MORPHOSYNTACTIC PROCESSING IN GERMAN AGRAMMATISM: A REPLICATION AND REVISION OF VON STOCKERT/BADER (1976)

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1. INTRODUCTION

In 1976, von Stockert and Bader published the results of a constituent ordering study with German aphasics which has been quite influential in the literature on agrammatism. Their data strongly supported “the assumption that the linguistically prominent deficit of the Broca’s aphasics is a loss of grammatical capacity, whereas the prominent sign of Wernicke’s aphasics is a disturbance of the lexical semantic” (p. 57). The study thus provided additional confirmation for the hypothesis of a double dissociation between Broca’s and Wernicke’s patients with respect to morphosyntax and lexical semantics.

Recently, however, data have been presented which seem to be in conflict with a central syntactic deficit theory of agrammatism. For example, Schwartz and Saffran (1983) found that four patients with agrammatic speech production performed remarkably well on a grammaticality judgement task involving various syntactic violations, even though they had severe deficits in more conventional tasks for syntactic comprehension such as sentence-picture matching. They proposed an alternative theory of agrammatism which – contrary to the central syntactic deficit theory – ascribes largely unimpaired syntactic competence to “so-called agrammatics”. Their trade-off theory explains the apparent syntactic deficits in production and comprehension as disturbances of processing rather than of representation: the observable deficits arise only in the interaction of syntax with semantics. Clearly, the strong form of the syntactic deficit theory and the trade-off theory would make different predictions with regard to the agrammatics’ performance on morphosyntactic tasks with non-words, in which no semantic processing is possible. Within the framework of a syntactic deficit hypothesis, patients would be severely disturbed on such a task which does not allow the compensatory use of semantic heuristics, whereas their performance should be quite successful according to the trade-off theory, since there is no semantic processing using up available resources.

A third class of theories neither assumes a complete preservation nor a complete disturbance of syntactic knowledge. They propose that an impairment with respect to a particular syntactic-principle combined with certain processing factors may be the underlying reason for the agrammatics’ failure with different syntactic structures (e.g. Grodzinsky, 1986; Caplan and Hildebrandt, 1986). As a consequence, they would not make straightforward predictions about a patient’s success or failure in a specific task (e.g. using nonsense-words), but they would
rather expect the performance to depend on the particular syntactic and processing principles involved.

As German aphasiologists, we were faced with a dilemma. On one hand, the results of von Stockert’s study for German provided strong evidence for a complete morphosyntactic deficit in grammaticism; on the other hand, more recent studies predominantly with English speaking patients offered strong arguments against it. We therefore considered a replication of von Stockert’s study desirable.

2. THE ORIGINAL STUDY (1976)

Materials and Method

Thirty written declarative sentences were cut into three cards each. This material contained three different subtasks, each including ten sentences:

Condition a: Normal sentences (NOR)
(1) die Milch / läuft aus / der Kanne
(2) das Klavier / spielt auf / dem Karl
(3) das wampel / wird / gewampelt

Condition b: Syntax versus semantics (SVS)
(4) die Milch / der Kanne / läuft aus
(5) der Hase / schießt / den Jäger
(6) den Jäger / schießt / der Hase

Condition c: Nonsense (NS)
(7) das wampel
(8) der Kanne
(9) die Milch
(10) the piano
(11) the hunter
(12) the hare

In contrast to English, German has morphological Case marking in the article of Noun Phrases, which is the most unambiguous for definite, singular masculine noun phrases. In such cases, it is possible to determine the grammatical function of the NP (subject versus direct object) on the basis of the morphological endings of the article alone (der versus den). With feminine and neutral NPs, the definite article does not always unambiguously express Case (e.g. the feminine die or the neutral das can be either subject or accusative object, der can be either feminine genitive or dative object, etc). As the examples show, the original material was not controlled for unambiguous Case morphology, e.g. in (1), der Kanne can be either feminine dative or genitive. The genitive interpretation would result in another possible sentence:
(4) die Milch / der Kanne / läuft aus

Another weakness of the material was that the sentences were not comparable with respect to syntactic structure. Many sentences, especially in the nonsense task, were not even of an SVO-type (cf. 3). Moreover, the sentences were not split according to constituent boundaries (cf. 1, 2).

In summary, an estimation about the patient’s ability to handle morphological cues could not always be given. Nor was it possible in sentences such as (1, 2) to define verb-final tendencies, since the verb was automatically followed by a preposition. For these and other reasons, a revision of the material was necessary before replication.

Subjects

Thirty aphasics were classified according to clinical impression. They included ten fluent or Wernicke’s aphasics, ten non-fluent or Broca’s aphasics, and ten total aphasics.

No controls were examined with the test. Especially for condition b, syntax versus semantics, it would have been important to see how normals deal with such a task, because it is a task without a solution. For example, there would be two alternatives.

Results

The results of the original study for the three aphasic syndromes are given in Table 1.

There was a large discrepancy between Broca’s and Wernicke’s with respect to the nonsense task (NS). This would demonstrate the Broca’s inability to rely exclusively on morphosyntactic cues for word order. Three of ten patients even refused to perform this task. In contrast, Wernicke’s patients were on the whole quite successful.

Broca’s aphasics solved the syntax-versus-semantics task (SVS) by using semantic cues (i.e. OVS/OSV), whereas Wernicke’s aphasics used predominantly morphological cues (i.e. SVO).

In normal sentences (NOR), Broca’s and Wernicke’s aphasics were equally successful in constructing the correct order. On the basis of the other data, von Stockert and Bader concluded that Broca’s arrived at the correct result using morphological cues, whereas the correct results of Wernicke’s aphasics would be based on morphological strategies.

As a group, global aphasics performed better than Broca’s except on the task with the normal sentences. Some of the patients within the group performed morphologically at the high level of Wernicke’s, others as poorly as Broca’s.

<table>
<thead>
<tr>
<th></th>
<th>NORMAL (NOR)</th>
<th>SYN/SEM (SVS)</th>
<th>NONSENSE (NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(k=10)</td>
<td>(k=10)</td>
<td>(k=10)</td>
</tr>
<tr>
<td></td>
<td>% SVO</td>
<td>% other</td>
<td>% SVO</td>
</tr>
<tr>
<td>Broca (N=10)</td>
<td>.75</td>
<td>.25</td>
<td>.11</td>
</tr>
<tr>
<td></td>
<td>(.18 SOV)</td>
<td></td>
<td>(.52 OVS)</td>
</tr>
<tr>
<td>Wernicke (N=10)</td>
<td>.80</td>
<td>.20</td>
<td>.74</td>
</tr>
<tr>
<td></td>
<td>(.52 OVS)</td>
<td></td>
<td>(.33 OVS)</td>
</tr>
<tr>
<td>Global (N=10)</td>
<td>.60</td>
<td>.40</td>
<td>.62</td>
</tr>
</tbody>
</table>

*After von Stockert and Bader, 1976, pp. 52, 54, 56.*
The authors (p. 53) additionally reported a “typical Broca’s transposition” of the verb to the end of the sentence in main clauses, as seen in NOR (SOV) and SVS (OSV). It must be noted that the underlying position generally adopted in transformational grammars of German is verb final (XYV) for main clauses as well as subordinate clauses. This is realized in main clauses with the verb in second position (XYV). It would be very interesting if it could be demonstrated that the underlying order plays a role in language breakdown, as the authors’ observation supported. However, as noted above, in SVPrepO sentences, verb and preposition were given on one card. Still, the figures in Table I show that the authors must have interpreted verb-plus-preposition at the end of sentences as verb-final position.

3. THE REVISED STUDY

Materials and Method

For reasons mentioned above, a revision of the material had to be made before replication. The revised test consisted of four parts (see Table II), three of which are constructed after von Stockert and Bader (1976).

There were 25 normal (NOR), semantically irreversible declarative sentences. They were subdivided as follows; 15 Sentences were of the simple SVO-type, five with an accusative object, 10 with a dative object. The larger number of dative sentences was necessary because pilot studies with verbs subcategorized for a dative object had indicated the lack of a canonical SVO-order in dative sentences, in contrast to the accusative sentences. In addition, dative verbs differ from accusative verbs in that many of them take an object of the verb. Another ten sentences had prepositional objects. Five of the sentences. In addition, dative verbs differ from accusative verbs in that many of them take an inanimate subject and an animate object. This is especially so for ergative verbs like gefallen (please), where the generative analysis argues that the surface subject originates as an object of the verb. An interaction of ergativity or animacy factors with word order could not be a priori excluded. We therefore controlled the factor of animacy in dative sentences: five had animate subjects and inanimate objects and five sentences had the reverse. Another ten sentences had prepositional objects. Five of the SVPrepO sentences had an accusative and five a dative prepositional object.

The 25 sentence of the syntax versus semantics task (SVS) had a construction parallel to the NOR task reported above. The lexemes had similar structural and frequency characteristics to those used in the NOR task.

The nonsense task (NS) consisted of ten SVO and ten SVPrepO sentences. Dative and accusative objects were equally represented in each construction type. Only legal nonwords were used, with a syllable structure similar to that in the two tasks described above.

In general, only the definite article occurred, number was always singular, all nouns were concrete and of high frequency, gender was masculine for subject NPs and for accusative objects (der versus den), masculine or neutral (dem) for dative objects, so that Case marking was never ambiguous.

A fourth task, “minus-article” (MIN), was added to those originally devised by the authors, 25 semantically irreversible NP + V + NP sentences were selected from the NOR and SVS tasks, and the articles were deleted from the noun phrases, so that there were no longer morphological cues to word order. This resembles most closely the situation in English, where the article does not contain any morphosyntactic information. The resulting NVN sequences were grammatically incomplete but could be ordered according to semantics. They were thus a counterpart to the morphologically adequate but asemantic nonsense sentences. Moreover, since the same lexical material was used in sentences with and without article, a direct assessment of the contribution of morphology to constituent ordering could be made.

Sentences were presented in three blocks. The first block consisted of the “minus-article” (MIN) sentences. Thus, morphosyntactic interference from other items was avoided and the equivalent sentence with morpho-syntactic marking had not yet been encountered. In the second block, the non-word sentences (NS) were offered in randomized fashion. They were kept together in one block because von Stockert and Bader’s results suggested that some patients would refuse to perform this task, and their presence among other stimuli could have a negative influence on the motivation to pursue further tasks. In the third block, the NOR and SVS sentences were mixed, again for the purpose of motivation. Having all non-solvable SVS items together would be too frustrating for normals as well as for patients. The construction of the test with examples for each item-type is given below.

Block I. Minus-Article (MIN: k = 25)

VERB subcategorizing an accusative object (k = 10)
e.g. Vater mäht Rasen
(Father mows lawn)

VERB subcategorizing a dative object (k = 15)
e.g. Hut gefällt Madchen
(Hat pleases girl)
Fahrer folgt Schild
(Driver follows sign)

Block II. Nonsense sentences (NS: k = 25)

Subject-Verb-Object (k = 5)
e.g. Der Dodier medelt den Schnell
(The wugger macks the leek)

Subject-Verb-Object (k = 10)
e.g. Der Bess gemöht dem Turtz
(The dess resates the turt)

TABLE II

<table>
<thead>
<tr>
<th>Test Construction</th>
<th>SVO (k=65)</th>
<th>SVPrepO (k=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OAcc</td>
<td>ODat</td>
</tr>
<tr>
<td></td>
<td>OAcc</td>
<td>ODat</td>
</tr>
<tr>
<td>1. NOR</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2. SVO</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>3. NS</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4. MIN</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Subject-Verb-preposition-Object (k = 5)
e.g. Der Belch schließt gegen den Sirk
(The rint tases against the pook)

Subject-Verb-preposition-Object (k = 5)
e.g. Der Lese kiehlt mit dem Fautzig
(The neap smakes with the beshing)

Sentences were printed on cards in capital letters 1 cm high. For the SVO sentences, there were three cards corresponding to the major constituents. For the SVprepO sentences, a division of four cards was preferred, so that an exchange of O and S would be possible without creating non-constituents like V-prep.

The patients were given three warming-up examples with the instruction to put the cards together into a sentence. They were told that the sentence should not be a question. The examiner offered the cards in randomized sequence, and read each card aloud while putting it down. One practice item consisted of three cards (der Junge/sieht/die Frau/: the boy sees the woman), another one illustrated the task with four cards (das Mädchen/hat sich/an/gezogen/: the girl dressed herself) and the task without articles was practiced with a third item (Bauer/sieht/Kranken/: farmer sees patient). Before starting with the nonsense items, the examiner told the patient that there would now be "funny words" which do not really exist.

Subjects
Ten normal speakers without brain damage were used as controls. They were comparable to the aphasics in age, education and social origin.

<table>
<thead>
<tr>
<th>Patients</th>
<th>T.T. (PR)</th>
<th>REP (PR)</th>
<th>WRIT (PR)</th>
<th>NAM (PR)</th>
<th>COMP (PR)</th>
<th>SYNb</th>
<th>ALLOC classificatione</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1. C.B.</td>
<td>56</td>
<td>58</td>
<td>39</td>
<td>59</td>
<td>71</td>
<td>1</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 2. M.B.</td>
<td>53</td>
<td>33</td>
<td>52</td>
<td>47</td>
<td>53</td>
<td>1</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 3. M.H.</td>
<td>58</td>
<td>53</td>
<td>51</td>
<td>49</td>
<td>76</td>
<td>1</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 4. M.S.</td>
<td>33</td>
<td>42</td>
<td>70</td>
<td>59</td>
<td>56</td>
<td>1</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 5. K.L.</td>
<td>74</td>
<td>61</td>
<td>69</td>
<td>81</td>
<td>100</td>
<td>1</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 6. H.R.</td>
<td>83</td>
<td>73</td>
<td>86</td>
<td>96</td>
<td>100</td>
<td>1</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 7. H. Sch.</td>
<td>99</td>
<td>44</td>
<td>82</td>
<td>93</td>
<td>65</td>
<td>2</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 8. H.J.</td>
<td>76</td>
<td>68</td>
<td>52</td>
<td>77</td>
<td>100</td>
<td>2</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 9. M.P.</td>
<td>74</td>
<td>39</td>
<td>80</td>
<td>79</td>
<td>76</td>
<td>2</td>
<td>100 % Broca</td>
</tr>
<tr>
<td>B 10. H. Th.</td>
<td>89</td>
<td>83</td>
<td>93</td>
<td>84</td>
<td>92</td>
<td>2</td>
<td>100 % Broca</td>
</tr>
</tbody>
</table>

AAT subtests are abbreviated as follows: TT = Token Test, REP = Repetition, WRIT = Written Language (reading aloud and writing to dictation), NAM = Confrontation Naming, COMP = Auditory and Reading Comprehension; PR = Percentile Rank.

*Rating of syntax in Spontaneous Speech: 1 = severe agrammatism, 2 = mild agrammatism

*ALLOC, Nonparametric discriminant analysis program for a posteriori allocation of patients to one of the standard aphasic syndromes on the basis of AAT test results.
The target population consisted of 10 Broca's aphasics. Results for each individual patient on the subtests of the AAT are given in percentile ranks in Table III (see Huber et al., 1984, for a description of this clinical aphasia test).

All patients had a stable aphasia and were tested at the earliest two years post onset. Aetiology was vascular in nine cases, traumatic in one.

Patients were selected from the population of Broca's aphasics on the basis of agrammatic speech production. They could be subdivided into four "mild" and six "severe" agrammatism by a rating of the spontaneous speech produced during the semistandardized interview of the AAT.

"Mild" patients showed agrammatism of the constructional type: syntax is predominantly simplified, with only occasional subordinations. Direct speech is used where indirect speech would be expected. Sometimes, the sentences are syntactically correct, but more frequently function words are lacking and in some cases substituted. Verb forms are generally inflected. This type of agrammatism is illustrated in the following example.

Example of constructional agrammatism in spontaneous speech

(Examiner's question: Doesn't your son want to go to bed at night?)
"Nee, freiwillig, nee ich bin nicht müde, der kann sich fast gar nicht mehr die Augen zu, auf ja aufmachen aber trotzdem ich bin noch nicht müde, aber jetzt hab ich gesagt, du mußt im Bett; du mußt morgen Schule, Wochenende darfst du dann länger aufbleiben, aber so, das geht ja nicht, so die halbe Nacht".

("No, willingly no I am not tired, he can hardly shut his eyes, open yes open but nevertheless I am not yet tired, but now I have said, you have to go to bed (Case error); you have to go to school tomorrow, weekend, he can stay up longer, but that way that is impossible, half the night.")

"Severe" patients showed agrammatism of the telegraphic type. Utterances are usually one to two words long. Function words rarely occur, and verb forms are generally restricted to the infinitive or the participle. The following example illustrates this type of agrammatism.

Example of telegraphic agrammatism in spontaneous speech

(Examiner: What did you do there during vacation?)
"... lang schlafen und... Kaffee getrunken... spazieren gehen und dann essen. und eine Stunde niedergelagert. dann Kaffee getrunken.
("Sleep long and uhm... drink coffee... walk. and. then. eat. and uhm rested hour. then drank coffee...")

(Examiner: Did you have to stay inside most of the time?)
"Nein, Schirme... und. ä. sechs oder sieben Tage schön Wetter."
("No. umbrellas... and. six or seven days fine weather.").

Results

There was a different number of possible solutions for SVO and SVprepO sentences, since SVO sentences were presented in three cards, SVprepO sentences in four cards. Therefore, the results for the two structures will be discussed separately.

Against usual practice, we will first report the data collapsed over different sentence types and then look at some interesting patterns more closely. Our primary goal was an overall comparison with the findings of the von Stockert/Bader study. Since we separated out linguistic variables which were left uncontrolled in the original work, a one-by-one comparison of the different subtasks was not possible. Moreover, their individual treatment would have made the paper unnecessarily lengthy.

SVO-sentences (k = 65)

Ordering the verb

All 65 items were analyzed with respect to the position of the verb (verb-second as in main clauses, verb-first as in yes-no questions, and verb-final as in subordinate clauses). As is clear from Table IV, 7 of 10 agrammatists did not differ from the normal controls and put the verb in second position, either as SVO or as...

<table>
<thead>
<tr>
<th>Verb-second</th>
<th>Verb-first</th>
<th>Verb-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broca's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B 1</td>
<td>48*</td>
<td>9</td>
</tr>
<tr>
<td>B 2</td>
<td>52*</td>
<td>-</td>
</tr>
<tr>
<td>B 3</td>
<td>64</td>
<td>1</td>
</tr>
<tr>
<td>B 4</td>
<td>52*</td>
<td>12*</td>
</tr>
<tr>
<td>B 5</td>
<td>63</td>
<td>1</td>
</tr>
<tr>
<td>B 6</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>B 7</td>
<td>64</td>
<td>-</td>
</tr>
<tr>
<td>B 8</td>
<td>63</td>
<td>-</td>
</tr>
<tr>
<td>B 9</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>B 10</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C 1</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 2</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 3</td>
<td>64</td>
<td>-</td>
</tr>
<tr>
<td>C 4</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 5</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 6</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 7</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 8</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 9</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>C 10</td>
<td>65</td>
<td>-</td>
</tr>
</tbody>
</table>

* For B1, B2, B4, the probability of choosing verb-second position is always below a criterion probability of 0.9 according to the binomial model (cf. D.B. Owen, 1962, Tab. 9.6). But in all three cases, verb-second is significantly more frequent than the other two positions (binomial model, p<.0001 each). B2 gives significantly more verb-end than verb-first orderings (p<.001). For B4, it is the other way round (p<.01). For B1, both are given with a similar frequency. B3, B5-B10, and all C-subjects use verb-second almost exclusively (at least 63 times out of 65).
TABLE V

<table>
<thead>
<tr>
<th>Patients</th>
<th>Verb-second</th>
<th>Verb-first</th>
<th>Verb-end</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ Art.</td>
<td>MIN</td>
<td>+ Art.</td>
</tr>
<tr>
<td>B 1</td>
<td>77.5*</td>
<td>68.0*</td>
<td>10.0</td>
</tr>
<tr>
<td>B 2</td>
<td>97.5</td>
<td>52.0*</td>
<td>-</td>
</tr>
<tr>
<td>B 4</td>
<td>92.5</td>
<td>60.0*</td>
<td>7.5</td>
</tr>
</tbody>
</table>

* For all C-subjects and B3, BS-BIO, verb-second was present almost exclusively for + Art (at least 97.5%) and for MIN (at least 92.0%).

For B2 and B4, verb-second is significantly more frequent in + Art than MIN (Fisher's exact test for a 2X2 table, p<.01 each, one-sided, see Finney et al., 1963. The FORTRAN program KONTAN by Weiss, 1978, is used to carry out the exact permutation test).

B1 is the only patient who has verb-second position below a criterion probability of .90 for both + Art and MIN (Binomial model).

OVS. The remaining three agrammatics also used verb-second significantly more often than any other alternative, but patient no. 2 tended to vary toward verb-end, patient no. 4 toward verb-first, and patient no. 1 had random distribution over verb-first and verb-end in his deviant reactions.

A comparison of the 40 items containing a Case-marked article with the 25 sentences without an article (see Table V) showed that with respect to the position of the verb, patients no. 2 and no. 4 only differed significantly from the controls in the task without article. Thus, the verb-end reactions of patient no. 2 and the verb-first reactions of patient no. 4 occurred predominantly in MIN sentences (a task not included in the original study), in which constituent boundaries are not marked by a determiner. Patient no. 1, whose deviant verb-orderings were equally distributed over verb-first and verb-end, differed significantly from normals both in sentences with and without article.

In summary, there was no indication for any of the agrammatics in our study of a "typical Broca's transposition" of the verb to the end of German main clauses in which NP-constituents carry an article. This contradicts the results of von Stockert and Bader.

Ordering of the NPs around the verb

Since theoretically German has free NP order (deriving SVO and OVS from an underlying XYV structure in the same manner, by moving V to COMP and either X or Y to the TOP-position), the question whether psycholinguistically there exists a canonical order is an empirical one. This question must be answered for normal controls before the constituent orderings of the agrammatics can be interpreted as pathological. Also, the strategies normal subjects use in coping with an impossible task like SVS must be known in order to have a basis of comparison for agrammatics.

NP ordering by normals. For all 65 items, SVO occurred significantly more...
often than OVS for each of the ten control subjects, but OVS occurred quite often also, as Table VI shows.

Although such a distribution might seem to indicate the lack of a strict canonical order, this was only apparently so. For sentences with an accusative object, the canonical order was clearly SVO. Table VII shows the results for all accusative sentences except those in the SVS task. There was more variation in sentences with a dative object (see Table VIII). However, this resulted from an interaction between dative verb and the animacy of the grammatical subject. If the subject of the irreversible sentence was at the same time animate, only OVS was used; if, however, the object was animate – which is usually the case in irreversible dative sentences — OVS also occurred. Table IX shows this interaction.

It follows from the results of the normal controls that in processing isolated short German sentences there is a fixed canonical SVO order for accusative sentences and even for irreversible dative sentences if the subject is animate. Thus, the variability in Table VI cannot be entirely reduced to the inanimate dative constructions but must to a large part be due to reactions in the SVS task.

Remember that in this task, there was an unsolvable conflict between the morphologically marked subject and object of a sentence and the logical/semantic subject and object, as illustrated in the following example:

(7) Der Rasen mäht den Vater (The Lawn is mowing the father)

In general, it must be observed that normal subjects did not solve the task straightforwardly but made comments about its nonsensical nature, changed the morphological markings of the stimuli, etc. In a first evaluation, we simply scored the ordering of constituents without taking the side-comments into account. Table X gives a comparison of NP orderings in the NOR and in the SVS condition for accusative and dative sentences combined.

Reactions of most control subjects in the SVS task clearly differed from those in the NOR task. The data show interindividual variability within the group, and roughly three strategies could be identified in the subjects' coping with this "task without a solution":

(a) The constituents were ordered according to semantic features but were read with morphological corrections. This strategy was typically used in the OVS reactions, e.g.

(8) Ordering: Den Kater fängt den Hamster (The cat catches the hamster)

Reading: Der Kater fängt den Hamster

(b) The subjects followed the ordering dictated by the morphological marking but commented that it made no sense. This was the case in the SVO-reactions. Remarkably in such cases, there was no morphological correction which would
have made sense of the material. Typical reactions were:

(9) Ordering: Der Rasen mäht den Vater
(The lawn mows the father)

nom  

ace

Comment: Garbage!!

(c) Some subjects alternated between (a) and (b).
On the whole, the reactions of the normal subjects demonstrate that the SVS task is inappropriate to investigate dissociations between syntactic and semantic disturbances in patients. Clearly, the OVS sequences of our normals, whereby constituents are ordered according to semantics, are not indicative of a morphological disorder or even insensitivity, a conclusion drawn by von Stockert and Bader for their Broca's.

**NP ordering by agrammatics.** Table XI summarizes the results with respect to the ordering of NPs for the 10 agrammatic patients.

It is striking how similar the performance of the agrammatics as a whole is to that of the normal controls in this test. Those structures which had a canonical SVO-order for the controls (accusative sentences, dative sentences with an animate subject and an inanimate object) have the same canonical form for most of the agrammatics. Two of the patients who produced deviant verb order (B2, B4) also have some exceptional NP orderings (OVS) in the canonical sentences. However, these exceptions are hard to interpret. At any rate, they cannot be retraced to spared semantics in the face of disturbed morphology, since they occur in real sentences as well as in nonsense, especially for B2. The structures which did not have a canonical order for the controls, i.e. which showed a variability between SVO and OVS (dative sentences with inanimate subject and animate object, sentences in the SVS condition), were characterized by the same variability in the agrammatic data.

The strategies used by normals to cope with the SVS task (e.g. comments about the nonsensicality, morphological corrections, etc.) were also used by the agrammatics, as already noted by von Stockert and Bader for some of their patients. Our data show that this is neither an aphasic nor an agrammatic phenomenon. However, the corrections made by our agrammatics differ from those of normals in that they are not always successful. Especially in dative sentences, often only one NP is corrected, resulting in a sentence with two oblique NPs or two nominative NPs, e.g.

(10) Ordering reaction: Der Maler gelingt dem Bild
(The painter succeeds the painting)

nom  

dat

“Corrected” reading: Der Maler gelingt das Bild

nom

Dem Maler gelingt dem Bild

dat  

dat

Target: Dem Maler gelingt das Bild
(The painter succeeds in painting the picture)
Summarizing the data of normals and agrammatics on SVO sentences, one can say that, except for patient B1, B2 and B4, the agrammatics' constituent ordering fell within the normal range. The general performance for verb position of the three disturbed patients still followed the trend of normal performance, i.e. verb-second. With respect to disturbances of NP-ordering, only such tasks and sentence types could be evaluated for which normal controls showed a canonical solution. This excludes the SVS task and dative sentences with inanimate subjects. In the remaining data base, most of the agrammatics performed extremely well with nonsense as well as with real sentences. There was thus no evidence for a morphosyntactic deficit. This could not even be isolated as the single cause underlying the disturbed performance of two of the patients, who showed violations for German as well as for neologistic sentences.

**SV-prepO-sentences (k = 30)**

The task of ordering SVprepO sentences differed from that with SVO-sentences in several ways. There were 24 rather than 6 ordering possibilities, since there were 4 rather than 3 cards. Moreover, whereas all 6 ordering possibilities in SVO-sentences were "somehow" German (a statement, a question, or a subordinate clause with or without topicalisation), 4 of the 24 SVprepO-ordering possibilities were unconditionally German (a statement or question with or without topicalisation) and some of the other orderings were possible German under certain conditions, especially in the nonsense task when lexical-semantic restrictions were absent.

A striking example of such structural variability occurs in cases where the preposition is homophonous with an inseparable verbal prefix or with a separable verbal prefix. This is the case for some but not all prepositions, and the occurrence as a separable or inseparable prefix is lexically specified. E.g. "unter" (under) can have all three functions, "bei" (near) only two, and "in" (in) only one.

**Preposition:**

(11) Der Mann sitzt in dem Stuhl
   (The man sits in the chair)
(12) Der Junge kriecht unter den Tisch
   (The boy crawls under the table)
(13) Der Mann wohnt bei der Kirche
   (The man lives near the church)

**Separable prefix:**

(14) Der Schwimmer taucht den Mann unter
   The swimmer pushes the man under (water)
(15) Der Mann wohnt bei der Versammlung
   (The man attends the meeting)

**Inseparable prefix:**

(16) Der Arzt untersucht den Patienten
   (The doctor examines the patient)
   In nonsense, where the lexical-semantic criteria for determining the specific syntactic functions of the homophonous form are absent, different orderings are structurally correct.

**Preposition:**

(17) Der Ehler nörkt unter den Duhm
   *in accusative* (in)
(18) Der Ehler nörkt bei dem Duhm
   *in dat*

**Separable prefix:**

(19) Der Ehler nörkt den Duhm unter
   *in accusative* (in)
(20) Der Ehler nörkt dem Duhm bei
   *in dat*

**Inseparable prefix:**

(21) Der Ehler unternörkt den Duhm
   *beinörkt* (in)
   *innom* (in)

Given this variability, we will evaluate the reactions of normal controls and take them as the standard with which to measure the aphasic responses, as we did with SVO sentences.

**Ordering of SVprepO sentences by controls**

Except for one reaction of one subject, all controls restricted themselves to the unmarked, untopicalized statement SVprepO in normal sentences (NOR) and they did not make use of the allowed variability. Also in the nonsense-task (NS), the predominant reactions were of the canonical type. One subject varied between SVprepO and an alternative legitimate form (prepOVS) in which the prepositional phrase rather than the subject is in TOP-position, e.g.

(22) In dem Duhm poicht der Wex
   (In the doot poicht the wex)
   nom
   dat

   There was some slight remaining variation due to the subjects' interpretation of the preposition as a verbal prefix, e.g.

(23) Der Ille gleimt dem Koll zu
   (The ilk glutes the choll up)
   nom
   dat

   As was the case in the SVO-sentences, there existed interindividual variability in the solution of the artificial SVS-task: Some subjects followed the morphological marking but complained about the semantic nonsense, others ordered the constituents according to semantics. This resulted in a highly ungrammatical sentence (O prepS) which the control subjects read aloud while correcting the morphology, e.g.

(24) Ordering reaction: DeN Sportler läuft durch deR Wald
   (The sportsman runs through the forest)
   nom
   acc

   Reading Reaction: DeR Sportler läuft durch deN Wald
   nom
   acc

**Ordering of SVprepO sentences by agrammatics**

In the NOR-task, six of the ten agrammatics performed exactly like the controls, using the canonical SVprepO ordering. Deviations from the normal pattern occurred for the three agrammatics who had shown some problems in the SVO-task, and for one additional patient (B3). She apparently adhered to an SVO
pattern and ordered the constituents as SprepO, i.e. she interpreted the prepositions as verbal prefixes in illegitimate cases. Patient no. 4, whose deviant reactions tended toward verb-first in SVO-sentences, showed the same tendency here. The other two patients had random exceptions.

For the six agrammatics who performed like the controls on the NOR-task, the predominant reactions were SVPrepO in the NS-task also with very few exceptions. The four patients who showed disturbances in the NOR-task were even more clearly disturbed here. Patient no. 1 obviously could not manipulate four nonsense constituents and always left one unintegrated. Patient no. 3 tended even more strongly toward SprepVO with nonsense items than with real words (see Table XIII for results on NOR and NS combined).

In the SSV-task, the same six agrammatics were again undistinguishable from controls: they either ordered the constituents following morphological markings and commented on the anomalous nature of the sentence, or they followed a semantic ordering (OVprepS) and made more or less successful morphological corrections, like in the SVO-task.

For the four disturbed agrammatics, the majority of the reactions also showed the same pattern (SVPrepO or OVprepS). However, in contrast to the controls and the good agrammatics, these patients did not attempt to make morphological corrections of the semantically ordered sentences. In addition, they produced some other uninterpretable reactions.

Summary

The aim of this study was to examine whether von Stockert and Bader's (1976) results (for German Broca's aphasics with agrammatic speech production) would be replicable. Their data provided strong evidence for a total and selective loss of morphosyntactic abilities in such patients, in contrast to Wernicke's aphasics and normals. Since we tried to avoid the weaknesses identified in the original material in our reconstruction, we did not expect that our results would be identical in percentage of errors, but given the similarity of the task, a dissociation between morphosyntax and semantics and a verb-final trend should also have been present in our data. However, the performance of six of our ten agrammatic patients on the tasks of ordering constituents into SVO and SVPrepO sentences fell within the normal range. The remaining 4 patients (see Table III, patients no. 1, 2, 3, 4) had a predominant ordering of the verb in second position for simple SVO sentences. They showed some problems with respect to the ordering of nouns around the verb and/or with the integration of prepositions within SVPrepO sentences.

Clearly, our data do not support an across-the-board morphosyntactic explanation of agrammatism. The majority of our agrammatic patients had no problems in this simple task, not even in the nonsense task in which only morphological cues were present for syntactic ordering. Moreover, the disturbances of four patients on the constituent ordering task were not a direct mirror of their severe agrammatic speech production. Two patients with a similar type and severity of agrammatism in spontaneous speech (AAT-rating 1, see Table III, patients no. 5, 6) did not differ from normals on the constituent ordering task. However, these two patients performed significantly better on the Token Test and on the AAT-naming test (see Table III). Thus, problems with the constituent ordering task could reflect the severity of the aphasia rather than the agrammatic disorder per se.

4. MORPHOSYNTAX IN GLOBAL APHASIA

The enormous discrepancy between our results and those of the original study needed further clarification. Could it be that our results were not comparable because of a population artefact? It could very well be that our Broca's aphasics were much more mildly affected than those in the original study. Our Broca patients were examined with a standardized aphasia test and had clearly agrammatic spontaneous speech. Von Stockert and Bader's Broca's, however, were simply selected on the basis of a clinical impression of non-fluency combined with good comprehension for simple written commands. Many of our global aphasics would fit this description.

We therefore examined three further patients with the constituent ordering test. According to the AAT, they were clear cases of global aphasia (see Table XII for AAT-results).

One patient (J.K.) had severely agrammatic speech production like some of our Broca's (see rating of syntax 1), but one to two word propositions were quite rare, she uttered automatic speech much more frequently, and the test results were on the whole much lower than for Broca's. We compared her to two other global aphasics (W.B. and H.K.) who had no speech output except for some highly automatized words, and whose test results were also extremely low.

The performance of all three patients on the constituent ordering test was much more unstructured than that of Broca's aphasics.

This is especially visible in the ordering of SVPrepO cards. In this task, there were four cards which could be ordered in 24 different sequences, but normals and undisturbed Broca's limited themselves to a canonical form SVPrepO. Remember that of the four disturbed Broca's, patient B1 could not process four nonsense cards so that his data could not all be evaluated. The reactions of the three remaining Broca's which deviated from the canonical form could usually still be explained in a principled way: they either showed orderings which are

<table>
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<th>TABLE XII</th>
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<tr>
<td>Individual Results on AAT-Subtests for 3 Global Aphasics*</td>
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<tr>
<td>Patients</td>
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<tr>
<td>G 1 J.K.</td>
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<td>G 2 W.B.</td>
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<td>G 3 H.K.</td>
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*For abbreviations see Table III.
possible in German (verb first: VSprepO/VprepOS; prepositional phrase as a subject complement so that the verb comes last: SprepOV; topicalization of the prepositional phrase: prepOVS) or they overgeneralized the simple SVO-structure by treating the preposition as a verbal prefix (SprepVO). In contrast, reactions of the global patients were distributed irrespective of the grammaticality status of the ordering. This is shown in Tables XIII and XIV.

It is thus unlikely that the discrepancy between our results for agrammatic Broca’s and those of the Broca’s in the original study depends solely on population differences. Our global patients do not perform like von Stockert and Bader’s Broca’s aphasics. In fact, the poor performance is not comparable to any of the groups in the original study: their total (global) aphasics were on the whole better able to exploit morphosyntactic information than Broca’s patients. We did not find any evidence for this surprising result. What we did find was that most agrammatic Broca’s are very well able to benefit from morphosyntactic markings in a task like von Stockert and Bader used. A comparison with global patients — who lacked any sensitivity in this regard — also made clear that this is a real linguistic ability, and not a consequence of the simple demands posed by the task.

### TABLE XIII

<table>
<thead>
<tr>
<th>Patients</th>
<th>Canonical</th>
<th>Verb-first</th>
<th>Verb-“end”</th>
<th>PP-topicalized</th>
<th>Complex</th>
<th>Other</th>
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<tbody>
<tr>
<td></td>
<td>SVprepO</td>
<td>VSprepOV/SprepOV</td>
<td>SprepOV</td>
<td>PrepOVS</td>
<td>Verb-second: SprepVO</td>
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<td>Broca’s with normal</td>
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<td>patients)</td>
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<td>4</td>
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<td>Broca’s with disturbed</td>
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<td>performance</td>
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<td>Globals with random</td>
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<td>performance</td>
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<td>W.B.</td>
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<td></td>
<td>NOR and NS combined.</td>
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*The distribution of legal and illegal (other) orderings for these patients is not significantly different from a random distribution (Fisher’s exact test, 2 × 2 table). In contrast, B2, B3 and B4 had p < .0001.

### TABLE XIV

<table>
<thead>
<tr>
<th>Type of ungrammatical sequence</th>
<th>“Oth­er”</th>
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<tr>
<td>Broca’s with disturbed</td>
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<tr>
<td>performance</td>
<td>B2</td>
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<td>B3</td>
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<td>Globals with random</td>
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*NOR and NS combined.

5. DISCUSSION

Returning to the three views on agrammatism presented in the introduction, our data offer ample counterevidence to strong versions of the syntactic deficit hypothesis. Instead of the expected selective disturbance of morphosyntax in agrammatic Broca’s, we found complete preservation in 6 patients and relatively mild disorders in 4 others in a constituent ordering task. This, however, does not mean that morphosyntax is available across the board in agrammatic patients.

We have presented additional data on morphosyntactic production for three of the patients in this study (B1=C.B., B3=M.H., B6=H.R.) in another paper (Bayer, De Bleser and Dronsek, 1987). This involved among others an examination of the patients’ abilities to complete case-endings while reading sentences with a canonical versus a non-canonical sequence, and sentences with a genitive NP-complement, e.g.

**Sentences with canonical order:**
- Nominative (25) Ein... hungri... Bettler trifft einen reichen Mann
  
  A hungry beggar meets a rich man
- Accusative (26) Ein flih... Seemann braucht ein... streng... Kapitän
  
  An able sailor needs a severe captain
- Dative (27) Ein alter Gärtner droht ein... jung... Koch
  
  An old gardener threatens a young cook

**Sentences with uncanonical order:**
Nominative (28) Einen hungrigen Bettler trifft ein... reich... Mann
Accusative (29) Ein... fähig... Seemann braucht ein strenger Kapitän
Dative (30) Ein... alt... Gärtner droht ein junger Koch

Sentences with a genitive case depending on an NP:

(31) Die Frau ein... faul... Wirt... putzt den Boden
(The wife of a lazy bartender cleans the floor)

Remember that B6 (H.R.) had no problems in the constituent ordering task, and that B1 (C.B.) and B3 (M.H.) had some disorder but had a clearly above average random performance.

Their reactions on the case completion task are summarized in Table XV. Under the canonical sentence condition, C.B. tended to use the accusative as a default case and M.H. the nominative. H.R., whose performance was "normal" in the constituent ordering task, also had the most meaningful reactions here, at least with respect to the nominative and accusative Case. However, she adhered to this SVO-sequence in the non-canonical sentences and thus produced almost entirely inaccurate reactions. The other two patients continued to use the default Case they had in the canonical condition.

Most surprising were the results for Genitive Case, which is almost dying out in colloquial German. Still, all three patients produced this Case form remarkably well in the appropriate environment.

It is hard to see how an account like the trade-off theory, which is fully formulated in terms of a disorder of processing, could explain the patterns in our data. We did not find any major differences between morphosyntactic tasks with nonwords versus real words in the constituent ordering study. In contrast, differences do exist within one single task for morphosyntactic operations with various structural demands but in which processing requirements were quite similar like in the Case-completion study. It would seem to us that revised versions of the syntactic deficit theory, as advocated by the third class of theories, could better capture the patterns of performance by agrammatics like those reported here. What needs to be explained is why inflectional (and other) morphology is in principle preserved in these patients who avoid morphologically complex words in spontaneous speech.

We have argued elsewhere (De Bleser and Bayer, 1988) that the assumption of a relatively well-retained morpholexical component and of a severely limited phrase-building module goes a long way in explaining at least the elicited data of German agrammatics, which show neither an across-the-board preservation nor disturbance of morphosyntactic abilities. As long as only highly frequent sentence types are used, like in the constituent ordering task, or local, endocentric constructions, like in the task of Genitive Case assignment, the syntactic requirements are within the agrammatic competence and the morpholexical component can be implemented. If, however, structural relations have to be determined non-locally, in exocentric constructions, like in the canonical/non-canonical sentence task, or if the planning of such constructions is required by communicative needs like those governing spontaneous speech, the preserved morpholexical abilities of the agrammatics can no longer operate.

The evidence we have available on German agrammatics suggests that they are largely asyntactic but not amorphological, and that their so-called lack of morphology occurs at the interface of preserved and disturbed linguistic systems.

**ABSTRACT**

This paper reports the results of a revised replication of the von Stockert/Bader constituent ordering study (1976) with German agrammatics. Part 1 describes why such a replication was necessary. In part 2, the original study is summarized and the weaknesses are identified which caused a revision. Part 3 reports the replication study with 10 German agrammatics. The findings of the original study with respect to Broca's aphasics could not be replicated: instead of an almost total loss of morphosyntactic sensitivity, there was almost total preservation. Part 4 eliminates the possibility of a population artefact by reporting on the performance of 3 patients with global aphasia. Part 5 integrates the results of this study within a larger framework of syntax and inflectional morphology in (German) agrammatism.

**REFERENCES**


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