Verb Inflection and Verb Diversity in Three Populations: Agrammatic Speakers, Normally Developing Children, and Children with Specific Language Impairment (SLI)

Roelien Bastiaanse and Gerard Bol

Graduate School for Behavioral and Cognitive Neurosciences (BCN), Groningen, The Netherlands

Published online March 9, 2001

The present study focuses on the relation between a grammatical and a lexical–semantic aspect of verb production. The spontaneous speech of three different populations (normally developing children, agrammatic aphasics, and children with a specific language impairment) has been analyzed with respect to the proportion of finite clauses and the diversity of the produced lexical verbs. The group results show that in the three populations both the proportion of finite verbs and the variability of the lexical verbs is low. When the individual scores are considered, differences between the normally developing children and the language-impaired subjects show up. Whereas in normally developing children verb finiteness and verb variability go hand-in-hand, the reverse relationship between these variables is observed in the agrammatic aphasics and the children with a specific language impairment. Given this reverse relationship, it is probable to assume two separate disorders. We therefore suggest an impairment at the interface level where lexical information and syntactic structure are integrated during sentence production.

INTRODUCTION

In various populations, the production of finite verbs is known to be compromised. It has been shown that agrammatic aphasic speakers use a reduced proportion of finite verbs (see, e.g., Bastiaanse, Rispens, & Van Zonneveld, 1999; Friedmann & Grodzinsky, 1997; Hagiwara, 1995). The same has been observed in normally developing children and children with specific language impairment (SLI), in that they produce a relatively larger number of so-called optional inﬁnitives than finite verbs (e.g., Wexler, Schaeffer, & Bol, 1998). Optional inﬁnitives are uninflected verbs, produced by children who are already aware of finiteness (Wexler, 1996). Nevertheless, they produce both main clauses with finite verbs and main clauses with uninflected verbs, where finiteness is obligatory.

In a recent study, Bastiaanse and Jonkers (1998) showed that in the spontaneous speech of agrammatic aphasics both the diversity of the produced verbs and the proportion of finite verb forms are reduced compared to that seen in the speech of non-
brain-damaged speakers. There was no relation, however, between the number of correctly produced verbs on an action naming test and the diversity of the produced verbs in the spontaneous speech. This suggested that the reduced diversity of verbs in spontaneous speech is not a direct reflection of a problem in verb retrieval. Inspection of individual data showed that in all but one patient there existed a reversed relationship between the proportion of finite verbs and the diversity of the verbs produced: those patients who had an above-average proportion of finite verbs produced a relatively limited set of lexical verbs, and those patients who produced a wide range of verbs produced a relatively low proportion of finite clauses. These results, in relation to the results of a study by Bastiaanse and Van Zonneveld (1998), who found that problems in the production of finite verbs are caused by a syntactic rather than a morphological or general processing disorder, made Bastiaanse and Jonkers (1998) conclude that the syntactic disorder in agrammatism may result not only in problems with the production of finite verbs, but also in a low diversity of the produced verbs, especially in those patients who (unconsciously) focus on using finite verbs, in spite of their syntactic problems.

For the use of optional infinitives, several explanations have been given. Marchman and Bates (1994) argue that it is impossible for typical children to produce a normal proportion of finite verbs, since they still have a highly reduced vocabulary of verbs. The argument is that if these children do not have a certain number of lexical verbs in their lexicon, they cannot inflect them. The same has been suggested by Conti-Ramsden and Jones (1997) for SLI children, the so-called SLI critical mass hypothesis. This is one of the issues that will be addressed in the present study. De Jong (1999) also shows that children with SLI have a reduced vocabulary of verbs compared to normally developing children matched on noun vocabulary.

In sum, in agrammatic spontaneous speech, there seems to be a (reverse) relationship between the proportion of finite verbs and the diversity of verbs (Bastiaanse & Jonkers, 1998; Bastiaanse et al., 1999). Both normally developing children and children with SLI produce relatively many optional infinitives (Wexler et al., 1998). Children with SLI have a reduced vocabulary of verbs.

The aim of the present study is to find out whether a similar relationship between verb finiteness and verb diversity can be detected in the spontaneous speech of Dutch normally developing children and children with SLI.

In the next section, some grammatical background of verbs in Dutch will be given, which shows that Dutch is an excellent language for studying verb production. Next, the methods will be described, followed by the results for the three populations. Finally, the results will be discussed in relation to the theories mentioned in the Introduction and an alternative suggestion for the underlying disorder in agrammatic aphasia and SLI will be made.

**VERBS IN DUTCH**

Dutch has been analyzed as an SOV language, meaning that the base-generated position of the verb is after the object (Koster, 1975). In embedded clauses the (finite) verb is in final position, as illustrated in example (1). In Dutch declarative matrix sentences, the finite verb has to be moved to second position, as shown in example (2). This movement is known as *Verb Second*. If a lexical verb clusters with a modal verb or auxiliary in the matrix clause, the main verb remains *in situ* and the modal verb or auxiliary is moved to the Verb Second position, as in example (3). In embedded clauses, the entire verb cluster remains in sentence final position, as in example (4):
(1) embedded clause
(ik denk) dat de boer de koe melkt
(I think) that the farmer the cow milks
(I think that the farmer milks the cow)

(2) matrix sentence without modal verb/auxiliary
de boer melkt de koe
the farmer milks the cow

(3) matrix sentence with modal verb
de boer wil de koe melken
the farmer wants the cow to milk
(the farmer wants to milk the cow)

(4) embedded clause with modal verb/auxiliary
(ik denk dat) de boer de koe wil melken
(I think that) the farmer the cow wants to milk.

Examples (2) and (3) show that in matrix clauses (the only clauses aphasics and children produce), the infinitive is in the final position and the finite verb is in the second position. This rule is hardly ever violated by agrammatic aphasics (Bastiaanse et al., 1999) or by normally developing children and children with SLI (Wexler et al., 1998). So, unlike the situation in English, it can easily be established whether a verb is finite or nonfinite, even though Dutch does not have a rich inflection system.

METHODS

Subjects. For each group of subjects, eight participants were included. The eight agrammatic aphasics were the same as those mentioned in Bastiaanse and Jonkers (1998). They are all aphasic due to a stroke, right-handed and the mean time postonset is 59.12 months (range 5–154 months). Both the normally developing and the SLI children were selected from the Bol and Kuiken database (Bol & Kuiken, 1988). The relevant data are given in Table 1.

Materials and scoring. From each subject, a spontaneous speech sample of at least 300 words was available. The sample length was established with the method used by Vermeulen, Bastiaanse, and Van Wageningen (1989). These samples were transcribed into orthographic script and analyzed with regard to the following variables:

The type–token ratio of lexical verbs (the number of different verbs—the types—divided by the total

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Mean Age (Range between Brackets) and Gender of the Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Gender</td>
</tr>
<tr>
<td>Agrammatics</td>
<td>53.00 (38–72)</td>
</tr>
<tr>
<td>Normally developing children</td>
<td>2:11 (2:4–3:6)</td>
</tr>
<tr>
<td>SLI children</td>
<td>6:2 (5:3–8:2)</td>
</tr>
</tbody>
</table>

1 In Dutch the infinitive is stem + [-en]. The stem is used for first person singular, present tense and the infinitive is also used for all plurals in the present tense. When in doubt, we analyzed a verb form according to its position in the clause. If its position was dubious (e.g., when the second position was also the last position), the clause was not analyzed.
The type–token ratio was supposed to reflect the diversity of the verbs produced: the higher the outcome, the more variety a subject exploits in his or her verb production.

The finiteness index: the number of finite verbs, divided by the number of clauses containing a verb. For this variable, auxiliaries, modals, and copulas were included. The higher the index, the more finite clauses have been produced.

### RESULTS

In Table 2 the group results are given; the graphical representation for mean length of utterance (MLU), type–token ratio, and finiteness are given in Fig. 1.

There are no significant differences between the groups, neither on the type–token ratio, nor on finiteness. Although the groups perform very similarly, the previous study of agrammatic spontaneous speech showed that individual results are more revealing. These are graphically represented in Figs. 2a and 2b. The subjects are ordered with respect to MLU, meaning that the leftmost subject has the shortest MLU and the rightmost has the longest MLU.

Figure 2a shows that for the normally developing children and the aphasic speakers, roughly speaking, the finiteness index increases when MLU increases; for both groups, there is a significant correlation between these two variables (children, rho = .72, p < .05; agrammatic, rho = .76, p < .05). There is no such relation for the SLI children (rho = .52, p > .05).

![FIG. 1.](image) The group scores on mean length of utterances (MLU), finiteness, and type–token ratio.

---

2 The use of type–token ratios is heavily under debate (see, e.g., Richards & Malvern, 1997). Since the sample size was equal for each subject and only one word class (lexical verbs) was involved, the figures we used were quite reliable, especially since the number of tokens was equal in the three subject groups (Malvern & Richards, pers. commun., November 1998).
FIG. 2. The individual scores for each group on finiteness (2a) and type–token ratio (2b). The x-axis is the mean score of the subgroup; hence negative scores are relatively low and positive scores relatively high. The MLU of the individuals within each group increases from left to right.
In Fig. 2b it can be seen that there is no relation between MLU and the type–token ratio: the correlations between these variables are not significant (agrammatics, rho = .19; normally developing children, rho = .02; SLI children, rho = .45).

In Fig. 3 the comparison between type–token ratio and finiteness is illustrated. As mentioned in the Introduction, we found a tendency toward a reverse relationship between these variables for the agrammatic speakers, which can be seen in the graph: either the white bar or the gray bar is below zero (the mean of the group). A similar pattern can be seen for the children with SLI: all but two SLI children (subjects 4 and 8) are either relatively good in the production of finite verbs or have a relatively large diversity in produced verbs. Only two normally developing children (subjects 6 and 7) show the same phenomenon; the rest of them are good at both or poor at both variables.

**DISCUSSION**

**Group Results**

The group results show that the spontaneous speech of agrammatic aphasics, normally developing children, and children with SLI show the same deviances with regard to the production of finite verbs: the proportion of finite verbs is compromised, which confirms earlier data from studies of the different populations (Bastiaanse & Jonkers, 1998; Wexler et al., 1998). For both the agrammatic and the normally developing children there is a significant relationship between utterance length and finiteness: when the speakers produce more finite verbs, the sentences get longer. Hence, when analyzed in the same way, similarities between the normally developing children and agrammatic aphasics show up, as suggested by Jakobson (1941). Such a relationship has not been found for children with SLI: they are matched with the normally developing children on MLU, but there is no increase in the proportion of finite verbs when sentence length increases. We will come back to this point when the individual results are discussed.

New is the finding that the three groups show very similar results in the limited set of verbs they produce in spontaneous speech: whereas non-brain-damaged healthy speakers have a type–token ratio of .74, all three groups score around .50. This does not necessarily mean that the same problems underlie the limited set of verbs. From aphasiological research it is known that agrammatic speakers have a very low type–token ratio on an action naming test (Bastiaanse & Jonkers, 1998). It is far more plausible that these speakers encounter problems retrieving verbs from the lexicon during spontaneous speech production. The same thing might be the case for the normally developing children, but their
vocabulary of verbs is smaller as well: they cannot produce a large variety, as they have only a small vocabulary. It is remarkable in this respect that the much older children with SLI do not produce a wider range of verbs than the MLU-matched, normally developing children. It is unlikely that their verb vocabulary is limited to the 15 verbs they use on average, since their mean age is 6;2. We will come back to this when the individual data are discussed.

All in all, from the group comparison, we conclude that there are certain superficial parallels between the groups, but there are also several factors (a significant correlation between utterance length and finiteness for two groups and a lack thereof in the third group). The probably different causes of reduced diversity of produced verbs that justifies a closer look at the individual data.

**Individual Data**

The individual data demonstrate that there are similarities between the agrammatic aphasics and the SLI children that are not found in the normally developing children. Whereas in the group of normally developing children the vocabulary of verbs seems to develop more or less in parallel with the ability to produce finite clauses (they are either good at both or poor at both for six out of eight children), the pattern is different from the one in the two language-impaired groups. In both agrammatism and SLI there is a reverse relation between the two variables: good at one is poor at the other. Only two agrammatic and two SLI children do not fulfill this pattern.

How can such an effect be explained? In the literature it has often been suggested that both populations suffer from a grammatical deficit (for agrammatism, see, for example, Haghiwara, 1995; Friedmann & Grodzinsky, 1997; Bastiaanse & Van Zonneveld, 1998; for SLI, see Rice & Wexler, 1996). At the same time we know that agrammatic aphasics have problems accessing verbs (see, for example, Thompson, Lange, Schneider, & Shapiro, 1997; Bastiaanse & Jonkers, 1998). De Jong (1999) suggests that the vocabulary of verbs in SLI children is severely limited. However, it is not very likely that the low type–token ratio of SLI children is caused only by their small vocabulary: in fact, it is highly unlikely that these children do not have more verbs in their vocabulary at the mean age of 6;2 than the average of 15.1 that are produced. This means that the possibility exists that the SLI children suffer from both a grammatical and a word retrieval problem. In that case the suggestion from Conti-Ramsden and Jones (1997), that is, that you cannot expect a child to inflect verbs when they do not have enough verbs, might be the right one. However, when we look at the individual data (Fig. 3), the pattern shows the opposite from what Conti-Ramsden and Jones suggest: the children who do have a relatively wide variation in their verbs do not inflect them, whereas the children with a relative small vocabulary are able to produce finite verb forms. A question could then be raised: if a combination of disorders is not the right explanation for the data, then what is?

**A Proposal**

The data of the two language-impaired groups shows a reverse relationship between a grammatical and a lexical–semantic variable: good on finiteness implies a low diversity of verbs and vice versa. As mentioned above, assuming two separate impairments cannot explain this pattern.

For an alternative explanation the process of building a sentence has to be taken in consideration. Highly simplified, during this process a syntactic structure is formed, in which the words are filled in. The words have to be retrieved from the lexicon. In order to form a sentence structure, several syntactic operations have to
be performed, among which is the “movement” of the finite verb to second position. It is conceivable that neither of these two processes (constructing finite clauses and verb retrieval) is impaired in agrammatism and SLI and actually this is supported by the data: some SLI children and some agrammatics are close to normal in the number of different verbs (and type–token) they produce, while others produce a virtually normal number of finite clauses. Nevertheless, only 2 of 16 language-impaired subjects score above average on both variables. All language-impaired subjects produce finite clauses in at least 50% of their utterances, meaning that they are well capable of forming this construction and hence have syntactic representations of finite sentences and can produce them. The fact that they do so less than comparable non-language-impaired speakers has often been taken as support for a syntactic deficit hypothesis. When the production of verbs as such is taken into account, a syntactic deficit hypothesis is not enough. We would therefore like to suggest that it is not so much the syntactic representation nor verb retrieval or a limited set of verbs that is impaired in these language-impaired speakers, but the interface level where syntactic structures and lexical items are integrated: finite verbs can be produced, but at the cost of lexical diversity. Language-impaired speakers can produce a virtually normal range of verbs, but at the cost of finiteness.

So, we prefer not to assume two different disorders responsible for the low type–token ratios and the proportion of finite clauses, but rather one single disorder at the level where syntax and lexical semantics meet. The fact that there are two different patterns visible, (1) relatively good in finiteness = relatively low type–token ratio and (2) relatively high type–token ratio = relatively few finite clauses, raises another question: are these, within single speakers, fixed patterns or may the patterns reverse the next day? In other words, could one language-impaired speaker be poor at finiteness, with a relatively high type–token ratio one day and show the opposite pattern the next day? Of course, we cannot say anything about this on the basis of the present data, but Bastiaanse (1995) described an agrammatic patient who changed her speech style from syntactically good and lexical–semantically very poor to the opposite in the middle of her spontaneous speech, at the moment of a topic switch, clearly perceptible and quantifiable. Although this is only one case study, it suggests that intrapersonal changes are possible. This would, again, point in the direction of an impairment at one level that does not show up in the same way in each speaker, nor on every occasion.

CONCLUSION

The group comparisons showed a clear resemblance among the three subject groups: both the proportion of finite clauses and the diversity of lexical verbs are low. When the individual data are compared, the two language-impaired groups show a pattern that is not visible in normally developing children: there is a reverse relationship between the proportion of finite clauses and the diversity of produced verbs. Rather than assuming two separate disorders, these patterns suggest a disorder at the
level where lexical–semantic items and syntactic structures are integrated. A disorder at this level may result in either poor syntactic performance (a low proportion of finite verbs) or a poor lexical–semantic performance (low diversity of the verbs produced). A similar level of breakdown has been suggested by Piñango (1999) for comprehension in agrammatic Broca’s aphasia. Further research on both agrammatism and SLI is needed to translate this suggestion into a testable hypothesis.

REFERENCES


