SYNTACTIC REPRESENTATIONS IN AGRAMMATICAPHASIA:
THE CASE OF PREPOSITIONS*

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The focus of this paper is the syntactic deficit in agrammatic aphasia. The specific issue is the extent to which prepositions are impaired in this syndrome. This category is of particular interest because of the unique role its members play in the grammar. This is the organization of the paper: First, several descriptive generalizations are examined critically, and arguments against them are advanced. Then, a new hypothesis is formulated, stated in terms of current linguistic theory. This hypothesis views the deficit as being partial from a syntactic point of view. The relevant notion to account for the data (i.e., partitioning the impaired from preserved prepositions) is Government, a structural relation that must hold between the preposition at issue and the verb. The consequences of this hypothesis are derived, and an experiment that was conducted to test them is reported. The findings of this experiment not only support the hypothesis, but also suggest that the impairment is unique to agrammatic aphasic patients, since the performance of a control group of fluent aphasic was different. Finally, several theoretical issues are discussed in light of the findings and of the proposed description of the agrammatic deficit.

Key words: aphasia, syntax, prepositions, agrammatism

INTRODUCTION

This study investigates the syntactic abilities of patients who have suffered brain damage. Specifically, the issue it addresses is the precise character of the syntactic loss in agrammatic aphasia. This issue has been the center of a recent debate among neuro-

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psychologists of language. An examination of the literature shows a representative for virtually every logically possible position: It has been suggested by some that agrammatic aphasics have lost their syntax completely (Caramazza and Zurif, 1976; Caplan and Futter, 1986); there have been claims that the syntactic loss is partial (Grodzinsky, 1984b, 1986a); and it has even been argued that, in fact, there is no syntactic impairment in agrammatic aphasia (Lineberger, Schwartz, and Safran, 1983). It is worth noting, however, that there is very little theoretical input to the debate, and that the argument, in effect, concerns the proper description of the impairment.

This debate is among the factors that have led to the present study, which focuses on the representation of prepositions in agrammatism. It was conducted, first of all, in order to enrich the data base on the syntactic abilities of agrammatic aphasic patients. Second, it was designed to test a specific hypothesis concerning the structural impairment in agrammatism. Third, the findings raise issues with far reaching consequences for general theoretical issues in linguistics and psycholinguistics. In what follows, previous findings and accounts are reviewed critically, and a new hypothesis is presented. Then, some of its consequences are derived and tested empirically. Finally, the results are discussed in relation to theoretical and methodological issues.

AGRAMMATIC REPRESENTATION OF STRUCTURE

It has been known for some time that the traditional descriptions of agrammatism in Broca's aphasia are inaccurate. These accounts amount to the statement that while comprehension is almost impaired in this syndrome, grammatical formatives are invariably missing from the speech of the patients (Goldstein, 1948; Goodglass and Kaplan, 1972). Findings of the past decade have shown, first of all, that not all grammatical formatives are missing in the speech of this group of patients (e.g., Friederici, 1982; Grodzinsky, 1984b), and, second, that they have some comprehension problems (e.g., Caramazza and Zurif, 1976; Zurif and Caramazza, 1976; Schwartz, Safran, and Marin, 1980; Grodzinsky, 1984a). Given the body of data available today, most investigators of this syndrome would probably agree on the following:

a. The production deficit in agrammatism involves the grammatical formatives (function words) in the language, but these are not necessarily omitted.

b. The deficit goes beyond speech production, and all other modalities are involved to some degree.

However, despite the utility of these descriptive statements as a common ground for everyone, very little else is agreed upon. It is debatable, for example, whether the deficit in comprehension parallels the production deficit; there are conflicting views about the fate of several grammatical formatives, and there are other points of disagreement; and all this even before one begins to identify the causes of the impairment.

The focus of this paper is a special case: agrammatic representation of prepositions. As will be shown, there are several reasons to believe that, due to their unique position
in the grammar, the study of prepositions in agrammatism can lead to important insights regarding the nature of the syndrome.

The special status of prepositions in the grammar

The arguments presented in this paper necessitate some discussion of the grammatical status of prepositions, which must precede the presentation of the hypothesis and the experiment.

In contrast to other syntactic categories, prepositions occupy a doubly ambiguous position in the grammar: First, unlike the rest of the closed class, prepositions count as a major category in syntax and play a role in the phrasal analysis of a sentence; yet, in phonology, many of them behave as do the rest of the minor function words. It can be shown, by a variety of constituency tests that, in languages like English, the preposition and the phrase immediately following it form a constituent which the preposition heads (called prepositional phrase – PP), yet the behavior of this category at the phonological level may be different from other heads of phrases (nouns, verbs and adjectives). In English, this difference is manifested in stress. The major categories are always stressed, whereas prepositions may be clitics and not participate in the stress pattern of a sentence. (A discussion of this issue can be found in Garrett and Kean, 1981.)

There is a second sense in which prepositions hold an ambiguous position in the grammar. In many instances their distribution is syntactically determined, whereas in other cases they are selected freely on semantic grounds. Compare (1) and (2):

(1) John applied for financial aid.
(2) John sat on a chair.

In the first sentence, the preposition is selected by the verb, but in (2) it is selected freely and is crucial for semantic interpretation.

These observations make prepositions an especially interesting object of study in agrammatic aphasia, because it seems that the linguistic impairment in this syndrome extends to some, but not all, of their functions in the language.

After this general description of the functional role of prepositions, let us look a bit more closely at the details of their distribution. It is important to note, first, that a preposition may or may not be a head of a phrase. If it is not, it is a verb particle:

(4) John ran up a large bill. [P. V]

If a preposition heads a PP, as in all the cases below, it may appear in PPs that are parts of any phrasal category: NP (5), VP (6), AP (7), PP (8):

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1 A head of a phrase is defined by X-bar theory (e.g., Jackendoff, 1977). For our purposes, P is the head of a PP, V is the head of a VP, N of NP, A of AP. For constituency tests, see the appendix in Hornstein and Weinberg (1981).

2 The notation [X, Y] is interpreted as: Y is the first branching node dominating X.
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(5) a. A rose for Emily. [PP, NP]
   b. Pictures of my mother. [PP, NP]

(6) John pleaded for help. [PP, VP]

(7) a. John was happy for Mary. [PP, AP]
   b. Mary was proud of John. [PP, AP]

(8) The bug flew out of the window. [PP, PP]

In addition, a preposition may or may not be a thematic role assigner according to the theory. In (5a), (6), and (7a), it assigns the NP that follows it a thematic role (agent, theme, goal, etc.), and is thus a part of the semantic representation of the sentence. In (5b), (7b), and (8), by contrast, it does not, and the role it plays is purely syntactic.

Two other types of prepositions complete the paradigm. The first is a preposition which is subcategorized by a verb, similar to (6), yet its choice is semantically determined, unlike (6):

(9) John put the book on the table. [PP, VP]

The last type of preposition is a head of an optional prepositional phrase, that may be temporal or locative, or the passive by. These are adjoined to S, as indicated in (10a–c):

(10) a. John plays tennis on Sundays. [PP, S]
   b. John plays tennis on a clay court. [PP, S]
   c. John was beaten by Mary in the Sunday game. [PP, S]

There are several tests that determine the status of each preposition. The reader is referred to Jackendoff (1977) and Hornstein and Weinberg (1981) for further information.

Having described the distribution and functional roles of prepositions in the grammar, we are now in a position to review previous studies of the behavior of prepositions in agrammatic aphasia.

Previous evidence and accounts concerning prepositions in agrammatism

The sparing and loss of prepositions in aphasia has been recently investigated by Friederici and her colleagues (Friederici, 1982, 1985; Friederici, Garrett, and Schonle, 1982). These studies show quite clearly that not all prepositions share a common fate following brain damage. The ability of agrammatic patients with respect to some prepositions is severely impaired, yet with others their ability is quite normal. Friederici (1982) reports that in production the German analogues of the types in (11) are likely

3 There are actually two other positions in which prepositions can appear in English, but they are irrelevant here. These are cases like: Pied-piping – *the room in which I live*, as well as purpose clauses – *John studied for the exam.*
to be produced, but the analogue of the one in (12) is regularly omitted:

(11) a. Peter stands on the table.
    b. Peter got up.

(12) Afghanistan applied for economic aid.

Another study by Friederici et al. (1982) showed that, on a sentence-completion task, agrammatic aphasics performed almost normally when they had to pick out the correct preposition to complete a depicted sentence, and the preposition carried semantic content, as in (13):

(13) The cat is lying under the chair.

A similar finding was obtained by Schwartz, Saffran, and Marin (1980) for a sentence-picture matching task, where prepositions of the type in (13) were used.

Finally, Zurif and Caramazza (1976), using an anagram task with a variety of syntactic constructions, again found differential sensitivity to prepositions. When confronted with sentences like (14a), the patients placed the preposition in its correct position, yet they erred in cases like (14b):

(14) a. John gave the cookie to Bill.
    b. The prisoner wanted to escape.

These findings indicate quite dramatically that the distinction of content vs. function words (or open- vs. closed-class) does not adequately describe what is preserved and what is impaired in agrammatic aphasia. Members of the category preposition are always closed-class items, yet they are impaired selectively.

The next question concerns the precise manner by which prepositions break down in agrammatism. Is the right distinction semantic, syntactic, phonological, or perhaps something else?

Considering this issue and acknowledging the partiality of the deficit, Friederici (1985) proposed that “lexical” prepositions are preserved whereas “obligatory” ones are impaired. This proposal, however, does not seem to be well supported from a grammatical point of view. That is, it is unclear how it can be accommodated within the grammar. Recall the discussion of the functional role and distribution of prepositions. Notions like “lexical” and “obligatory” are not compatible with the description provided in any obvious way. For one thing, these notions ignore several types of prepositions, such as those in (5)–(7). Admittedly, these types have not yet been tested, yet one of the main purposes of a descriptive statement such as Friederici’s is to go beyond the available data and serve as a discovery procedure for the deficit, whose consequences could be derived and tested. This end is not accomplished by Friederici’s descriptive statement, which makes it an inadequate account.

Another account of the observed phenomena has been proposed by Rizzi (1985). His point of departure is the Zurif and Caramazza (1976) finding, coupled with Kolk’s (1978) finding that agrammatic patients have difficulty with adjectives. Rizzi observes
that both adjectives and the infinitival to in (14b) are not assigners of thematic role, according to the theory of syntax (Chomsky, 1981). On the other hand, the unimpaired preposition to in (14a), as well as nouns and verbs, are assigners of thematic role. This contrast leads Rizzi to suggest that the proper description of the findings is that thematic role assigners are unimpaired. The consequence of this hypothesis for English is that the only prepositions to be omitted (or substituted) will be of and the infinitival to.

The data reviewed so far, however, seem to disconfirm this claim. Namely, it appears that prepositions other than the two just mentioned are omitted. Specifically, Friederici's finding that agrammatics omit prepositions such as in (12) speaks directly against Rizzi's account, since these prepositions are assigners of thematic roles. In addition, other data, reported by Linebarger et al. (1983), show that use of prepositions is not preserved or impaired along thematic lines.

Since these two descriptive proposals are inadequate, the next thing to consider is an alternative that casts the deficit in structural terms.

A configurational account

If one examines the available agrammatic data against the distribution of prepositions in normal language (as presented above), a pattern emerges immediately: Only un gover ned prepositions (at S-structure) are unimpaired. A detailed explanation is now in order.

In current theory of syntax (Chomsky, 1981), the notion Government plays a central role. It is a structural relation that has to hold among constituents for a variety of conditions to be met. For a constituent to be governed, two conditions must be met: There must be a governor (one of several designated categories), and this governor must stand in a specific structural relation to the governed constituent.

So, all the major categories may be governors, and they have to be in a certain configuration relative to the constituent they govern. Consider the case in (15a), with a concrete example in (15b):

\[(15)\ a.\]

\[(\text{\scriptsize{\begin{tabular}{c}
\toprule
\hline
\hline
\end{tabular}}})\]

\[(15)\ b.\]

\[(\text{\scriptsize{\begin{tabular}{c}
\toprule
\hline
\hline
\end{tabular}}})\]

\(\alpha\) must be a lexical category. \(\chi\) must be the first (minimal) phrasal category dominating \(\alpha\) and must also dominate (although not necessarily immediately) \(\beta\), in order for government to hold. In (15), then, assuming \(\chi\) to be an S, governs \(\alpha\). \(\beta\) governs neither \(\alpha\) nor \(\chi\) and \(\gamma\) governs both \(\alpha\) and \(\beta\). In (15b), the verb governs the preposition since the first phrasal category dominating the verb (VP) also dominates the preposition. The preposition, in turn, governs the NP following it (Bill) for the same reason, but it does not govern the verb, because the first phrasal category governing the
preposition (PP) does not dominate the verb. This extremely simplified presentation of the notion of government will suffice for present purposes. For a detailed discussion and precise formulation, see Aoun and Sportiche (1983).

Returning now to prepositions, a preposition is ungoverned in English in one case only: when it is sentential (or VP) adjunct (10), as the reader may verify. Elsewhere, prepositions are governed. That is, only in the former cases is there a phrasal category (VP) intervening between the verb and the prepositions to block government. We may use this distinction that the theory makes to partition the prepositions that are impaired in agrammatism from those that are spared. It was observed that only sentential adjuncts and particles are impaired in this syndrome. Assuming that a verb-particle is analyzed as a part of the verb at this level (as can be shown by constituency tests) and hence is not a preposition at all, we find that the following is an adequate descriptive generalization over the findings:

(16) In agrammatism, prepositions are impaired, unless they are ungoverned.

Although the problematic prepositions are identified (by the criterion above that picks out the impaired ones), the precise nature of the impairment still remains to be specified. Following the analysis proposed in Grodzinsky (1984b) and Zurif and Grodzinsky (1983), it is proposed that the content, yet not the categorial identity, of the impaired prepositions is deleted from S-structure representation. What this would mean, in effect, is that the agrammatic patient can identify the preposition as such, having access to its categorial identity, but has no access to its actual, lexical identity. This can be stated as a condition on S-structure representation:

(17) In agrammatism, governed terminal nodes at S-structure that are dominated by the category P are deleted.5

This presentation assumes government to apply both left to right (α governs β) and right to left (γ governs α). This is a non-trivial assumption with a variety of consequences. See Travis (1984). It should also be noted that only one type of government is discussed here—lexical government. The other type, antecedent government, is not relevant here and will thus be ignored.

One finding is left unaccounted for, as Douglas Sady (p.c.) points out: Zurif and Caramazza (1976) found, as we have seen, that agrammatics are sensitive to dative prepositions as in (14a), contrary to the prediction in (17). Sady proposed to account for it by appealing to the nature of the task used by these authors. This seems to me the wrong move, since we are talking about the patients’ internal representations that should have reflections in any linguistic task. What could be questioned, though, is the status of these prepositions with respect to government. Various extraction phenomena suggest that they may be actually ungoverned.

Stephen Crain (p.c.) wonders how the data reported by Linebarger et al. (1983) are accommodated by this statement. These authors presented to their patients strings whose acceptability had to be judged. Yet in all their experiments there is no case where the ungrammaticality had to do with prepositions; thus their data do not fall within the scope of the present claims.
The hypothesis to be tested, based on the claim in (17), is that the content of all and only the governed prepositions is inaccessible to agrammatic aphasic patients.\(^6\)

The reader may have noticed that the scope of the present proposal is rather narrow: It pertains to prepositions only. In particular, it does not relate to other members of the closed class group, which are also impaired in agrammatism, as Stephen Crain (p.c.) notes. The claim, then, is that the impairment to prepositions is unique and necessitates a special statement. There are two reasons for that. The first, grammatical reason is that prepositions have a unique position in the grammar, and that this uniqueness is reflected in agrammatism. The second, empirical reason is the fact that no other category is impaired as selectively as prepositions. That is, as far as the available data go, all other categories are subject to patterns of impairment and sparing regardless of the structural configuration in which they appear. The impairment to prepositions, by contrast, seems to be predictable by the context in which a particular item is embedded.

**Consequences – towards an empirical investigation**

According to the hypothesis just presented, in every case where a preposition is governed, it will be deleted from the agrammatic representation. All the other prepositions should be spared. The clearest test for this hypothesis calls for minimal pairs of sentences that differ in that the preposition is governed in one, while it is ungoverned in the other. Indeed, the theory of syntax followed here provides one such case: the two types of passive. The details of the analysis follow.

It is an accepted observation by virtually everyone in linguistics that there are different types of passive constructions. What is not agreed upon is the precise representation of the different types. Some theories maintain that certain passives are derived by a transformation that moves the object from its D(ep)-structure position to S(urface)-structure subject position, while others see passive as a non-syntactic, hence lexical process. The analysis to follow represents the approach of the theory assumed above (Chomsky, 1981). It should be noted, however, that there are others (e.g., Bresnan, 1982).

In the Government and Binding theory, it is maintained that the fact that two lexical elements have the same morphology is not necessarily an indication of a common syntactic source. So, tensed sentences that contain passives come from two sources: They can be either syntactic, in which case they are derived by a transformation (and govern traces at S-structure), or lexical, where they are not transformational (and do not govern a trace). There are established criteria to decide whether a passive is syntactic or lexical in English (see Wasow, 1977). The contrasts in (18) are an illustration of the different syntactic behaviors of the two types:

\(^6\) Doug Saddy (p.c.) suggests that the same facts could be recast differently: that the same partition of the data could be achieved if we said that heads of subcategorizedPPs are omitted, otherwise retained. This proposal, however, falls short of one fact: that the preposition *of*, which is usually not subcategorized, yet governed, is impaired in agrammatism.
(18) a. John was pushed by Bill.
   b. John was interested in Bill.
   c. *John appeared pushed.
   d. John appeared interested.

This leads one to assume a different representation at the level of S-structure for each type of passive. A syntactic passive is given in (19a–b), and a lexical passive in (19c–d):

(19) a. The boy is hit by the girl.

\[
\begin{array}{c}
S \\
\text{NP} \quad \text{VP} \\
\text{Det} \quad \text{N} \quad \text{V} \\
\text{the} \quad \text{boy} \quad \text{is} \\
\text{hit} \quad \text{t} \quad \text{by} \\
\text{the} \quad \text{girl} \\
\end{array}
\]

b. The boy is interested in the girl.

\[
\begin{array}{c}
S \\
\text{NP} \quad \text{VP} \\
\text{Det} \quad \text{N} \quad \text{V} \\
\text{the} \quad \text{boy} \quad \text{is} \\
\text{interested} \quad \text{in} \\
\text{the} \quad \text{girl} \\
\end{array}
\]

Consider the differences between the two representations. There are two. The first is that the syntactic case has a trace in the representation whereas the lexical one does not. This is a consequence of the assumption that the former is derived by a transformation, and that the transformational movement of the boy from object position (in deep structure) to subject position leaves a trace in the vacated position. In the lexical case, no such movement occurred, hence no traces are present. A second difference, crucial for us here, has to do with the positioning of the PP. In the syntactic case the PP is analyzed as a sentential adjunct [PP, S]; in the lexical case, as a complement [PP, VP]. The main argument for this analysis, given in Grodzinsky (1986b), is based on the following contrast:

(20) a. You heard about Bill’s interest in John.
   b. You heard about the city’s destruction by the enemy.
   c. Who did you hear about Bill’s interest in?
   d. *Who did you hear about the city’s destruction by? 
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The contrasts in these examples indicate that no extraction (in this case, by Wh-movement) is possible in (20b) from the NP the city’s destruction by the enemy, whereas in (20a) extraction is possible from Bill’s interest in John. This can be accounted for if we assume that the trace in (20b), but not in (20a), is in a domain from which nothing can be extracted. An independently motivated constraint – Huang’s (1982) Condition on Extraction Domains (CED) – may be useful here: It states that extraction is possible only if a domain is governed. If we assume that the PP in (20b) is ungoverned, this provides the right constraint: Since this PP (that is, by the enemy) is ungoverned, no movement out of it is possible, and the ungrammaticality of (20b) is explained. Yet in (20a) the PP is governed, therefore the grammaticality of (20a) is correctly predicted. (For further details on the analysis of passive, see Jaeggli’s, 1986, review.)

Given this analysis (according to which the by-phrase in verbal passive is ungoverned, and the PP in lexical passive is governed), we have a good testing ground for the hypothesis outlined above. In the syntactic passive, the PP is ungoverned at S-structure. In the lexical passive, it is governed. In addition, there is the case of subcategorized prepositions in active sentences (6), which are governed, too. These structures can be tested against the hypothesis. A set of sentences of all three types was constructed. The details, methods, and predictions are given below.

THE EXPERIMENT

Syntactic constructions and predictions

It has been established above that the agrammatic deficit vis à vis prepositions must be accounted for in configurational terms. Several constructions have been considered. They are reiterated below, with a set of possible outcomes.

Two construction types contain governed prepositions – with subcategorized (obligatory) prepositions (21a) and lexical passives (21b). One type – syntactic passive – contains ungoverned prepositions (21c):

(21) a. The boy counts on the girl.
    b. The boy is interested in the girl.
    c. The boy is pushed by the girl.

Before proceeding to the predictions, the task that the patients were presented with must be considered. Obviously, coherent predictions can be made only if both the syntactic types as well as the method of presentation are known.

Since the hypothesis in question states that the patients have access to the category label but not to the actual identity of governed prepositions, the most direct way to test it is by grammaticality judgment. Indeed, the patients were presented with grammatical and ungrammatical sentences containing prepositions, where the violations of grammaticality consisted in substitutions of the preposition appropriate in the context by another. They were supposed to judge the grammaticality of those strings. Examples of such violations, corresponding to the cases in (21), are given in (22):
(22) a. *The boy counts in the girl.
   b. *The boy is interested on the girl.
   c. *The boy is pushed in the girl.

Several possible outcomes should be considered. According to the configurational hypothesis, the agrammatic patients would be sensitive to the ungrammaticality of strings where a preposition was substituted if that preposition is ungoverned (22c), and insensitive to the others (22a–b). Their failures would stem from the fact that the substitutions are within the same category. It is possible, however, that this hypothesis is incorrect, and that other parameters determine the availability of prepositions. For example, it might be the case that passive morphology has to do with the impairment. In this case, the prediction is that the pattern would be (22a) against the other two. In addition, the analysis of passive followed in this paper might be incorrect. Other theories of sentence structure (e.g., Bresnan, 1982) would analyze both lexical and syntactic passives as having the same configuration, the verb governing the preposition in both.

If such an analysis is correct, then there is no configurational difference between the three constructions, and according to the configurational hypothesis, they should all pattern in the same way in the experiment. Given these predictions, we can now proceed to the details of the experiment itself.

Materials and methods

Six experimental items were constructed and presented to the patients. They consisted of two conditions for each of the 3 construction types discussed above, one grammatical, the other ungrammatical. Each condition consisted of 10 sentences, so that there was a total of 60 sentences in the experiment, presented to the patients in a random order. All the experimental sentences are listed in the appendix.

The subjects' task was to judge the grammaticality of the sentences, recorded and presented to them auditorily. The sentences were read into a tape recorder by a native speaker of English at a slow, normal rate. Special care was taken, in reading the ungrammatical sentences, to imitate the intonational contour of their grammatical counterparts, so that intonation would not give away the grammatical status of the sentence. Also, given the unusual nature of the task, all subjects (normal controls as well as aphasic patients) had a training session prior to testing. Only after the experimenter made sure that they understood the task, did the experiment begin.

Subjects

Three groups of subjects were tested in the experiment: neurologically intact, agrammatic aphasic, and fluent aphasic subjects (for details, see below). The neurologically intact subjects served as a control group and were expected to perform in the test without errors. The fluent aphasics were controls of a different kind. Their performance was expected to address the question of whether the impairment is unique to agrammatism, or rather, is the effect of any left hemispheric lesion to the language areas. The agrammatic patients were the experimental group.
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Twelve subjects were tested in this experiment. They were four agrammatic aphasics, four fluent aphasics (Wernicke's or anomasias), and four normal controls. Subjects were roughly matched for age, educational level, and socio-economic status. They were all paid volunteers, recruited through the Aphasia Research Center at the Boston VA Medical Center. Diagnosis of patients was based on the BDAE (Goodglass and Kaplan, 1972), CT scan information, when available, and clinical workup. The agrammatic patients were three males and one female, diagnosed by the BDAE as Broca's aphasics. They had high school or college education, and their ages ranged from 50 to 68 years (mean age 60). All of them were right-handed and had suffered strokes six to eight years prior to this experiment. They had agrammatism both in their output, which was telegraphic, and in comprehension, as discerned on a number of informal clinical assessments. Their lesions (when known) involved broadly the areas of the brain implicated in Mohr's (1976) discussion of Broca's aphasia. The fluent aphasics, by contrast, all showed fluent speech with paraphasias and some neologisms, as well as impaired comprehension as assessed clinically. They were all right handed males, whose ages ranged from 55 to 75 years (mean age 65). They had suffered strokes three to six years prior to their testing. Three had high school education, and one had eight years of schooling. Table 1 summarizes the clinical information.

Results

In Tables 2 and 3, the raw data (proportion of errors = 'misses' of ungrammaticality) are given for each agrammatic aphasic subject, listed by condition. All the normal controls performed correctly on all conditions. Table 2 shows the results for the ungrammatical conditions.

The results for the grammatical counterparts of all three conditions ('false alarms'), used to create a balanced presentation, are in Table 3.

As mentioned earlier, the critical planned comparison was between the actives and the lexical passives on the one hand, and the verbal (syntactic) passive on the other. That is, conditions $a-b$ against $c$. For the agrammatics the prediction was that sentence types $a-b$ would yield a performance level lower than $c$. This a priori comparison was statistically significant for the agrammatic patients [$F(1, 3) = 33.64; p < 0.05$]. It is important to show that this pattern is specific to this group of patients, rather than a general effect of aphasia. For this reason the same comparison was performed for the fluent aphasics. It was not significant [$F(1, 3) = 4.85; p > 0.10$]. In addition, the effect of the $a-b$ vs. $c$ contrast was reliably greater for the agrammatic than for the fluent aphasics [$F(1, 6) = 6.48; p < 0.05$]. This last effect represents a one degree of freedom test for the critical component of the patient by sentence type interaction. The a priori nature of this particular comparison between patient groups provides the motivation for this statistical test despite the absence of a reliable overall interaction of patient group by sentence type [$F(1, 12) = 2.33; p > 0.10$], when tested in a mixed design analysis of variance with patient group as a between-subjects factor and sentence type as a repeated measures factor. Thus, with respect to the hypothesis set forth above, the patient groups differed significantly from one another.

This analysis also revealed a less important effect of condition type
**TABLE 1**

Characteristics of the aphasic patients

<table>
<thead>
<tr>
<th>Patient type</th>
<th>Motor deficit</th>
<th>Lesion site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. agrammatic</td>
<td>R hemiplegia</td>
<td>no CT</td>
</tr>
<tr>
<td>2. agrammatic</td>
<td>R hemiplegia</td>
<td>left fronto-parietal</td>
</tr>
<tr>
<td>3. agrammatic</td>
<td>R hemiparesis</td>
<td>no CT</td>
</tr>
<tr>
<td>4. agrammatic</td>
<td>R hemiplegia</td>
<td>left fronto-parietal</td>
</tr>
<tr>
<td>5. anomic</td>
<td>left temporo-parietal extending to supramarginal</td>
<td></td>
</tr>
<tr>
<td>6. Wernicke’s</td>
<td>inf. distribution of left MCA</td>
<td></td>
</tr>
<tr>
<td>7. anomic</td>
<td>left posterior and angular gyri</td>
<td></td>
</tr>
<tr>
<td>8. anomic</td>
<td>left temporo-parietal</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 2**

Results for the ungrammatical conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Subject (proportion error)</th>
<th>Subject (proportion error)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>agrammatic</td>
<td>fluent</td>
</tr>
<tr>
<td></td>
<td>1  2  3  4  5  6  7  8  9</td>
<td>1  2  3  4  5  6  7  8  9</td>
</tr>
<tr>
<td>a. active</td>
<td>.9 .3 .3 .5 .50 .9 .4 .5 .8</td>
<td>.65</td>
</tr>
<tr>
<td>b. lexical passive</td>
<td>.9 .3 .8 .7 .68 .9 .6 .8 .8</td>
<td>.78</td>
</tr>
<tr>
<td>c. verbal passive</td>
<td>.5 .1 .2 .1 .23 .6 .5 .5 .7</td>
<td>.58</td>
</tr>
</tbody>
</table>
TABLE 3

Results for the grammatical conditions

| Condition         | agrammatic | Subject (proportion error) | fluent |  |
|-------------------|------------|-----------------------------|--------|
|                   | 1          | 2                          | 3      | 4  |
| a. active         | .1         | .2                         | .1     | .25 |
| b. lexical passive| 0          | .2                         | 0      | .1  |
| c. verbal passive | .2         | .2                         | .3     | .25 |

$[F(2, 12) = 14.11; p < 0.001]$, but no main effect of subject group $[F(1, 6) = 2.32; p > 0.10]$.  

A methodological remark concerning the method of analysis is now in order. In many studies, grammaticality judgment tasks have been analyzed by using signal detection theory, in order to separate effects of response bias from sensitivity to (in this case) ungrammaticality. In this particular case, however, this form of statistical analysis was not required since the critical statistical tests reported above all involved within subject comparisons. Any overall response bias of subjects would apply across conditions, and would not affect the interpretation of main effect of condition type or condition type by patient group interaction effects.

It should be added that similar results have been obtained in an analogous experiment which was performed in Hebrew (see Grodzinsky, 1984a).

DISCUSSION

The results of this experiment are quite straightforward, and commend four immediate conclusions: a. The linguistic deficit in agrammatic aphasia is much less pervasive than has been previously assumed. b. The best available account for this deficit is along structural lines (as suggested by the above account). c. The patterns of performance of agrammatic and fluent aphasics are quite different, indicating that the deficit observed here is specific to this syndrome. d. The patterns of agrammatic performance are consistent with the analysis of passive assumed above, and inconsistent with others.²

² For obvious reasons, this point and its implications cannot be elaborated here. The argument, in brief, is that a generalization over the pattern of results obtained here (coupled with some other findings) is unstable within linguistic frameworks which assume analyses of passive other than the one employed here (see Grodzinsky and Pierce, 1987).
If these conclusions are correct, then several previous descriptions of this syndrome can be rejected safely. Clearly, any claim that agrammatic patients are “asynaptic” in comprehension (Caramazza and Zurif, 1976, and many others), or that they have no syntactic knowledge beyond the lexical category identity of words (Caplan and Futter, 1986), cannot be maintained given this finding.\footnote{This particular finding is just one out of many that suggest the conclusion reached above. See, for example, Linebarger et al. (1983) for data; Zurif and Grodzinsky (1983) and Grodzinsky (1986a) for analyses.} It is clear that the ability to use some prepositions is preserved, yet some others are lost, where the best distinction between the two groups is configurational. Thus one must assume that at least some syntactic ability is preserved in agrammatism, contrary to the extreme positions just mentioned, that view agrammatism, by and large, as a total (or almost total) loss of syntactic ability.

The second position to be considered is an extreme of a different kind — that no syntactic deficit is to be found inagrammatic aphasia. This position, maintained in Linebarger et al. (1983), is based on the finding that while agrammatic aphasics were extremely sensitive to grammatical violations in certain construction types, their comprehension performance (as attested by “standard” tests, namely reversible relatives and passives), was at chance level. The contention is that this “discrepancy” in performance shows that syntactic knowledge, and the ability to recruit it for grammaticality judgment, are intact, yet some interpretive process has gone awry.

This position has already been challenged on descriptive grounds (Zurif and Grodzinsky, 1983). It was argued in that paper that the very same data reported by Linebarger et al., if looked at carefully, call for a different interpretation. Here, however, there is an opportunity to make the same point even more strongly. There are two reasons for that: First, the data reported here show very clearly that even in judgment of grammaticality there is an impairment in agrammatic aphasia, depending upon the syntactic properties of the stimulus sentence. The descriptive generalization proposed above maintains that there is a partial syntactic deficit, and specifies its nature precisely. This generalization, which the present data support, is clearly incompatible with the claims made by Linebarger et al.

Second, it must be noted again that success or failure in a task cannot, in and of itself, motivate any claim as for the linguistic abilities and inabilities of language users, impaired or unimpaired. In order to make such claims, the nature of the task coupled with the specific syntactic properties of the sentences presented must be considered. So, a task is not just “picture matching” or “grammaticality judgment.” Rather, it is judging the grammaticality of a sentence with a given set of properties, understanding the content of a sentence that has others, and so on. This is simply a matter of logic. If a deficit is partial from a syntactic point of view, as seems to be the case, then the grammatical properties of the stimulus materials, as well as the method of presentation, will affect performance. A similar line of reasoning was followed by Caramazza and Zurif (1976), who showed that when a semantic property of a sentence is varied (i.e., reversibility of agent and theme), the performance of aphasics changes drastically, although the “task” is kept constant — their patients were faced with a comprehension task in both instances.
Prepositions in Agrammatism

Table 4
Informal comparison of results in two different tasks

<table>
<thead>
<tr>
<th>Condition</th>
<th>Task comprehension</th>
<th>Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. active</td>
<td>good</td>
<td>poor</td>
</tr>
<tr>
<td>b. lexical passive</td>
<td>good</td>
<td>poor</td>
</tr>
<tr>
<td>c. verbal passive</td>
<td>poor</td>
<td>good</td>
</tr>
</tbody>
</table>

It should thus be clear that a claim based on tasks alone is meaningless. This, however, has not been taken into consideration by several researchers.

On the other hand, a syntactic typology of constructions cannot solely account for the patients’ performance either. To illustrate this point, consider the results of an experiment conducted by Grodzinsky and Pierce (1987), as contrasted with the findings reported here. This study tested comprehension of agrammatic aphasics on the same constructions as those used here for grammaticality judgment. The patients’ performance in the two experiments is compared in Table 4. The terms “good” and “poor” are used just for abbreviation. So, as this table shows, a syntactic construction alone is not an absolute predictor of performance, and as Caramazza and Zurif (1976) pointed out, neither is the task. In fact, one must keep in mind that the type of grammatical violation in the strings judged by the patients is crucial. So, for instance, when presented with passive sentences where the preposition by is missing (reported in Schwartz, Linebarger, and Saffran, 1985) the patients responded correctly, yet in this experiment, where substitutions were given, erroneous performance was observed. A claim that the patients’ overall ability to judge acceptability, or comprehend, is impaired, is thus unwarranted. The real story, it appears, is more complicated than that.

It is important to examine the theoretical predictions concerning the different types of passive. The hypothesis concerning prepositions predicts that substitutions would be detected only in the verbal passive case, because the preposition is governed, yet in the lexical passive, the level of correct detection would be low. This prediction is indeed confirmed. In the comprehension task, however, the prediction of the Trace-Deletion hypothesis (Grodzinsky, 1986a) is exactly the opposite – above-chance performance on lexical passives, and chance levels on the verbal passive. Again, a prediction that is borne out empirically. The inevitable conclusion, then, is that any theoretical discussion of the comprehension abilities of agrammatic aphasics must refer to the task coupled with the syntactic type in question.

In sum, the final conclusion to be drawn from this small study is this: A careful
examination of the syntactic deficit of agrammatic aphasics shows that the linguistic description of this deficit must be configurational, along the lines proposed above. In all likelihood, this deficit is restricted to this syndrome, as attested by the fact that a control group of fluent aphasics did not exhibit the same behavioral pattern. The precise formulation, as well as its scope, is an entirely empirical issue, and will probably change as more evidence accumulates.

REFERENCES

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APPENDIX

In this appendix, all the experimental sentences are listed. Each sentence appears in its grammatical form, and below the preposition is its substitute that results in an ungrammatical sentence. The sentences are listed by condition.

Subcategorized actives

1. Joe hopes for a happy ending.
   *on

2. The coach believed in his team.
   *on

3. The old man looked at the woman.
   *in

4. The fans stared at the actress.
   *of

5. Investors count on their banks.
   *of

6. Sally depends on her driver.
   *for

7. Most students apply for financial aid.
   *on
8. The boy listened to the radio.
   *on

9. My uncle longed for his wife.
   *in

10. The mayor arrived in the city.
    *for

**Syntactic passives**

1. The bike was stolen by the boy.
   *in

2. The cockroach was killed by Lisa.
   *in

3. The boy was bitten by the mosquito.
   *in

4. The sandwich was swallowed by the student.
   *in

5. The grass was eaten by the cows.
   *in

6. The city was destroyed by the storm.
   *on

7. A big house was built here by the neighbours.
   *in

8. A large van was driven by my sister.
   *in

9. The prisoner was watched by the policeman.
   *in

10. This bank was guarded by three men.
    *in

**Lexical passives**

1. My friend was very interested in Jane.
   *on
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2. She was satisfied with her grades.  
   *on

3. The thief is known to the police.  
   *on

4. The director was drawn to the actress.  
   *on

5. My uncle was enchanted with the baby.  
   *to

6. These teachers are puzzled by the problems.  
   *on

7. Harry was obsessed by this woman.  
   *on

8. Jack was very attracted to the dancer.  
   *on

9. She was really infatuated with Henry.  
   *on

10. This key is attached to a chain.  
    *in
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