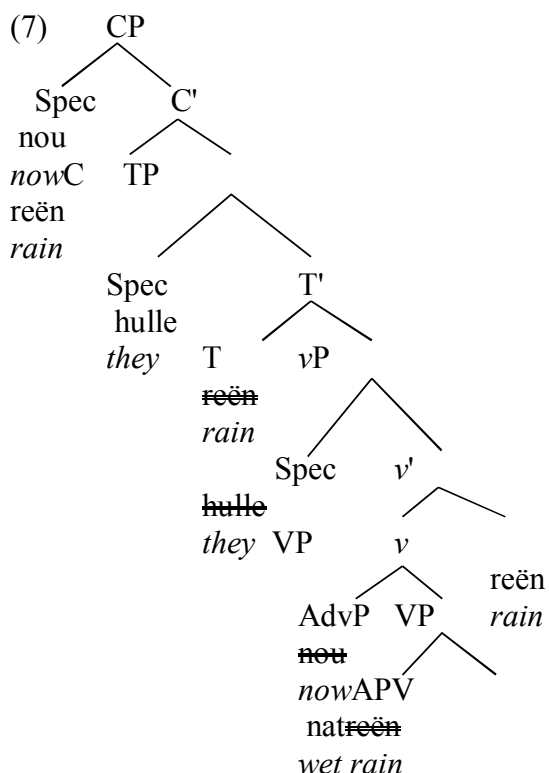
We propose that these doublings could be accounted for by an approach which takes the impairment to involve the syntax-PF interface. Stated differently, these patterns can be interpreted as deviant externalisations of (non-deviant) syntactic representations. Let us first consider the verb doubling patterns in (1) to (3). It could be that these multiple occurrences of the verb result from the multiple realisation (i.e., Spell-Out at PF) of traces. More specifically, under the assumption that traces are actually copies of the displaced element (see Chomsky 1995), these doubling patterns result from externalisation (i.e., pronunciation) of more than one copy.⁵ Normally, only a single copy – typically the highest one, i.e., the head of the chain – is pronounced. For example, in the target expression *Nou reën hulle nat* in (1), it is the verbal copy in the C-position (the verb-second position) in Afrikaans which surfaces phonetically (i.e., is pronounced in PF). The lower copies in T, *v* and V remain unpronounced. In the

⁴ It has been noted in the literature that certain doubling patterns encode particular meanings such as emphasis and focus. See, for example, Martins (2007) for doubling of finite verbs in European Portuguese and Nunes and Quadros (2004) for Brazilian Sign Language (see (i)). However, other patterns of doubling, e.g., the pattern of *wh* duplication in certain variants of German (see (ii)), does not seem to trigger any special meaning effects.

(i) ILOSE BOOK LOSE (Brazilian Sign Language; Nunes and Quadros 2004)
'I LOST the book (as opposed to, say, *sold it*).'
(ii) **Wen** glaubst du [**wen** Jakob gesehen hat] (German; McDaniel 1986)
whom thinks you whom Jakob seen has
'Who do you think that Jakob saw?'

⁵ For discussion of multiple realisation of copies, see, amongst others, Boskovic (2001), Nunes (2004) and Corver and Nunes (2007).

expression **Nou reën hulle nat reën*, one of the lower verbal copies is also pronounced. This is represented in the tree diagram in (7).⁶



As shown by (2), these doubling patterns also occur with finite auxiliary verbs, such as *kan* "can". Also for this doubling, we argue that there is nothing "syntactically wrong" with it; that is, the syntactic derivation of this linguistic expression is similar to that of the target linguistic expression ... *kan ons nie grootword nie*. However, at Spell-Out, a lower copy of the chain, which is supposed to be left unpronounced, is in fact spelled out. Thus, the verbal copy *kan* is not only pronounced in the hierarchically most prominent position (i.e., the verb-second position C) but also in one of the lower verbal head positions.

In sum, the verbal doubling patterns produced by children with SLI seem to receive a natural account in terms of the syntax-PF interface relation: Impairment regards the externalisation of chains. In a way, too much linguistic material is externalised. One might raise the deeper question here as to what underlies this richness in externalisation. At present, we do not have any definite answers. Along the lines of Chomsky (2009, 2010), one might speculate that double articulation is interpretatively useful (since each position in the chain is interpretatively relevant) but "physically" costly (i.e., articulation requires a lot of energy; Chomsky 2010). In adult speakers without SLI, optimality (i.e., economy) in terms of sound typically wins over optimality in terms of meaning (where the latter entails explicitness about the positions of interpretation; e.g., the verbal position where theta-roles are assigned and the position where illocutionary force is defined). Possibly, in the case of children with SLI, the "meaning side" sometimes trumps the "sound side" – that is, explicitness about the syntactic positions which play a role on the meaning side (e.g., the theta-role position and the illocutionary position, the

⁶ Under the assumption that both VP and vP are head-final, it is difficult to determine whether the "doubled" copy is realised in V or v. What is relevant for us is that both the highest copy and a lower one are externalised.

latter being the verb-second position) is more relevant at times than the pronunciation costs associated with double articulation.⁷

Having given an account of verbal doubling patterns in terms of externalisation of chains (i.e., multiple copy spell-out), let us turn next to the other doubling patterns, starting with (4). The linguistic expression **ons saam ons* features both omission and doubling. Omission regards the preposition *met* which, as shown by the target expression *saam met ons*, co-occurs with *saam*.⁸ Of note is that, besides *saam met ons*, we also find *met ons saam* in adult, unimpaired Afrikaans. We will assume that the latter word order is derived from *saam met ons* via leftward displacement of the PP *met ons*. If so, the doubling pattern could again possibly be interpreted as an instance of externalisation of two (PP) copies of a chain. More specifically, both the foot of the chain (*saam [P_o ons]*) and the head of the chain, i.e., the displaced PP (*[P_o ons]saam*), are pronounced, yielding the pattern *[P_o ons] saam [P_o ons]*.

We now turn to the *nie*-doubling in (5). Admittedly, an analysis in terms of syntactic displacement and multiple copy spell-out seems less likely for those patterns. Following the line of reasoning that doubling in impaired Afrikaans is a phenomenon on the PF side of the grammar, we tentatively propose that *nie*-doubling in expressions such as *nie my pa nie* follows from a PF-merger operation which concatenates and copies the final *nie* to the immediate left of the negated phrase to its left. In a way, the first prephrasal *nie* phonologically anticipates the second postphrasal *nie*. In this case, concatenation and duplication take place at PF, an "affix-hopping"-like operation in the sense of Chomsky (1957),⁹ where the final *nie* is taken to be an affix-like element which PF-merges (via concatenation and duplication) onto the initial element of the preceding phrase.¹⁰ Schematically, this can be represented as shown in (8):¹¹

⁷ One might further speculate and try to relate this to the notion of 'phase' (Chomsky 2000, 2001), where a phase is a syntactic object of which the parts (more specifically, the complement of its head) can be inspected for convergence (at PF and LF). Under the assumption that *v* and *C* are the phase heads in the clausal architecture, one might argue that doubling is typically associated with the verbal phase heads *v* and *C*, i.e., the points in the derivation at which material – i.e., the complement of *v* (viz. VP) and the complement of *C* (i.e., TP) – is sent off to be interpreted semantically and phonologically. Double externalisation of the verbal copies in those phase heads may be a way of "keeping track" of the (meaning of the) sentence during the utterance thereof.

⁸ See section 4 for P-omission in prepositional phrases (PPs).

⁹ See also Embick and Noyer (2001) for extensive discussion of PF-displacement operations.

¹⁰ In traditional grammar, this phenomenon of grammatical anticipation is referred to as "prolepsis": an element appears "too early" in the linguistic representation, i.e., in a position which is not its canonical position or where it does not have its origin (Overdiep 1937). A well-known case of prolepsis is the phenomenon in which a *wh* word belonging to an embedded verb appears in the main clause, as in *Who do you think John saw?*. In the generative framework, this pattern of prolepsis has been analysed in terms of syntactic displacement. Another phenomenon of prolepsis in Dutch is the leftward spreading of attributive adjectival inflection onto certain degree adverbs (see Corver 1997, 2006). Compare, for example, the Dutch patterns in (i).

(i)	a.	een [heel erg leuk- <i>e</i>] auto	(a really very nice- <i>e</i> car)
	b.	een [heel erg- <i>e</i> leuk- <i>e</i>] auto	(a really very- <i>e</i> nice- <i>e</i> car)
	c.	een [hel- <i>e</i> erg- <i>e</i> leuk- <i>e</i>] auto	(a really- <i>e</i> very- <i>e</i> nice- <i>e</i> car)
	d.	*een [hel- <i>e</i> erg leuk- <i>e</i>] auto	(a really- <i>e</i> very nice- <i>e</i> car)

A possible way of interpreting this phenomenon is in terms of leftward affix-hopping, interpreted in the sense of Chomsky (1957), which means that it is an operation that takes place at PF: the affix *-e* hops in PF from right to left and each time right-adjoins to the preceding adverbial element (*erg*, *heel*).

¹¹ One possible alternative analysis of the pattern illustrated in (8) would be that such examples involve both sentential and constituent negation. On this analysis, (a) the sentence contains two PolPs, one dominating the CP and the other dominating the negated constituent in question; (b) two movement operations take place, resulting in the CP being moved to the specifier position of the left-most PolP and the negated constituent to the specifier position of the PolP immediately dominating it; and (c) as a result of the two movement operations, two *nie*_{2S} end

- (8) a. ja maar nie soos [my pa] **nie** (syntactic representation)
 b. ja maar nie soos **nie**+ [my pa] **nie** (PF-merger of *nie*)

It does not seem implausible to extend this line of approach to the diminutive-morpheme duplication in (6). The diminutive morpheme *-tjie* starts out on the nomen and "spreads" to the left via PF-merger. In this case, the bound morpheme right-adjoins to the prenominal attributive adjective. Schematically, this can be presented as in (9):

- (9) a. 'n rooi hoed-**tjie** (syntactic representation)
 b. 'n rooi-**e-tjie**¹²hoed-**tjie** (PF-merger of *-tjie*)

In summary, our proposal is that the phenomenon of doubling or overrepresentation of lexical material indicates that the locus of impairment in SLI can be the interface between syntax and PF. As such, SLI can be characterised as an externalisation problem, that is, a problem pertaining to the mapping from syntax to the sensorimotor systems (i.e., pronunciation).

4. Omission phenomena in Afrikaans SLI utterances

A lot of research on the language of children with SLI centres on tense-marking, as the latter has been proposed as a clinical marker of SLI in certain languages – see Rice and Wexler (1996) for English; Bortolini, Caselli, Deevy and Leonard (2002) for Italian; and Southwood and Van Hout (2010) for Afrikaans. The explanation that we offer for the omission of tense-marking is that the derivation is complete (i.e., adult-like) but is not spelled out (or externalised) in an adult-like manner. The reason why elements relating to tense are not spelled out pertains to the number of different formal means by which past tense can be expressed in Afrikaans: At Spell-Out, there is competition between these forms.¹³ This language-internal diversity in the formal expression of past tense is illustrated by the sentences in (10), which can all have the meaning "He wanted to sleep yesterday".

- (10) a. Gister wou hy geslaap het
 yesterday want.to-past he sleep-past.participle have
 b. Gister wou hy slaap
 yesterday want.to-past he sleep-infinitive
 c. Gister wil hy geslaap het
 yesterday want.to-present he sleep-past.participle have

up adjacent to one another, with only one of them phonetically spelled out in unimpaired adult speech (see Biberauer 2006).

¹²*rooietjie* could be analysed in at least two ways. On the one hand, the noun *rooietjie*, with the meaning 'red one-diminutive', could be taken to consist of *rooi* (adjective) + the nominalisation affix *e* + the diminutive suffix /ki/, pronounced as [ki] in this case. On this analysis, the child is seen as using a DP consisting of D-N-N. On the other hand, the *-etjie* could be taken to be an allomorphic variant of /ki/, pronounced as [ici]. In other words, on this possibility, the *e* is not a distinct (nominalisation) affix. This [ici] form of the diminutive is widely used in Afrikaans, particularly after short, unstressed vowels followed by a sonorant consonant, as in *man* 'man' – *mannetjie* 'man-diminutive' and *krul* 'curl' – *krulletjie* 'curl-diminutive'.

¹³Our approach is corroborated by recent insights from the field of experimental psycholinguistic studies on morphology. Experimental data seem to support theories claiming that regular inflected forms are not computed in speaking by adding affixes to roots, but are retrieved in their complete form from the lexicon (e.g., Stemberger 2004). Both irregular and regular forms are accessed directly from the lexicon, which is in line with Word and Paradigm morphology (Blevins 2003). If regular forms are accessed and retrieved directly from the mental lexicon, then the selection process has to deal with competing, phonologically neighbouring forms (that is, competing lexical forms with almost similar PFs).

- d. Gister wil hy slaap
yesterday want.to-present he sleep-infinitive

The problems which the child with SLI experiences with selecting the correct verbal form could be of such a magnitude that, at times, the child selects the wrong past tense form and, at other times, the child opts for not spelling out the past tense carrier at all, the latter resulting in apparent absence of tense marking in the syntactic representation. We illustrate this with (11), one of 17 past tense forms produced by the Afrikaans-speaking children with SLI in which the obligatory *het* "have" was not spelled out; the typically developing 4-year-olds produced four such forms and the typically developing 6-year-olds produced one.

<i>Utterance by child with SLI:</i>	<i>Target:</i>
(11) *hulle seergekry they sore.get-past.participle "They got hurt"	hulle <u>het</u> seergekry they have sore.get-past.participle

If there is **no** modal auxiliary in the sentence that can check the Verb feature of the T – as in (11), compared to *hulle sou seergekry het* "they would have gotten hurt" where there is a modal (*sou*) – then the derivation should crash if the *het* is omitted, given that T would have an unchecked Verb feature. However, these derivations do not crash in the case of children with SLI, as can be seen in (11); therefore, we propose that *het* is part of the numeration and input to the syntactic derivation: It merges with vP and is subsequently moved to the T, leaving behind a copy (yielding *hulle het seergekry het*, should one ignore the other movement operations) and then to the C, again leaving behind a copy (yielding *hulle het_C hulle het_T hulle seergekry het_V*, should one consider all movement operations). However, at the point of Spell-Out, no copy of *het* (not even the left-most one of the chain {*het*, *het*, *het*}) receives sound form. Importantly, the past tense meaning is recoverable from the past participle form *seergekry*, which is determined by the auxiliary *het*.¹⁴ Possibly, this local recoverability of tense information plays a role in the omission (i.e., nonpronunciation) of the auxiliary.¹⁵

Het "have" is however not the only auxiliary to be omitted. Children with SLI, but not typically developing children, also omitted modal auxiliaries. An example of such an omission is given in (12).

¹⁴ See Chomsky's (1957) analysis of verbal forms in terms of affix hopping. On this analysis, information about the form (i.e., morphology) of the verb which is selected by the auxiliary is specified on the auxiliary. For example, *het* is lexically specified for the past participle bound morpheme *ge-*. In PF, this morpheme "hops" onto (i.e., PF-merges with) the verb *seerkry*, which is in the complement position of *het*. Thus, ignoring linear order, we could represent the affix hopping operation for *ge-*, as in (i):

(i) hulle het_[ge-] seerkry → (ii) hulle het seergekry

¹⁵ Another possible reason why a child with SLI may find it acceptable to leave *het* phonologically empty could be related to Kayne's (1993) proposal that 'have' could be seen as 'be' plus an incorporated preposition (i.e., 'have'=Preposition_{DATIVE/LOCATIVE}+ 'be'), along the lines of Benveniste (1966). As both 'be' and the abstract preposition are semantically poor, it could be that the child does not provide the complex form [Preposition+'be'] with phonological contents at Spell-Out.

<i>Utterance by child with SLI:</i>	<i>Target:</i>
(12) *OK nou die kinders eet ¹⁶	OK nou moet/wil die kinders eet
OK now the children eat	OK now must/want.to the children eat
"OK, now the children must/want to eat"	

Our impaired syntax-PF mapping account will offer the same explanation as it does for temporal auxiliary *het* "have", namely that the (at times tense-carrying) modal is in fact part of the numeration and the derived syntactic representation but does not receive sound form at Spell-Out.

Some established accounts of SLI (specifically the ATOM of Schütze and Wexler 1996; Wexler, Schütze and Rice 1998) **do** offer adequate explanations for impaired tense marking in Afrikaans. Our account however appears to be more in line with the observation that omission of lexical material (both free morphemes and bound morphemes) is a phenomenon that affects more than tense/agreement marking. For example, omitted material in the Afrikaans data from children with SLI included the following: (Omitted material enclosed in parentheses.)

- (i) past participles as a whole – **hulle altwee het op 'n blou bed (geslaap)*"both of them (slept) on a blue bed";
- (ii) the past participial morpheme *ge-* – **so haar (ge)kou het*"chew(ed) her like this";
- (iii) verb particles – **dan sit jy die ander een (neer)*"then you put the other one (down)";
- (iv) particle verbs – **hoe kan ons die rugsakkie af(haal)?*"how can we (take) the little rucksack off?";
- (v) negative elements – **ja hy's nie so ander Nese (nie)*"yes he's not like other Chinese (not)";
- (vi) possessive markers – **en juffrou kyk die kyk die *ystervarks (se) maag*"and teacher looks at the porcupine('s) stomach";
- (vii) determiners – **soek jy (die/'n) kas?*"do you want (the/a) cupboard?";
- (viii) pronouns – **shame (sy) rug kry seer*"shame, (his) back is being hurt";
- (ix) nouns – **en 'n pappa sit (?hoedjies) op*"and a daddy puts (?caps) on"; and
- (x) prepositions – **Karel Kat gaan jou (na) die plaas toe vat*"Tom Cat will take you (to) the farm to".

The number of times such omissions occurred is indicated in Table 2.

¹⁶ When considering this utterance out of context, one could argue that the intended utterance was a modal-less construction ('OK now the children eat'). The "children" in this instance are little figurines which the girl with SLI who made this utterance had just dressed in crash helmets. Immediately after saying **OK nou die kinders eet*, the girl looked at the figurines, presumably saw that they could not eat with their head gear on and said *Nou hoe? Hoe moet julle eet?* 'How now? How must you-plural eat?', which led us to believe that the child intended to say *OK nou moet/wil die kinders eet. Nou hoe? Hoe moet hulle eet?* 'OK, now the children must / want to eat. How now? How must they eat?'.

Table 2. Frequency of Selected Apparent Omissions in the First 30 Minutes of Language Samples Collected from the Participants with SLI, the Typically Developing 4-Year-Olds(TD4) and the Typically Developing 6-Year-Olds(TD6)

Omitted element	Number of omissions made per group		
	SLI	TD4	TD6
Past participle as a whole	6	2	0
Past participial morpheme	18	2	0
Verb particle	6	1	2 ^a
Particle verb	6	0	0
Negative element	8	1	1 ^b
Possessive marker	3	0	0
Determiner	45	19	4
Pronoun	22	4	3
Noun ^c	5	0	0
Preposition	24	4	1

^aThe two verb particles omitted by the typically developing 6-year-olds involved less frequently used words (*afrig* "coach", *oppas* "cares for / looks after") than the words from which particles were omitted by their peers with SLI (e.g., *insit* "put in", *afhaal* "take off").

^bThis utterance was **moet ek nie 'n papier gaan haal dan teken ons goedjies wat ons hierin kan sit Ø?* "shouldn't I go and fetch a piece of paper then we draw little things which we can put in here?", which is more complex than those utterances from which the children with SLI omitted a negative element, for instance, **dan is dit nie lekkerØ* "then it is not nice".

^cHere, we considered only those omitted nouns that would **not** have comprised NPs on their own in adult derivation, i.e. where a determiner or adjective is present without the noun, as in **daar nog 'n Ø hier* "there (is) still a Ø here".

The omission of a past participle verb (as a whole), noun or preposition may be problematic for accounts placing the locus of the impairment in the computational system, for the following reason: Under a generalised view of omission as absence of a lexical item L (and its projection LP) in the syntactic representation, lexical categories would sometimes simply not be part of the linguistic expression generated by the child with SLI. That is, if a noun is not present, then there will be no noun and no projection NP in the derived syntactic representation. Similarly, omission of a preposition implies absence of P (and its projection PP) in the syntactic representation. However, this generalised view of omission of lexical material as absence in the representation seems problematic. Consider, for example, the following data on impaired Afrikaans, which exemplify noun omission (13) and preposition omission (14):

- | | <i>Utterance by child with SLI:</i> | <i>Target:</i> |
|------|---|--|
| (13) | <i>*hierso moet nou nog 'n rooi Ø kom</i>
here must now still a red come | <i>hierso moet nou nog 'n rooi een / keppie kom</i>
here must now still a red one / cap-diminutive come |
| | "A red one / cap should now still be placed here (on this figurine's head)" | |
| (14) | <i>*dan hy dan wil dit hom koppe sit hy</i>
then he then want.to it him heads put he
"Then he wants to put it on his head, him" | <i>dan wil hy dit op sy kop sit hy</i>
then want.to he it on his head put he |

In (13), the noun is omitted. This raises the question as to what syntactic structure should be assigned to the string *'n rooi*. The indefinite article *'n* typically does not merge with the lexical category Adv (*rooi*). That is, indefinite articles are typically part of the extended **nominal** projection in the sense of Grimshaw (1991/2005). This suggests that there is a noun present in the syntactic structure that corresponds to the linear string *'n rooi*. The only difference between the target (i.e., non-SLI) utterance *'n rooi een/keppie* and the SLI utterance *'n rooi* then regards the pronunciation (i.e., externalisation) of the N-position: N remains silent in the utterance produced by the child with SLI.

Consider **hom koppe* in (14), which has the spatial interpretation "on his head". As indicated by the target expression, this spatial information is typically expressed by the preposition *op*"on". Under a rigid "omission = (syntactic) absence" approach, there would be no P(P) in the utterance. This raises two questions. First, how is "spatial information" then expressed? Second, how do selectional relations work, as the verb *sit* "put" in (14) does not seem to be subcategorised for a nominal expression? Our explanation would be that *sit* is indeed present in the derivation but then, due to an externalisation error, receives no sound form. It seems that many accounts can give explanations for the omission of functional categories but that the impaired syntax-PF mapping account offers satisfactory explanations for a wider range of omission phenomena found in the utterances of children with SLI.

5. Deviant word order in Afrikaans SLI utterances

In the Afrikaans data, there were several instances of utterances in which no deletion took place but in which the word order was non-adult-like. All three groups of Afrikaans-speaking children made some word order errors, indicating that word order is not yet completely adult-like by the age of 6 years. However, not all types of errors were made by all of the groups. Of interest here is that two of the error types, that of main clauses with a Subject-Object-Verb surface word order – as exemplified in (15) – and main clauses with a Verb-Subject-Object order – as exemplified in (16) – were used exclusively (although infrequently) by the children with SLI. (The derivation of a representative number of these utterances is discussed in Southwood 2007.)

	<i>Utterance by child with SLI:</i>	<i>Target:</i>
(15)	*hulle TV kyk they TV watch "They are watching TV"	hulle kyk TV they watch TV
(16)	*vryf hy die been en 'n pappa rub he the leg and a daddy "He is rubbing daddy's leg"	hy vryf die been van pappa he rub the leg of daddy

Some word order errors which were more difficult to classify also occurred. These are illustrated in (17).

<i>Utterance by child with SLI:</i>	<i>Target:</i>
(17) a. *en hulle meet om hulle op die lorrie te gaan and they measure infinitive. complementiser they/them on the truck to go "And they measure them to go onto the truck" [them = captivity-bred ostrich chicks, measured to decide whether they are big enough to be sold]	en hulle meet hulle om op die lorrie te gaan and they measure them infinitive. complementiser on the truck to go
b. *ek sal ry fiets I will ride bicycle "I will cycle"	ek sal fietsry I will bicycle.ride
c. *waar's nog ene so? where.be-contracted another one such "Where's another one like this?"	waar's nog so ene? where.be-contracted another such one

In (15) to (17), no apparent deletion or insertion occurs and tense marking appears adult-like (although the present tense is used in all of these example utterances and the present tense form resembles the infinitival form in Afrikaans). Yet the word order differs from that of adult speakers of Afrikaans. That is, the utterances produced by the children with SLI are linearised differently from the target expressions. According to Chomsky (2010:10), "linear order derives from the fact that order is a property of the sensory motor system". In other words, the linear aspect of language is a property that is not encoded in the syntactic representation and that is irrelevant for the interpretive part (i.e., LF) of a linguistic expression.¹⁷ If Chomsky is correct in saying that linearity is a property of PF (and not of syntax), then the "mislinearisations" of the SLI utterances in (15) to (17) could also be interpreted as so-called PF errors. Of interest is that all the word order errors in these examples involve two linearly adjacent elements. For example, instead of the target sequence *kyk TV* "watch TV", we have *TV kyk* (15) in a main clause, and instead of the target sequence *so ene* "such one", we have *ene so* (see 17c). An interesting mislinearisation is the one in (17a). Instead of the order *hulle om* "them to" (i.e., object of the matrix verb *meet* "measure" + infinitival complementiser of the embedded clause) we find the reverse order *om hulle*. It seems unlikely that *om* has somehow become part of the matrix syntactic structure. Nor is it likely that this second *hulle* is somehow part of the embedded clause structure. In short, the sequence *hulle om* seems to be a linearisation error; that is, the syntactic structure is similar to that of the target language, but the linearisation of the structure may be deviant as a result of "inversion" of two string-adjacent elements.

To summarise, we have shown in this section that certain SLI errors involve the linearisation of two lexical items that are string-adjacent to each other. Under the assumption that linearisation is a PF property, rather than a syntactic one, this type of SLI error too may be characterised as an error at the interface between syntax and PF, that is, an externalisation error.

We conclude this section by pointing out that only a small portion of the sentences produced by the three groups had incorrect word order: 1.8% by the children with SLI, 0.8% by the 4-year-olds and 0.9% by the typically developing 6-year-olds. Mostly, then, the children with SLI produce sentences with correct word order. Bearing this in mind, we propose that it is more

¹⁷ See Kayne (1994) for a different view: He argues that linear order (precedence) is connected to hierarchical structure. More specifically (and somewhat simplified), if constituent A asymmetrically c-commands constituent B, then A precedes B.

plausible that these children have intact computational systems with the phonological spell-out of the derivations sometimes being incorrect (thus that the impairment lies at the syntax-phonology interface) than that these children sometimes have correct underlying syntactic structures and at other times not (which will be the case if one accepts that the impairment lies somewhere within the computational system).

6. Conclusion

In this article, we have argued on the basis of a variety of phenomena attested in linguistic expressions produced by Afrikaans-speaking children with SLI that this impairment is essentially what may be called an "externalisation problem". Children with SLI typically have a problem with mapping the syntactic representation onto a proper sound representation. In other words, the problem regards the syntax-phonology interface. We based our conclusion on a variety of syntax-phonology interface phenomena, namely (i) double articulations of lexical material, which either involved multiple spell-outs of copies of chains or PF-mergers of morphemes onto adjacent lexical or phrasal categories; (ii) omissions, or silences (i.e., non-pronunciation), of structurally available positions, such as the functional category T, but also lexical categories such as N and P; and (iii) "inverse" linearisations (i.e., word orders) of string-adjacent elements. Importantly, our account proposes that the language problem of children with SLI does not lie in the computational system (i.e., not with Merge or Move), as the syntactic structures generated do not really deviate from those generated by adult speakers of Afrikaans – that is, up to the point of Spell-Out at PF. Furthermore, taking a unified approach towards SLI phenomena, we concluded on the basis of the aforementioned variety of phenomena (doubling, silence and inverse linearisation) that the locus of the impairment should not be sought in a defective or incomplete (morpho)syntactic structure.

Our proposal that children with SLI have problems with Spell-Out at PF can be viewed as preliminary at best, for the following reasons:

- (i) It is based on data obtained from one language only. In order to offer an account of SLI in general, it needs to be tested against crosslinguistic data.
- (ii) We had access to a limited number of children with SLI. More data, including elicited data using a variety of techniques, from a larger number of children are needed to offer support for our account.
- (iii) Doubling, omission and non-adultlike word order were also present (although to a lesser extent) in the utterances of the younger, typically developing Afrikaans-speaking children; these phenomena are thus not "SLI-specific phenomena" by nature, but seem to be present in the language of children with SLI for an extended period of time when compared to the language of typically developing children.

The question might be raised as to **why** children with SLI should have problems with Spell-Out at PF. Although we do not have any conclusive answers to this question, we agree with Berwick and Chomsky's (in press) statement that "externalization is not a simple task." As they point out, externalisation has to relate two rather distinct systems to each other: the computational system for thought, on the one hand, and the sensorimotor system, on the other. As Berwick and Chomsky (in press) point out, "morphology and phonology – the linguistic processes that convert internal syntactic objects to the entities accessible to the sensorimotor system – might turn out to be quite intricate, varied and subject to accidental historical events." They further argue that these domains of human language are the domains of parametrisation

and diversity. Furthermore, morphology and phonology appear to be those domains of language that children take longest to master fully. Our Afrikaans SLI data seem to offer support for this.

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