SLI AS A PROCESSING DEFICIT?

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Abstract

The question “Is SLI a processing deficit or a representational deficit?” have been the focus of attention in language disorder studies and it has been investigated in various languages. Declarative memory is viewed as an “associative memory that stores not only facts and events, but also lexical knowledge, including the sounds and meaning of words,” whereas procedural memory sub-serves the implicit learning and use of a symbol manipulating grammar across sub domains that include syntax, morphology and possibly phonology. The present study provides an overview of SLI accounts and reviews Orgassa & weerman’s work (2008) in detail with reference to them. In order to determine whether SLI is caused by linguistic representational deficit or by general processing problems they conducted an experiment on the acquisition of Dutch gender agreement in attributive adjectival inflection and definite determiners in different groups of learners: typically developing L1 children, L1SLI children, impaired and unimpaired L2 children. For adjectival inflection adult L2 were also included. The first language of L2 group was Turkish. They built their argumentation on the differentiation between referential versus processing accounts.

Keywords: SLI, representational deficit, processing deficit,
Introduction

The Surface Hypothesis

Leonard et al. (1989) proposed a surface hypothesis that assumes a general processing capacity limitation in children with SLI. This account assumes a normal underlying grammar in children with SLI but they have problem of slow intake of data due to reduced speed of processing. The organization of these children grammar, the order and type of hypothesis they form are not different from normally developing children. These children have problem in perceiving grammatical morphemes of relatively short duration e.g. the third person singular s and past tense “ed” inflections, possessive s, articles, copula, auxiliary be forms, infinitival to, and the Complementiser that etc. processing is pressed from two directions, processing of a first item must be completed before it fades away from the memory and it must be processed in time for the next item. It is assumed that children with SLI can’t complete processing of one item before the next item appears. As a result some material is processed incompletely or not at all. It is expected that in a language such as English if an inflected word is processed incompletely processed only bare stem will be retained. Another reason is that words with brief inflections resemble closely to their bare stem than words with longer inflections.

The reason behind relating the perceptual properties to processing is that if the input material is not perceived properly, it will not be registered adequately. Processing is performed on material already registered. This results in incomplete processing. Children with SLI require more exposure to these morphemes than normally developing children. These morphemes may be sufficiently abundant in the input but they are processed incompletely, therefore fewer instances of these morphemes had an impact on the underlying grammar. Only the fully processed forms have an impact on the paradigm.
Leonard et al. suggested a slow development of grammatical morphology in English speaking children with SLI. (They observed that children with SLI have difficulty in processing free standing closed class morphemes e.g. auxiliaries and articles. When these forms are separate morphemes, children have to perform additional operations, such as discovering the grammatical function of the form and placing the form in the proper cell of a morphological paradigm. Hence, these children require greater exposure before these brief grammatical forms are established in grammar.)

According to Pinker (1984) children initially create word specific paradigms. A paradigm is a representation model framework of a set of related morphemes. Paradigms contain cells with different levels and dimensions. In case of inflection, each cell contains the stem as well as inflection. When the child learns the new word, a new word specific paradigm is created. These word specific paradigms then develop into general paradigm that is paradigms containing inflections free of stem. When the general paradigms have not yet been developed, inflected forms require additional operation like the uninflected forms. For instance laughed requires relating laughed to laugh and then splitting the paradigm to include a separate cell for past and then placing the laughed in it. According to surface hypothesis, these additional operations lead to incomplete processing of inflected words of short duration, as a result these words are reduced to their bare stem counterparts. Therefore, English speaking Children with SLI require greater number of exposure before these forms are fully computed and properly placed in paradigms. It is assumed that the speed of processing limitation is general rather than specific. Morphological features in languages such as English are quite fragile. Other languages that are typologically different from English may have different linguistic profile for this same processing limitation.

There are two fundamental assumptions of surface account, first is that already perceived material can be lost when additional processing is required, Second is that the processing
limitations place the material of relatively short duration at a great risk of loss. Processing limitations may prevent brief material from being preserved or the similarities between the bare stem and the same stem with brief close class morphemes may promote the replacement of the later by the former. Omission is the usual result of incomplete processing but substitutions are also possible.

Several investigators criticized surface hypothesis for its shortcomings and many empirical finding suggest that the account is incomplete. Surface hypothesis fails to account for differences in degree of use of grammatical morphemes that have identical phonetic values, such as plural s and third person singular verb inflection (Gopnik 1991, Rice & oettiing 1993). Children with SLI sometimes produce preverbal case errors e.g. Me take that. Surface hypothesis can only account for problems with nominative case pronouns, because these pronouns are very brief in duration but there is no reason to expect forms such as me, her, and him, to replace their nominative case counterparts, because they have longer duration.

Another empirical finding that pose problem for surface hypothesis is a finding by Leonard (1995) that children with SLI showed lower percentage of auxiliary inversion in wh questions than a group of MLU controls. The surface accounts assumes a normal underlying grammar in of children with SLI, there is no reason for expecting lower rates of inversion when an auxiliary is available.

The surface hypothesis provides no rationale for expecting problems with irregular past tense in children with SLI. Some investigators have found higher percentages of use of irregular than of regular past in these children (e.g. Leonard, Bortolini, McGregor1992, Oetting et al. 1997).
There are also some other empirical findings from languages other than English for which the account has no explanation. For example Clahsen et al. (1992) found that German speaking children produced participles as accurately as their MLU controls. Some of the components of participles (e.g. ge, t) are of short duration and should have produced differences between the groups.

Rice and Oetting (1993) compared children with SLI and MLU controls in the use of plural s and third person singular s. Differences between the groups were small for the plural inflection while for third person singular the differences were much larger. Because the plural is expected to be learned earlier than third person singular. However Rice and Oetting (1993) found no differences between subgroups of children with SLI and MLU controls. Whose percentage of use of plural s was relatively low. According to surface account, the MLUs of the sub group with SLI should have been higher.

Grammatical representational accounts of SLI

There are many accounts that assume deficit in underlying grammar of children with SLI. Some of these accounts focus on grammatical deficit as a knowledge problem. SLI children have problems with morphosyntax due to incomplete knowledge of particular rules, principles, and constraints of grammar. As a result of limitation in grammatical knowledge, different accounts assume different patterns of weaknesses in children’s sentence production and comprehension.

Functional category deficit. This account assumes that children with SLI have problems in acquiring functional categories (Leonard 1995, Allen & moss 1991). The logic behind this proposal is that in the earliest stages of grammatical development the grammars of children acquiring language such as English contain lexical categories only (Noonan et al. 1992, Platzack 1990, Radford 1988, 1990). This proposal comes from work with young normally
developing children. It is assumed that at an early stage of development grammar of normally
developing children contains only the lexical categories; functional categories appear later
until children reach approximately age of two years.

**Extended optional infinitive account** Rice and her colleagues presented this account that is
based on Wexler’s work. Who argued that account young normally developing children go
through a stage during which they fail to obligatory mark a tense in main clause (Wexler
1994). According to extended optional infinitive account, the problem is one of knowledge,
these children do not know that tense is obligatory in main clauses, they understand the tense
and agreement but only they treat them as optional. It is assumed that by the time normally
developing children reach five years of age, they have proceeded to the more advanced stage
of using finite forms consistently where these are required in adult grammar. Children with
SLI are assumed to remain in the earlier stage for an extended period (Rice, Wexler & cleave
1995, pp 852-853). The extended optional infinitive account doesn’t describe how long
children with SLI remain in the optional infinitive stage. However, serious problem with
tense and agreement can persist through the school years and even adulthood (Ullman &
Gopnik, 1994)

**Implicit grammatical rule deficit** Gopnik et al. (1990, 1994) proposed the feature blindness
theory. They proposed that children with SLI have permanent inability to acquire implicit
rules to mark tense, number and person. Features of number and person etc. are assumed to
be missing from underlying grammar of children with SLI. As a result morphophonological
rules are missing. Although inflected words are occasionally noted in the speech of children
with SLI but it was assumed that these forms are phonological variants with no grammatical
significance. According to Gopnik et al. children with SLI are unable to formulate implicit
grammatical rules. Without access to the implicit rules, individuals compensate in one of the
two ways. One option available to them is to memorize inflected forms as unanalyzed lexical
items e.g. learning of went as the past form of go. The second option is to employ explicit rules that have been taught to them, such as add for more than one or add “ed” to describe past events (Gopnik, 1994).

**Narrow rule learning** This account assumes that children with SLI develop a normal grammatical system but they apply these rules to a restricted range of contexts. According to Morehead and Ingram (1973) SLI children do not develop a strange or unusual grammatical system that is different from normal children. Rather, they develop a quite similar grammatical system with a marked delay in the onset and acquisition time. Once this grammatical system is developed, SLI children do not use them as creatively as normal children for producing highly varied utterances. It is assumed that rules can be applied productively. The problem is that when these rules finally appear they are applied to a more limited range of possible exemplars than they should. (They reported that a group of children with SLI produced grammatical constructions using a narrow range of syntactic categories than MLU controls. Ingram and carr (1994) observed in their case study that children with SLI used a restricted type of verb compliments. These findings point to a narrow scope for the grammatical rules used by children with SLI.)

**The missing agreement account** This account assumes that agreement is strongly affected in children with SLI than Tense. For instance Past tense verb inflections are not assumed to be problematic for children with SLI because they do not involve agreement. Similarly difficulties with determiners are not expected to extend to definiteness because this feature is not related to agreement. The reason behind this selective impairment is that children with SLI have problem in establishing the structural relationship of agreement. Clahsen (1989) suggested that these children lack the knowledge of asymmetrical relations between categories, where one category controls the other. According to missing agreement account children with SLI do not have a paradigm of person and number verb inflections, they are
unable to generate appropriate finite forms. Uses of correct forms are the results of children having learned them on a rote basis, as separate lexical items. Sometimes correct marking of gender on determiners and adjectives is seen because the children memorize the forms for specific determiner and adjective. (Grammatical details that are severely affected by this agreement deficit include: verb inflections, auxiliaries, copula forms that must agree with the subject according to person and number, gender and number agreement between determiners and nouns, possessive suffix, case marking on determiners etc.) Percentages of correct use in obligatory contexts are lower than MLU controls. Whenever the correct forms occur, these correct instances are rotely learned by children with SLI.

**Representational deficit for dependent relationships** van der Lely (1994, 1996) characterized the problems of children with SLI as a representational deficit for dependent relationships. According to this account, in addition to problems with tense, agreement, and case, the children with SLI have difficulty in assigning thematic roles to NP’s when only syntactic structure is given. Evidence comes from studies that show that children with SLI have difficulty in comprehension of reversible passives. They also have difficulty when asked to act out sentences containing nonsense verbs. Van der Lely (1994) found that SLI children have difficulty with sentences containing a novel verb.

**Orgassa and weerman’s findings**

In order to determine whether SLI is caused by Linguistic representational deficit or by general processing problems Orgassa & weerman (2008) conducted an experiment on the acquisition of Dutch gender agreement in attributive adjectival inflection and definite determiners in different groups of learners: typically developing L1 children, L1SLI children, impaired and unimpaired L2 children. For adjectival inflection adult L2 were also included. The first language of L2 group was Turkish.
Orgassa et al. (2008) compared children with SLI to the adult L2 learners. Children with SLI are not comparable to adult L2 learners but rather they are comparable to L2 children because both of them acquire language within the critical period but children with SLI construct rules based on the poorer intake than the unimpaired L1 children. They argue that children with SLI and adult L2 learners both rely on declarative memory that makes them comparable. They discussed two approaches to SLI i.e. SLI as a grammatical deficit and SLI as a processing deficit and tested both of them in their experiment. In order to see whether SLI is a processing deficit or grammatical deficit they compared the groups in the following pattern.

SLI as an agreement deficit
a. Child L1-SLI, child L2-SLI and adult L2 are comparable.

b. Child L1 and child L2 are comparable

SLI as a processing deficit:
a. Child L1, child L2, child L1-SLI and child L2-SLI are comparable.

b. The adult group stands alone.

**Adjectival inflections results:**

**Table 1:** shows the results of attributive adjectival inflections where a schwa is always required in the definite and indefinite common gender contexts. In Both contexts all child groups showed the higher rates of accuracy except the L2 adult group. The adult L2 learners incorrectly used the bare adjectives and show the higher percentages (32%, 35%, 27%) than the children groups. They attributed this error pattern to the early stages of acquisition.
Table 1: Inflection on attributive adjectives in definite and indefinite singular contexts (%) requiring schwa

<table>
<thead>
<tr>
<th></th>
<th>Definite common gender (e.g. de groene appel ‘the green apple’)</th>
<th>Definite neuter gender (e.g. het grote paard ‘the big horse’)</th>
<th>Indefinite common gender (e.g. een groene appel ‘a green apple’)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>schwa</td>
<td>*bare</td>
</tr>
<tr>
<td>Child L1</td>
<td>91</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Child L1-SLI</td>
<td>112</td>
<td>96</td>
<td>4</td>
</tr>
<tr>
<td>Child L2</td>
<td>82</td>
<td>94</td>
<td>6</td>
</tr>
<tr>
<td>Child L2-SLI</td>
<td>91</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>Adult L2</td>
<td>38</td>
<td>68</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 2: presents the results of the groups regarding the special rule of adjectival inflection, where a bare adjective is required in indefinite, singular, neuter gender contexts. The lower scores of SLI and L2 groups indicate that the acquisition of special rule for adjectival inflection is difficult for SLI and L2 groups. The adult L2 learner’s performance is not lowest in this context. (31%). This high score is related to table 1 adult L2 profile showing the incorrectly use of bare adjectives in adults (32%, 25%, 27%). That shows high score (31%) doesn’t mean that they marked the gender correctly. The error rate in using the schwa incorrectly shows that L2 children (77, 84) made more errors than L1 children (55, 69).

The unimpaired L1 children made fewer errors in the indefinite neuter context. The comparison between SLI group and unimpaired children shows the **SLI effect**. Statistical testing shows that the difference between the child L1 and child L1-SLI is significant. Whereas the higher scores in child L2 group are not significantly different from child L2 SLI group. Significant **L2 effects** were found between the unimpaired child L1 and child L2 groups. But no significant difference between the L1-SLI and L2–SLI children. The L2 -SLI were the least proficient group.
Table 2: presents the results of the groups regarding the special rule of adjectival inflection.

**Results of determiners**

Table 3 presents the results for the outcome of the common gender nouns. Learners hardly over generalize the neuter determiner “het” in the common gender context. Both child L1 and child L1-SLI achieved high accuracy (93, 89 %) in the common gender context than the L2 group (child L2 and child L2-SLI). Child L2-SLI showed less accuracy than child L1-SLI. Statistical testing showed the significant L2 effects between the child L1-SLI and child L2 –SLI and between impaired L1 and L2 groups. All group except the normal L1 children showed omission of definite determiners except the normal L1 Children. The child L1 SLI group used significantly less bare nouns (7%) than the child L2 –SLI group (29%). The child L2 group takes an intermediate position because their use of bare nouns (13%) can be compared to that of child L1-SLI children (7%). Unimpaired child L2 produced 10 % neuter gender determiner het as a substitute. It makes them comparable to unimpaired childrenL1 group (7%).

Table 3: Use of definite determiners with common gender nouns (%): common gender (e.g. de auto ‘the car’)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>de</th>
<th>*het</th>
<th>bare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child L1</td>
<td>278</td>
<td>93</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Child L1-SLI</td>
<td>348</td>
<td>89</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Child L2</td>
<td>234</td>
<td>77</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Child L2-SLI</td>
<td>267</td>
<td>71</td>
<td>0</td>
<td>29</td>
</tr>
</tbody>
</table>
Table 4 presents the production of definite determiners with neuter nouns. There are clear differences between the accuracy rates of L1 and L2 groups. Both L1 groups used het more accurately: the child L1 group (56-24%) outperforms the child L2 group (15-1%). The child L1-SLI (24%) group outperforms the child L2-SLI (1%). Both SLI groups produced higher error rates as compared to unimpaired L1 groups. It seems that the L2 effect is stronger than the SLI effect because the unimpaired children produced more errors than the L1-SLI group. Both child L1 groups substitute default gender de for neuter het, whereas L2 learners frequently produced bare nouns. Statistical testing shows that the L2 and L2 –SLI groups produced significantly more bare nouns than the unimpaired L1 and L1 and LI-SLI group. Orgassa et al. (2008) suggested that the occurrence of bare nouns is the characteristic of early stages in the development. Both child L2 groups seemed delayed in their acquisition of gender agreement.

Table 4: Use of definite determiner with neuter gender nouns (%) (e.g. het paard ‘the horse’)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>*de</th>
<th>het</th>
<th>bare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child L1</td>
<td>266</td>
<td>44</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>Child L1-SLI</td>
<td>347</td>
<td>71</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Child L2</td>
<td>244</td>
<td>68</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Child L2-SLI</td>
<td>262</td>
<td>76</td>
<td>1</td>
<td>23</td>
</tr>
</tbody>
</table>

Summing up the results, L1-SLI children produced higher error rates than child L1, L2-SLI showed more incorrect responses than L2. The error rates in child L2 are greater than child L1, and error rates in child L2-SLI are greater than child L1-SLI which shows a double delay in child L2-SLI. On the basis of above findings and results, they argued that all children generalized the schwa ending in adjectival inflection but not the bare adjective. On the other hand adults L2 learners produced both type of errors in adjectival inflections. These results are in line with the processing approach because all children revealed the same type of errors.
Both SLI children produced a higher rate of definite determiners omission, more overgeneralization of common determiner de in neuter contexts, and schwa overgeneralization in adjectival inflections where bare adjectives were required. Which suggests that poorer intake in SLI children leads to a delay and a higher error pattern than the unimpaired L1, L2 children.

**Discussion**

Orgassa & Weerman built their argumentation on the differentiation between referential versus processing accounts. They used Ulman's account as an example of a representational one, which is not a referential but a processing account. Declarative memory has been viewed as a system devoted to learning and remembering facts (semantic knowledge) and events (episodic knowledge), whereas procedural memory is implicated in the learning and processing of skills that require sequencing of mental representations or motor activities Ullman (2001). Ullman further proposes that “the declarative memory system underlies the mental lexicon, whereas the procedural system subserves aspects of mental grammar” (p. 718; see also Pinker & Ullman, 2002). Declarative memory is viewed as an “associative memory that stores not only facts and events, but also lexical knowledge, including the sounds and meaning of words,” whereas procedural memory subserves the implicit learning and use of a symbol manipulating grammar across sub domains that include syntax, morphology and possibly phonology. They compared the children with SLI with L2 adults. Ulman (2001, 2004) proposed that access to procedural memory is different after puberty, and access to procedural memory becomes more difficult when age increases. Children acquire their language within a certain critical period. The general cognitive and perceptual processes might be different in both of them.
References


