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Language impairment from a processing perspective

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1. Introduction

Children with Specific Language Impairment constitute a special group among young monolingual children. Otherwise no different from unimpaired children, they have problems acquiring their first language. It is often claimed that these children have general problems with grammatical morphology (e.g. Clahsen 1992, Leonard et al. 1992, Gopnik 1994, Clahsen et al. 1996, Rice & Wexler 1996).

> There seems to be a consensus that SLI children have problems in the area of grammatical morphology (Clahsen 1992:3)

Although the vast majority of studies report morphological problems there are also indications that word order can be problematic for SLI children. For example, studies of SLI in German (Grimm & Weinert 1990, Clahsen 1992, Clahsen et al. 1996) show that German children have problems with both agreement morphology and word order. For Swedish SLI children, problems with word order are found to be one of the most typical characteristics of SLI grammar (Nettelbladt et al. 1989, Håkansson & Nettelbladt 1993, 1996, Hansson & Nettelbladt 1995).

In this paper I will claim that it is not the morphological or syntactic markers *per se* that present problems for SLI children, but rather the level of grammatical processability that underlies them. Due to typological differences between languages, language impairment is visible in what is traditionally seen as different linguistic levels. This implies that in some languages morphology seems to be impaired, but in other languages word order and subordination are affected.

As the theoretical framework for the study, Pienemann's Processability Theory will be used (Pienemann 1996, to appear, Pienemann & Håkansson, to appear). This theory is based on Levelt's (1989) model of language production. Processability Theory focuses on the dynamic character of

language acquisition and spells out in detail the processing prerequisites that are needed for the automatization of grammatical rules on different developmental levels. By choosing a psycholinguistic theory of second language development I want to stress that I regard SLI grammar from a learning perspective. The SLI children are treated as language learners, building their own interlanguage grammar (cf. Selinker 1972), and not as having a static, defective variety of the target language.

The paper is organized in the following way. First, a short overview of the theoretical framework will be given. After that I will present some relevant aspects of Swedish grammar. Then the empirical study on the acquisition of Swedish by impaired and unimpaired children will be described. The results are first given as group means where the children are treated as two homogenous populations, and then individual variation is discussed. Finally, some preliminary conclusions are drawn regarding the importance of looking at underlying grammatical processes in cross-linguistic comparisons.

2. Processability Theory

According to Pienemann's (1996) Processability Theory, language acquisition can be described as a gradual construction of a mental grammar. Each stage in the development is built upon the automatization of the preceding stages.

> The basic claim behind processability theory is that second language acquisition can be understood as the gradual construction of the computational mechanisms needed for processing the second language. Processability theory spells out those mechanisms in abstract, non language-specific terms which are then translated through a linguistic theory to the requirements of individual languages. Determining the hierarchy of processing prerequisites constitutes an explanation of the developmental problem in language acquisition: the second language unfolds in the sequence in which the hierarchy of processing prerequisites becomes available. (Pienemann & Håkansson, to appear)

The learners' task is to build up his or her own grammar by testing hypotheses about the target language. The precise prerequisities needed for the processing of each stage in the development are described in table 1.

As a first step in this developmental route the learner identifies and acquires the *words* of the target language (level 1). The next step is to categorize the lexicon and list the diacritic features of the lexemes in the lexicon. This is the level of *lexical morphology* (level 2). Lexical morphology is a necessary prerequisite for *phrasal morphology* (level 3) to

Table 1. Hierarchy of processing prerequisites (after Pienemann 1996).

Processing prerequisites	*Exchange of grammatical information*
5 • clause boundary	clause hierarchy; main and subordinate clause
4 • S-procedure/ WO Rules	exchange of information between phrases
3 • phrasal procedure	exchange of information within phrases
2 • category procedure	no exchange, diacritic features listed in lexicon
1 • word/ lemma	no morphology; invariant forms, chunks

be processable. The processing of phrasal morphology allows the learner to exchange diacritic features between head and modifier in a phrase. When phrasal morphology is automatized, *inter-phrasal morphology* is processable (level 4). This step implies that the grammatical functions of the words in a clause will be accessible and exchange of grammatical information between phrases is possible. At this level the rule that regulates subject-verb inversion is processable. Finally, when main clause word order rules are automatized, the hierarchical relation between main and subordinate clauses is processable and the learner can apply different grammatical rules in *main and subclauses* (level 5).

3. Grammatical structures in Swedish

The sequences in which the target language develop were described in a non-language-specific manner in the section above. In Pienemann & Håkansson, to appear, Swedish grammar was translated into the hierarchy of processing complexity (PH). Here, I shall simply note those parts of Swedish morphology and syntax that have been selected for this study, and discuss the order in which they are predicted to develop in the acquisition of Swedish.

The following Swedish structures will be analysed:

Suffixes on nouns and verbs.
Agreement in NPs and VPs.
Subject-verb inversion in declaratives
Subordinate clause word order

Table 2 illustrates how these structures of Swedish are incorporated into the processability hierarchy.

3.1 Lexical morphological markings

At level 2, category procedure, we find suffixes which are used to mark gender (neuter and uter) and number (plural) on nouns, and tense (present,

Table 2. Processing hierarchy of Swedish structures (after Pienemann & Håkansson, to appear).

Processing prerequisites	*Exchange of information*	*Outcome: Swedish grammar*
5 • clause boundary	main and sub clause	subordinate clause word order
4 • S-procedure	inter-phrasal information	INVERSION
3 • phrasal procedure	phrasal information	VP agr (aux + supine)
2 • category procedure	lexical morphology	NP; plural VP; past, present
1 • word/ lemma	'words'	

past) on verbs. These morphemes are *lexical* since they belong to the diacritic features listed for every word in the lexicon.

3.1.1 Finiteness. In traditional accounts of Swedish grammar it is assumed that tense markers also express finiteness. In this paper, I will not follow that tradition but instead I will take the GB perspective and follow Platzack's (1996) suggestion that it is possible to distinguish finiteness from tense. In that way, the tense marker can be assumed to be a diacritic feature which is a part of the verb[1].

This separation of tense from finiteness bears important implications for the PH predictions. From the hierarchy of processing prerequisites presented above it can be expected that the processing of tense marker will appear *before* the processing of finiteness takes place, since the tense marking in itself does not involve any exchange of grammatical information between constituents, but is only a feature in the lexicon.

3.2 Phrasal morphology

At level 3, there is exchange of information between elements within the same phrase and the unification of the diacritic features is visible via agreement morphology. In Swedish the *phrasal morphology* is rather rich, with number and gender agreement between article, adjective and noun in NPs, as in the example below (Neut=neuter, U = uter/common):

(1) [[Ett]$_{Neut}$ [nytt]$_{Neut}$ [lamm]$_{Neut}$]$_{NP}$ 'a new lamb' [[En]$_{U}$[ny]$_{U}$[hund]$_{U}$]$_{NP}$ 'a new dog'

[1]According to Platzack 1996, finiteness in Swedish is situated in C. This implies that finiteness is expressed either by movement of a tensed verb to C or by use of a complementizer to introduce an embedded clause, see Håkansson (forthc).

In the VP, there is exchange of grammatical information between auxiliary and main verb to ensure that only one verb is marked for tense:

(2) [[har]$_{AUX\text{-}PRES}$ [ätit]$_{V\text{-}SUPINE}$]$_{VP}$
'has eaten'

Swedish perfect tense consists of the auxiliary *har* 'have' and a main verb in supine form. The supine is a non-finite form of the verb and cannot be used in isolation in main clauses. However, in subordinate clauses it is permitted to omit the auxiliary *har* and to use the supine form alone[2]. Examples 3-6 illustrate the phenomenon.

(3) Hon har köpt bil
'She has bought-SUP car'

(4) *Hon Ø köpt bil
'she bought-SUP car'

(5) ...att hon har köpt bil
'...that she has bought-SUP car'

(6) ...att hon Ø köpt bil
'...that she bought-SUP car'

Since the compound tense involves an exchange of information between constituents in the phrase, it is predicted that perfect tense will appear later than present and past tense in the development of Swedish.

3.3 Interphrasal morphology; word order rules

At the level of interphrasal morphology, the different grammatical functions of the constituents in the clause are identified and finiteness is used. Here, we commonly find subject-verb agreement, i.e. exchange of information between NP and VP. Swedish, in contrast to many other languages, does not have overt subject-verb agreement. Instead, the processing of this level is realized in the subject-verb inversion, which in Swedish is obligatory in yes/no questions, *wh*-questions where the subject is not questioned, and in topicalized declaratives.

Exchange of information between phrases is situated higher on the processability hierachy than exhange within phrases. Thus the subject-verb inversion is predicted to appear later than the perfect tense.

3.4 Clause boundary; subordinate clause word order

At the top of the processing hierarchy there is exchange of grammatical information between main clause and subordinate clause. In Swedish, word

[2]I sugggest that this is because there is no need to express finiteness on the verb in embedded clauses since it is already expressed in the complementizer. Another explanation is given in Hedlund 1992. She proposes that the supine suffix is in fact provided by a syntactic INFL-node and not derived from a morphological component.

order in subordinate clauses is different from the word order in main clauses. The V2-rule is only applied in main clauses, not in subordinate clauses. This means that main clauses have subject-verb inversion in topicalized clauses and the negation is placed after the finite verb. In subordinate clauses, however, the word order is always SVO and the negation is placed before the finite verb.

Following the Processability Hierarchy, subordinate clauses can be expected to appear after inversion in main clauses has been automatized, since there is a need of exchange of grammatical information between the clauses in order to treat the subordinate clause as a part of the main clause.

3.5 Predictions for the acquisition of Swedish

Concluding this section, I will summarize the PH predictions for the order of appearance of Swedish structures.

(i) Simple tense before compound tense
(ii) Compound tense before subject-verb inversion
(iii) Subject-verb inversion before subordinate clause word order

4. An empirical study of Swedish SLI children

4.1 Material and procedure

The aim of this study is to characterize Swedish SLI grammar in terms of stages of processability and to compare the developmental route of SLI children to the development of Swedish as the first language in unimpaired children.

10 SLI children and 10 unimpaired monolingual children were chosen as subjects in the study (table 3). The SLI children were independently diagnosed as SLI by speech therapists and their language performance was well below age expectations. A group of younger unimpaired children was chosen as control to the SLI children. Since the aim is to find early developmental stages, and not to define SLI children, we chose not to use unimpaired age-mates as control. Earlier studies have shown that Swedish unimpaired children use simple and compound tenses and word order in main and subordinate clauses according to the target language norm already at the age of four years. Instead we aimed at finding unimpaired children as young as possible to match the grammatical stages of the SLI children. The results from the pilot study showed that if the same elicitation material was to be used, the children in the control group could not be younger than three years of age.

Table 3. Subjects in the study.

	number	*age limits*	*mean age*
SLI children	10	4:0-6: 3	5:1
Unimpaired	10	3:1-3:7	3:4

Table 4. Test items and elicitation metods.

Test items	*Name of test*	*Elicitation procedure*
NP: plural	The Lund material[3]	picture description
VP: present, past		picture description
VPagr [aux + Vsupine]	Story book[4]	story retelling
INV	Story book	story retelling
Sub clause word order	LOTTO-game[5]	elicited imitation
		Memory-game

The children participated in a test session with an adult. Structures that were regarded as relevant for the different levels of processability were chosen and tests were designed to create obligatory contexts for these structures. The whole procedure was recorded. Table 4 shows which test items were elicited and by which procedures.

4.2 Analyses

The interviewer used a coding form to transcribe the elicited utterances. In addition to this form, parts of the dialogue were transcribed.

It is important to keep in mind that the perspective is developmental. The child's linguistic production is taken as representing an autonomous system and the aim is to investigate production or non-production of grammatical morphology at certain levels of processing complexity. This means that irregular verbs that are inflected as regular by the children (e.g. *drickte* instead of *drack* 'drank') are not analyzed as errors but as examples of productive morphology.

5. Results

The results of the elicitations were compiled both on a group level and for each individual. They will be presented under the headings *lexical*

[3]Holmberg & Stenkvist 1978. This material is commonly used by speech therapists for the language assessment of SLI children.
[4]Created by Kristina Hansson.
[5]Created by Kristina Hansson.

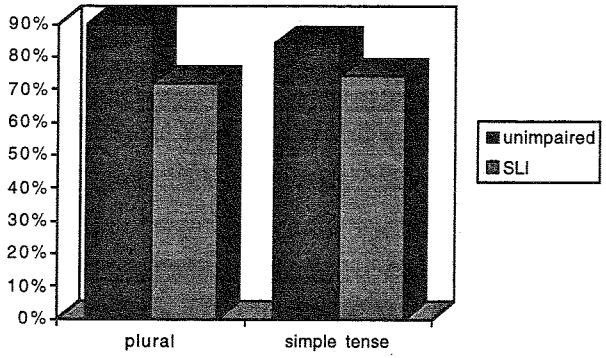

Figure 1. Use of suffixes for plural and simple tense (present, past) in obligatory contexts by 10 unimpaired children and 10 SLI children.

morphology, phrasal morphology, inversion, and *subordination*. These subdivisions represent different levels of the processability hierarchy.

5.1 Lexical morphology

Use of lexical morphology (plural and simple tense) was calculated on group level in percentages of suppliance in obligatory contexts. The results for the two groups are shown in figure 1. As can be seen from the figure, there is not a systematic difference between unimpaired children and SLI children in use of lexical morphology. Thus, the Swedish SLI children seem to be different from English SLI children who have been reported as being "especially weak in their use of grammatical morphology" (Leonard et al. 1992:152).

5.1.1 Verbs. Studies of English SLI children have shown that most errors occur with verbal morphology (Gopnik 1994, Leonard et al. 1992). It has even been suggested that tense markers could be used as a diagnostic tool to identify cases of SLI (Rice & Wexler 1996). The observed difference between Swedish and English SLI children in this respect calls for a more thorough examination of verbal morphology[6].

[6]Earlier studies of Swedish SLI children have, in fact, reported that Swedish SLI children have problems with verb morphology (Hansson 1992, Hansson & Nettelbladt 1995). However, a closer look at their results reveals that the problems most often concern what is called phrasal morphology in Processability Theory, and not the addition of a suffix to a verb stem.

Overgeneralizations of regular suffixes for irregular verbs are especially interesting, since they cannot be rote-memorized forms, but reflect a productive use of morphology. The Swedish SLI children supply tense suffixes to verbs in a consistent manner (74% of obligatory contexts, versus 84% by unimpaired children). If we take a closer look at the overgeneralizations of regular verb suffixes to irregular verbs, we find that the SLI children have even more examples of overgeneralizations than the unimpaired children have. The fact that SLI children use regular forms instead of the irregular ones indicates that their ability to use grammatical morphology is not impaired but, in fact, quite productive, see below.

Form used	*target form*		*no. ex SLI*	*unimpaired*
DRICKTE	*drack*	'drank'	4	4
DYKTE	*dök*	'dived'	2	–
GRÅTE	*grät*	'cried'	2	–
HÅLLDE	*höll*	'held'	1	–
LÄGGDE	*lade*	'put'	1	–
SITTDE	*satt*	'sat'	1	–
SKRIVDE	*skrev*	'wrote'	–	1
SOVDE	*sov*	'slept'	2	–
SPRINGDE	*sprang*	'ran'	1	3
ÄTE	*åt*	'ate'	4	4
total			18	12

Also this result stands in striking contrast to some findings from English SLI:

> There is some evidence that they have acquired the knowledge of the correct morphological form for regular past tense verbs using a rote memory system that non-impaired subjects are thought to reserve for irregular forms. In their spontaneous speech they virtually never produce morphologically nonce forms (such as *eated*); they use irregulars more reliably than regulars ... (Gopnik 1994:131)

A possible explanation for the observed difference between Gopnik's English subjects[7] and ours might be that the English and the Swedish subjects happen to be at different levels of the processability hierarchy. Hypothetically, Gopnik's subjects may be at level 1, with no productive

[7]It is interesting to note that in another study of English SLI, Leonard et al. 1992 mention that 20% or the errors among their SLI children were errors of overgeneralizations. This means that at least some impaired children use what I have called productive morphology. There is, however, an important difference in the interpretation of these forms. I interpret the child's grammar as an autonomous system in its own right, which implies that overgeneralizations are interpreted as productive morphology at level 2, whereas the same feature is interpreted as an error in Leonard et al.'s study.

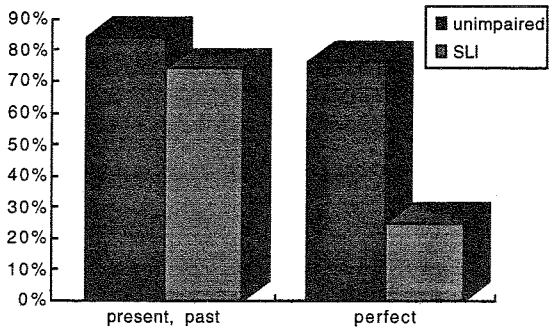

Figure 2. Use of present and past tense suffixes and auxiliary + supine (perfect tense) in per cent of obligatory contexts by 10 unimpaired children and 10 SLI children.

morphology, whereas our subjects are able to process level 2, i.e. lexical morphology. The explanation can also lie in the typological differences between Swedish and English. In Swedish, verb tense is less complex since it is possible to separate tense from finiteness, whereas in English tense markings are inseparable from agreement markers (e.g. Cann 1997). In terms of processability, this means that the Swedish simple tense markers are level 2 markers (lexical morphology) and the English markers are level 4 markers (inter-phrasal morphology).

5.2 Phrasal morphology

The results above showed that simple tense morphology is not problematic to Swedish SLI children. What about compound tense? Since compound tense is placed on a higher level in the PH, it could be expected that compound tense is more difficult to produce.

Further analyses of the transcripts therefore focused on the use of perfect tense. As was mentioned above, the production of perfect involves the use of auxiliary *har* 'have' together with a main verb in supine form. This implies that there must be some agreement; the two constituents in the VP must agree so that one of them takes the role of the tensed verb.

The comparison between the use of simple tense and the use of compound tense reveals a dramatic difference. The children with SLI differ greatly from the unimpaired children. The unimpaired children used compound tense with the insertion of an auxiliary in 76% of the obligatory

contexts, whereas the SLI children only used the auxiliary in 25% of the cases. Figure 2 illustrates this difference.

The difference between the unimpaired children and SLI children is exemplified below, where the youngest unimpaired child (no. 9, age 3;1) is compared to the oldest SLI child (Henrik, age 6;3). The children are performing a story retelling task, where the interviewer is using the perfect tense and asking the question *What **has happened** here?*. The child is expected to answer in perfect tense *He **has eaten** the fish*, etc.

UNIMPAIRED 9 (age 3;1)	*SLI Henrik (6;3)*
han **har** slä- **rasat** hela 'he has bro- turned-SUP the whole'	han Ø **vält** bordet 'he turned-SUP the table'
han **har lekt,** ta bort garnet 'he has played-SUP, take the thread'	han Ø **tagit** garnnystan 'he taken-SUP the thread'
han **har ätit** upp den 'he has eaten-SUP it'	han Ø **ätit** upp fisken 'he eaten-SUP the fish'
fisken **har trillat** ner 'the fish has fallen-SUP down'	dom Ø **tagit** upp fisken och **dödat** 'they taken-SUP the fish and killed-SUP'
han **har drickit** upp mjölken 'he has drunk-SUP the milk'	Ø **dricket** upp de 'drunk-SUP it'

Although both children use the supine forms of the verbs (correctly, except for some missing vowel changes) and not the past tense, we can see that it is only the unimpaired child that manages to produce the auxiliary with the supine form of the main verb. The SLI child very consistently omits the auxiliary and uses the supine form alone, which is not permitted in main clauses in Swedish.

As in English, the Swedish auxiliary *har* 'have' can also be used as a main verb. In that case it has a semantic content, in contrast to when it is used as an auxiliary. Interestingly, the SLI children have no difficulties in producing the word *har* 'have' when it is a main verb (e.g. Henrik: *Han ville ha nallen* 'He wanted to have the bear')

5.3 Inversion

The fact that SLI children in this study do not use phrasal morphology suggests that they have not reached the level where they can process exchange of grammatical information between constituents (level 3). Therefore, we can predict that they do not have access to the higher levels either. If they are subject to the constraints from the processability

hierarchy then they are not able to process inverted word order (level 4) or subordination (level 5).

The results from the investigation of inverted word order in obligatory contexts showed this to be true. The inversion rule is violated to a greater extent by the SLI children than by the unimpaired children. There are 13 examples (out of 22 contexts) from XSV order instead of XVS in topicalized main clauses in the SLI group, and only one occurrence in 61 obligatory contexts in the unimpaired group.

Another result from the analyses was that the SLI children provided fewer contexts of obligatory inversion than did the unimpaired children. Only four of the SLI children used preposed adverbs, in contrast to the control group, where all ten children used preposed adverbs[8].

When the SLI children did prepose the adverbs, however, they often used them together with non-inverted clauses. This behaviour is quite common among second language learners of V2 languages (and aphasics, cf. Håkansson 1995). It has been explained as the only possible solution when the speaker is able to process preposed constituents but not able to process subject-verb inversion (Pienemann 1996).

The prerequisites needed for the processing of subject-verb inversion are available later, at level 4, when phrasal processing has been automatized. This explains why SLI children violate the verb second rule, as is shown in the examples below:

Unimpaired (age 3;1)	*SLI (5;11)*
sen **ville han** han ha nallen	sen **jag vill höra**
'then wanted he he have the bear'	'then I will listen'
sen **ramla krukan**	sen **han trilla** här
'then fell the vase'	'then he fell down'

5.4 Subordinate clauses

According to the processability hierarchy, a learner is not able to process subordination before the phrasal and inter-phrasal agreement is automatized. Because of this constraint we don't expect the SLI children in this study to be able to access level 5 and use subordinate clause word order.

[8]According to Processability Theory, preposing of adverbials is processable at level 3, i.e. the level below inversion. This is also the level of VP agreement. Thus, it can be predicted that the children who are unable to process VP agreement also are unable to process topicalized adverbs. There were no tasks specifically aimed at eliciting this structure in the present study, but the results from the elicitation of inversion suggest that many of the SLI children are in fact unable to process preposed adverbs.

Table 5. Examples from the elicitation experiment with 10 SLI children.

TARGET SENTENCE:	*Hon har en hund som inte skäller* *'She has a dog that not barks'*		
Filip:	Hund ha	inte skäller	'dog have not barks'
Greg:	Jag inte vet	inte skäller	'I not know not barks'
Josef:	Hon har en hund	inte skäller	'She has a dog not barks'
Henrik:	Hon har en hund	inte skäller	'She has a dog not barks'
Robert:	Hon har en hund	inte skäller	'She has a dog not barks'
Tony:	Hon har en hund	inte skäller	'She has a dog not barks'
Krista:	Hon har en hund	inte skäller	'She has a dog not barks'
Fabian:	Jag har ingen hund m	skäller	'I have no dog m barks'
Hillevi:	Hon har en hund f	inte skäller	'She has a dog f not barks'
Hanna:	Hon har en hund som	inte skäller	'She has a dog that not barks'

Subordinate clause word order was elicited by two different methods, an elicited imitation and a communicative game (a memory game). Both these aimed at having the child use negative placement in relative clauses. The results from the analysis showed that most of the SLI children never used any complementizer to introduce the relative. As a consequence of this, their clauses could not be defined as subordinate clauses. In the unimpaired group, nine out of the ten children used complementizers and the subordinate clause word order according to the target norm. In the SLI group, only four children used complementizers (interestingly enough, three of them were the same children as had used preposed adverbs, i.e. they were able to process levels 3-5)

To investigate level 5 – exchange of grammatical information between main clause and subordinate clause – the analytical procedure was changed. Instead of analyzing the subordinate clause word order, the children's production was analysed as to whether they supplied complementizers in obligatory contexts. The use of complementizers (e.g. *som* 'that', *vad* 'what') was interpreted as a sign that the hierarchical relationship between main and subordinate clauses was known by the children.

The examples in table 5 are taken from the elicited imitation experiment. They reveal that the majority of the SLI children are not aware of the obligatory complementizer in the relative clause. They are strikingly consistent in omitting the relative complementizer *som.*

If we take a closer look at the individual children's performance, we can discern four subgroups within the SLI children. In group one, we find Filip and Greg who are unable to imitate the main clause *she has a dog ...*, but

manage to imitate the negation and the verb from the subordinate clause[9]. The majority of the children (Josef, Henrik, Robert, Tony and Krista) belong to group two. They imitate the whole sentence correctly except for the omission of *som*. In group three we find Fabian and Hillevi, who seem to be on the verge of processing a complementizer. They produce 'dummies' or 'fillers', the phones *m* or *f* instead of a word at the place where the complementizer was to be expected. The use of phonologically vague dummies as a strategy to fill an empty position has been observed in several studies from early development in unimpaired children (cf Peters 1995, Müller 1996), and it is generally assumed to be a precursor of the target item. Finally, Hanna is the only member of group four. She imitates the whole sentence including the complementizer.

None of the unimpaired children omit the complementizer in the elicitation experiment. They either refuse to imitate anything at all (three children), answer with a name (three children) or imitate the whole sentence, including the complementizer (four children).

5.5 Summary of results

The results of the comparison between the two groups are summarized in figure 3. They reveal that there are no great differences between unimpaired children and SLI children in the use of lexical morphology for plural, present and past tense. However, there are considerable differences between their use of perfect tense, subject-verb inversion and suppliance of complementizer. In other words, according to the mean values on group level, the SLI children are able to process level 2, but not levels 3-5 whereas the unimpaired children have the prerequisites to process level 5.

6. Individual variation

As was discussed above, the results of the analyses show that there is considerable variation among the individual children. Interestingly, the amount of individual variation is much greater in the SLI group than in the group of unimpaired children. However, the variation is not randomly distributed. If we arrange the children along a scale of processability, the variation becomes strikingly systematic.

[9]Placement of negation is not discussed in this study. However, it is worth noting that Greg always places the negation in front of the verb. This is common in early L1 acquisition as well as in early L2 acquisition and it has been classified as a level 2 structure of Swedish (Pienemann & Håkansson, to appear)

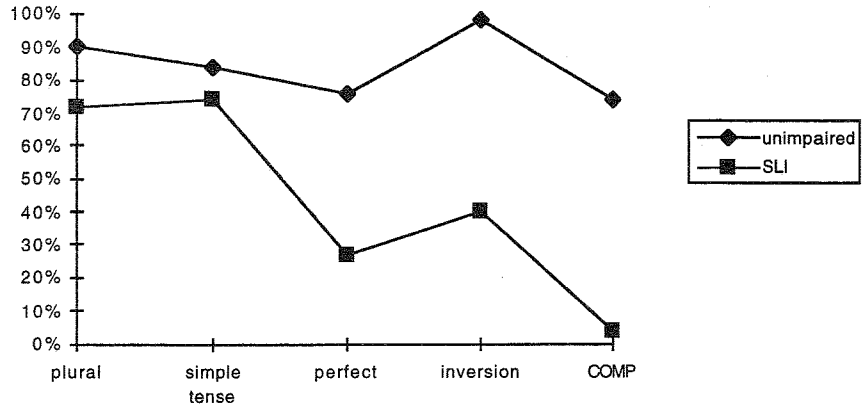

Figure 3. Use of plural, present and past tense morphology, perfect tense, subject-verb inversion and complementizers (COMP) in per cent of obligatory contexts by 10 unimpaired children and 10 SLI children.

In table 6 the data is ordered in an implicational scale, according to the predictions from the processability hierarchy. A plus in the row indicates that the child has at least one productive example in an obligatory context of the structure in question, a minus means no occurrences. The children are listed in order of proficiency, from the smallest to the largest number of PH levels.

The table shows that there is a clear implicational relationship between the processability of the different structures. If the children can process a structure to the right in the table, they can also process a structure to the left of it. Starting with the left column, we can see that all the SLI children show that they are able to process lexical morphology. Only four children (Hillevi, Hanna, Krista and Tony) have examples of the phrasal morphology in the next column, at level 3. Three children, Hillevi, Hanna and Robert, have examples from level 4, INV. Finally, four children, Hillevi, Hanna, Robert and Henrik have examples of COMP.

There are only three exceptions to the expected implication, which means that the scalability is 0.93 (Guttman's coefficient of reproducibility). It is generally assumed that a scalability above 0.9 indicates a valid scale (Andersen 1978).

Table 6. Binary implicational table for the individual SLI children.

PH level:	2	3	4	5
Structure:	*Pl-Tense*	*Aux*	*INV*	*COMP*
Filip	+	–	–	–
Greg	+	–	–	–
Josef	+	–	–	–
Fabian	+	–	–	–
Tony	+	+	–	–
Krista	+	+	–	–
Henrik	+	(–)[10]	(–)	+
Robert	+	(–)	+	+
Hillevi	+	+	+	+
Hanna	+	+	+	+

7. Conclusions

The results from the present study show the importance of investigating the processes underlying surface structures in crosslinguistic comparisons. The analysis revealed that what is traditionally thought of as 'tense morphology' is expressed by different processes in English and Swedish. In English, present tense cannot be separated from inter-phrasal agreement. Present tense is indicated by third person singular [-s] which implies that it involves the processing of inter-phrasal information, at level 4. In Swedish, on the other hand, the tense suffix only involves a marking of a diacritic feature of the verb, and is processed at level 2. In other words, it is easier to process present tense morphology in Swedish than in English.

However, Swedish grammar presents other problems to SLI children. The SLI children in this study differ from the unimpaired children in the processing of compound tense and word order. For the automatization of these structures, there has to be exchange of grammatical information between constituents. Thus, what English SLI children as well as Swedish SLI children have problems with is *precisely the same,* i.e. the exchange of grammatical information between constituents. In other words, the source of the problem is the same, but it is realized in different structures in the two languages. This finding stresses the importance of cross-linguistic studies to reach a better understanding of the nature of language impairment.

[10]Parenthesis means exceptions to the expected implication.

Another important finding of this study is that the individual variation found in the SLI children is not random but systematic. By using implicational scaling to capture the variation, it was found that the SLI children in this study differed from the unimpaired children, but they differed to a smaller or a greater degree. They can all be placed along a continuum of processing complexity. This suggests that it is fruitful to use a developmental perspective and study SLI children as individuals on different levels, instead of regarding them as a homogenous population with a common deficit.

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