

The syntactic characterization of agrammatism*

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Abstract

A new characterization of agrammatism is suggested, based on new data from Hebrew speaking agrammatic aphasics, and a reexamination of data from Russian and Italian. This characterization is formed in relation to linguistic levels of representation.

First, the description of agrammatism as omission of closed-class items is challenged on the basis of the data, and a new description is suggested—viewing agrammatism as mis-selection of items + default: in English the default procedure may always be used, but in the other languages discussed, the patient is forced, for structural reasons, to unconscious guessing that results, in many instances, in syntactically aberrant sentences in which each lexical item is well formed.

Second, after discussing issues concerning the proper relation between linguistic theories and processing models, a condition on a syntactic level (S-structure) in linguistic theory (Chomsky, 1981) is proposed, to account for agrammatic data from all the languages considered. It is then shown that agrammatic performance in a variety of tasks (including comprehension) is explained naturally as a consequence of this condition.

Finally, several related processing issues are discussed. In particular, the relationship between the proposed structural account and the model offered by Bradley et al. (1980).

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Introduction

The clinical literature on agrammatism describes the syndrome as consisting, in part, of omission of function words and inflectional morphology in speech (Geschwind, 1970; Goldstein, 1948; Goodglass and Berko, 1960; Tissot *et al.*, 1973). Most recent structural characterizations of agrammatism (Caplan, 1982; Kean, 1977, 1980), address the deficit in these terms, focusing, that is, on the partition between the omitted elements, or closed-class items, and the retained nouns, verbs and adjectives, or open class items. The first part of this paper will challenge this description. Taking agrammatism to be a universal phenomenon, I will argue that there are languages where for structural reasons, certain kinds of closed-class items cannot be omitted from agrammatic speech. I will seek to support this argument by presenting data I have collected from agrammatic speakers of one such language—Hebrew. Also, previously published data from Italian and Russian will be reviewed for contrastive purposes. These data will demonstrate that agrammatism has different configurations, depending on the type of language in which it occurs. I will propose a new general description of the syndrome, one that is compatible with the data from all languages considered. Finally, in this respect, I will deal with cross-linguistic diagnostic issues.

The second part of the paper will be a proposal for a structural characterization of agrammatism elaborated in terms of current linguistic theory. It will depict a syntactic level of the linguistic model as the relevant location for the contrasts necessary to account for agrammatism.

I. A rough typology and its consequences

Some structural facts

The closed-class vocabulary items fall into two morphologically distinct categories: the bound and free grammatical morphemes. The former constitute the inflectional morphology in English, and the latter, prepositions, pronouns, determiners etc.¹ The discussion here will focus on the so-called bound morphemes, since their status in different languages is crucial for the development of my argument.

¹Since the closed-class/open-class partition is empirically motivated, there are elements that have ambiguous status. There is conflicting empirical evidence concerning some adverbs and some auxiliary verbs. Bradley (1978) calls them 'floaters'. I will not discuss these elements here.

Roughly, there are three possible forms of relations that inflectional morphology can enter into with items of the major lexical categories:

(A) Lexical items may have existence independent of inflection. That is, verbs, nouns and adjectives may have a well-formed, uninflected (or \emptyset -inflected) form. English morphology is of that type. Consider the following inflectional paradigms for a noun and a verb in English, and note that both have an unmarked, well-formed \emptyset -form:

<i>noun</i>	<i>verb</i>
boy - \emptyset	walk - \emptyset
-s	-s
	-ed
	-ing

(B) Major lexical category items are morphologically, but not phonologically dependent on the inflection. That is, an uninflected element is a legal, well-formed phonological string, but it is a non-word. It must be inflected (usually by adding a suffix), in order to become a real word. This is the case, in many instances, in Russian and Italian. The following examples from these languages will demonstrate the dependency.

Consider the Italian adjective *rosso* (red). It is inflected for gender and number, and its inflections constitute the set [*rosso, rossa, rossi, rosse*] for masculine and feminine in singular and plural, respectively. The 'bare', uninflected stem *ross-*, which is certainly pronounceable in Italian, is not a word. It becomes a word only when inflected. The same holds for many other nouns and verbs as well. The infinitive in Italian is not the stem alone. Rather, a suffix must be attached to the stem, so that [stem + suffix] = infinitive. Hence, in *amazzare* (to kill), for instance, the stem is the non-word *amazz-*. Again, there is no \emptyset -inflected form.

The same is true for many nouns and for verbs in Russian. Consider the feminine noun *sumka* (a bag), and its inflectional paradigm:

stem	suffix	case
<i>su.nk</i>	-a	nominative
	-i	genitive
	-u	dative
	-oj	accusative
	-e	instrumental
	-e	locative

It is apparent from this table that *sumk-* is the stem, yet it is not a word. For verbs, a similar thing happens:

<i>gavarit</i> (to speak)		
	present	past
<i>gavar</i>	<i>-ju</i>	<i>-ila</i>
	<i>-is</i>	<i>-ili</i>
	<i>-it</i>	<i>-il</i>
	<i>-im</i>	<i>-ili</i>
	<i>-itsje</i>	<i>-ili</i>
	<i>-jat</i>	<i>-ili</i>

gavar- is the stem, but again is a non-word (although it is well formed phonologically).

(C) Lexical items depend both morphologically and phonologically on the inflectional morphology. That is, an uninflected item is not only a non-word, but also an illegal phonological string in that language. This is the case for Semitic languages.

Observe the following Hebrew pair: *simla*, *smalot* (a dress, dresses). Both words are related to each other by three consonants *S M L*, but there is no isolable string of elements that they share. In particular, they differ with respect to the whole vowel base.

Semitic morphology is pervaded by a wide variety of such forms—that is, forms that share only identical consonants (for a detailed theoretical discussion on Semitic morphology, see McCarthy, 1979, 1980; and Halle and Vergnaud, 1980).

It follows, therefore, that the morphology of Semitic languages cannot be characterized as having stems, suffixes and prefixes, as is the case in Indo-European languages. Rather, it has roots (some of the identical consonants that related items share), and the inflectional morphology consists of prefixes, infixes (the vowel base), and suffixes. The canonical form of a Semitic word is thus roughly [prefix-CVCVCV-suffix]. Hence, without inflections there is no vowel base (–_V_V_V–); and without the vowel base, there is no pronounceable string, but just a cluster of consonants. Also, the root relates items across lexical categories, so that a formal distinction between inflectional and derivational morphology is not possible (McCarthy, 1980).

Take, for example the root *K Š R*, and notice how the application of morphological rules on it yields words from different lexical categories, each

inflected for the various grammatical dimensions (yet the root itself is unpronounceable):

	Inf.	V past	V pr.	V fut.	Adj.	Noun
to tie	liKŠoR	KaŠaRti	KoŠeR	eKŠoR	KaŠuR	KeŠeR
to get tied	lehiKaŠeR	niKŠaRti	niKŠaR	eKaŠeR		hiKaŠRut

To review up to this point, then, languages can have morphologies such that a word is either (A) independent of inflection both morphologically and phonologically, or (B) dependent morphologically but not phonologically, or (C) dependent both phonologically and morphologically on the inflection.

Consider now agrammatism consequent to focal brain damage in the context of this typology. In English, we know that the 'omission' description is compatible with the data. In Italian and Russian, however, omission of the inflections would result in many instances in agrammatic productions of non-words, namely bare, uninflected stems. Even more strikingly, in Hebrew we would predict that agrammatism would result in mutism, as uninflected elements do not have phonological shape. But does the 'omission' hypothesis actually provide a good fit for the data? As I show below, it does not.

The empirical evidence

In this section I will present evidence that indeed, the bound morphemes are omitted in the languages in question only under very specific conditions and not across-the-board. Further, I will consider a general descriptive statement to accommodate the data both from English and from the other languages.

Data from Hebrew speaking agrammatic aphasics as well as from Italian and Russian, show that bound closed-class morphemes are omitted only under very specific conditions. In particular, inflections are retained insofar as they are an obligatory part of the word. So in Hebrew, inflectional morphology seems to be always retained, because phonological shape presupposes it; in Indo-European languages, inflection is omitted sometimes, namely in instances where the lexical item in question is well formed without it, that is, where the lexical item does not depend morphologically on the inflection. If this is the case, is omission of the free grammatical morphemes the only manifestation of agrammatism in these languages?

Even without the data, one would not anticipate this possibility, since in

English, all of the closed-class items are somehow involved. So it would follow that inflections ought to be retained in agrammatism in Hebrew, Italian and Russian, but still to be involved in the agrammatic impairment.

The data show this to be exactly what happens. Agrammatic patients produce fully inflected words when considerations of lexical well-formedness so indicate, but in many instances, they inflect them erroneously, so that the result is often a syntactically aberrant sentence, where all lexical items are well formed (barring phonemic paraphasias).

Observe the following agrammatic utterances from the various languages.

Hebrew

As Hebrew has the richest morphology of the languages I discuss here, it demonstrates most strikingly that words appear in the patient's speech in a fully inflected form, though in many of them there are violations of syntactic rules of agreement. Below are some examples from a corpus I collected from two agrammatic aphasics in Israel. More can be found in the appendix.

- (1) *nas'u ba'ali, 'anaxnu nasanu*
(drove (III pl.) my husband, we drove(I pl.))
- (2) *šaloš milim...lo...šloša milim ve-'arba'a ne'elam*
(three (F) words (F)...no...three (M) words (F) and four (M) disappears (M sing.))
- (3) *'ani nifsakti...lo...hifsika...lo tov...'ani hifsakti [lelamed]*
(I was stopped (M&F I sing.)...no...stopped (F III sing)...no good...stopped (M&F I sing. correct) [teaching])

In all these examples, rules of agreement are violated. In (1) between a verb and its agent noun, in (2) between a modifying adjective and its noun. In (3), the error is in verb class first (passive instead of active), then in person, and the correct form appears in the third trial.

Italian

The data from the Italian agrammatic patients is taken from Miceli *et al.* (1983).

- (4) *Andare [all'] ospedale. Non credere [alla mia] parola...non ci credevano i dottori*
(To go [to] hospital. Not to believe [to my] word...not to it believe the doctors)

Note that the verb *credere* (believe) is used once in the infinitive and once in a finite (III pl.) form. In both cases, as well as with other words in this sentence, inflected forms are used. If they were not used, and only the stems would have been retained, we would get:

(5) *and- ospedal-. Non cred- parol-...non ci cred- i dottor-*

Some other illustrations:

(6) *Cappucetto rossa andava per...cappucetto rosso andava per il bosco*
(little red (F) riding hood was walking through...little red (M) riding hood was walking through the wood)

Russian

The data from Russian is taken from Tsvjetkova and Glozman (1978).

- (7) *Grustnaja malčik. Malenki doč*
(Sad (F) boy. Little (M) daughter)
- (8) *Osjen pered zimji*
(Fall before winter (wrong case))
- (9) *Zajats sidjit [na] djerevo*
(Rabbit sitting [on] tree (wrong case))
- (10) *Snjeg mnogo*
(Snow (wrong case) much)

The whole corpus may be found in the appendix. Note, however, that in cases where the inflectional paradigm of an item does not include \emptyset —i.e., the 'bare' stem is a non-word—the patient inflected erroneously (*grustnaja* instead of *grustnej* etc.). But when \emptyset is an option—i.e. the stem is a word—the patient chooses it (*snjeg* instead of *snjega*).²

²*grustnaja* is inflected for gender and number and for case. In nominative: *grustnej grustnaja grustneje* for masculine and feminine singular, and for plural respectively. There is no \emptyset -form *grustn-*, and accordingly the patient mis-selected rather than omitted.

For *snjeg*, which is inflected for case, the nominative is \emptyset :

snjeg- \emptyset Nom.
-a Gen.
-u Dat.
-o Acc.
-om Inst.
-e Loc.

Indeed, the patient omitted the inflection in this instance.

An informal description that comes to mind after looking at these samples, states that agrammatic patients exhibit the following behaviour:

- (1) They omit *free* grammatical morphemes, i.e., prepositions, determiners, auxiliaries etc.
- (2) Whenever the well-formedness of a lexical item does not depend on its being inflected (i.e. it has a \emptyset -inflected, unmarked form) the form chosen tends to be the unmarked one.
- (3) In every other case (i.e. where the lexical item depends morphologically or phonologically on the inflection *vis-à-vis* its well-formedness), any form may be selected from the set of permissible inflectional configurations, regardless of syntactic constraints.

Such a description accommodates all the languages discussed here. It takes well-formedness of lexical items to be a 'criterion' used by agrammatic aphasic patients. It accounts for the omissions and for the mis-selection with respect to case and agreement when omission is not possible. To be sure, it is a very informal description, and it does not specify any of the processing antecedents for the agrammatic behaviour. But it has, nonetheless, several processing implications:

- (1) It allows a first approximation of the production deficit while generalizing over languages of various types.
- (2) It brings to the fore two tacit assumptions regarding the nature of the processing deficit: (a) that there is some 'default' procedure, by which patients select the \emptyset -form when possible, namely, that there is a set of options such that the \emptyset -form is always last, and (b) when (a) cannot be applied for structural reasons, some form of *unconscious* guessing takes place—guessing that results, in many instances, in mis-selection.³

A remark on the diagnosis of agrammatism

A reasonable objection may be raised at this point, that if the only pathognomonic for agrammatism is omission of closed-class items, and if there are languages where this does not happen, then one cannot in these cases diagnose agrammatism. In particular, 'mis-selection' is reminiscent of paragrammatic speech, which in English is a totally different phenomenon from agrammatism, and dependent upon a different lesion site.

There are, however, several reasons for dismissing this objection:

³It also makes a prediction concerning the retention of suppletive forms in English (go-went etc.).

(1) The claims I have made concern only the *bound* grammatical morphemes in the patient's speech. The free morphemes are expected to be omitted, since there is no structural difference with respect to these elements among the language types described here. And in fact, the data show that the free closed-class items are omitted. Moreover, when a bound morpheme is not morphologically necessary, i.e., considerations of lexical well-formedness do not require inflection, it tends to be omitted, too.

(2) Clinically, one invokes additional diagnostic criteria that are independent of the language used, like non-fluency, lack of neologisms or semantic paraphasias, and relatively intact comprehension. The authors I quoted invoked these criteria, and so did I for the diagnosis of the Hebrew speaking patients (cf. appendix for information on these patients).

(3) When available, information about lesion site (anterior *versus* posterior) should be used. Again, this has been used when available for the data presented here.

I believe that these are sufficient criteria for a positive diagnosis of agrammatism. Granting this description, and adequate resolution of the diagnostic issue, we can now move on to construct a model within a formal linguistic perspective.

II. Structural characterization of agrammatism

Structural characterizations of agrammatic language specify the conditions that have to be imposed upon an otherwise normal linguistic model, for it to account for agrammatic utterances. A neuropsychological account of agrammatism will specify, by comparison, the components of a processor that must be disrupted so that the conditions sketched by the structural account (and further requirements) be met. Thus, I will provide a systematic specification of the forms available in agrammatism, so that particular processing components may be functionally related to that specification (where 'available' means all the structures which the agrammatic aphasic patient can correctly analyze). The aim is to sketch an upper bound on the representation of structure in agrammatism, by suggesting a correspondence between grammars of normal and impaired language. Such correspondence may, in principle, be stated in two ways: the first is to claim that rules of grammar are either missing or modified after brain damage. To make such a claim, however, is to equate grammatical rules with psychological processes, which need not be true (see Fodor *et al.*, (1974) also Kean (1980), for detailed discussions on this issue). The second way to provide a structural account, is to specify

conditions on *representations* in the linguistic model, namely, conditions on structure, without making reference to a particular rule system. Thus, if such conditions characterize the structures which are blocked in agrammatism, then a processing account will specify the components of a processor that must be disrupted for such structures to be inaccessible. Consequently, the characterization here is concerned only with distributional evidence, namely, only with types of available structures, and not, for instance, with facts like overuse of infinitives by agrammatic aphasics. Frequency in use and real-time considerations are in the domain of processing theories.⁴

The data presented earlier suggest that whenever omission of a closed-class item is not permissible, and a lexical item must be inflected for it to be well formed, chances are that this item will be inflected incorrectly for person, gender and number, (or possibly for verb class in Semitic languages) or will be assigned the wrong case. The result is often an aberrant sentence. One way to represent these aberrations formally is by making claims on the disruption of rules of agreement and case marking, or by invoking restrictions on the application of these rules. For the reasons given above, I will attempt to formulate a condition on a representation—a condition that will result in a system where the boundaries of the normal grammar are extended, such that agrammatic sentences are now included, and considered well formed. In particular, the boundaries have to be extended such that each lexical item in a sentence is well formed by 'normal' criteria, but the sentence as a whole may be aberrant in the following respects:

(1) It may lack all the free closed-class morphemes, except a limited number of semantically determined prepositions, (Friederici, 1982) and particles (Goodglass, *et al.*, 1972), and

(2) It may contain any inflectional configuration of major lexical category items, regardless of whether they violate rules of agreement or case marking.

The problem is, then, to find a condition for '*grammaticality*' within the *agrammatic system*.

One of the syntactic levels of representation in the linguistic model will be a natural candidate for the imposition of such a condition. The formulation here consists of two parts: one for the prepositions, and one for the rest of the closed class items.

⁴The distinction between distribution patterns and patterns of preference, or overuse, has an analogue in linguistics. Consider the following sentence:

John read his mother's book

Although *John* and *his* may or may not be coreferent, there is a preferred reading. Linguistic theory, however, usually has no concern to account for such preferences. The discussion here follows this line.

To begin, note that prepositions may generally appear in five types of configurations:

- (a) When they are not heads of phrases, namely particles—[P,V],⁵ as in

John ran up a large bill

(b) When they are heads of phrases, and subcategorized for a verb, that is head of [PP,VP], in which case there are two options:

(i) a verb subcategorizes for a single preposition with no semantically based choice, as in

John hoped for the best

(ii) A verb subcategorizes for a preposition, but the choice is semantically determined, as in

John put the cookie on the table

(c) When prepositions are parts of noun phrases, yet heads of prepositional phrases, [PP,NP] where they can be:

- (i) θ -role assigners, as in

A rose for Emily

- (ii) non-assigners of θ -role, as in

The destruction of the city

- (d) When they are heads of prepositional phrases, [PP,PP], as in

The bug flew out of the window

(e) When they are heads of phrases which are adjoined to an S—[PP,S], as in

John plays tennis on Sundays⁶

There are several tests to determine the type to which each case belongs. The reader is referred to the discussion in Jackendoff (1977).

⁵A head of a phrase is defined in accordance with \bar{X} -theory (see Jackendoff, 1977). For our purposes, P is a head of a PP, V is a head of VP, N is a head of NP, A is a head of AP. The notation [X, Y] is interpreted as: Y is the first branching node dominating X.

⁶The need for distinguishing between the two semantically determined cases, namely (b(ii) and (e) is demonstrated by the following contrasts:

- (1) *John put the cookie
(2) John plays tennis

Also



The data available so far from agrammatism (Friederici, 1982; Friederici *et al.*, 1982; Goodglass *et al.*, 1972; Schwartz *et al.*, 1980; Zurif and Caramazza, 1976) suggest that the prepositions which are retained are those in adjoined phrases, and particles, namely those of types (a) and (e); for example, Friederici has shown that agrammatic aphasics deal easier with sentences like (11)—of the (e) type, than with (12) or (13)—of the (b) and (a) types, respectively:

- (11) *Peter steht auf dem Stuhl*—[PP,S]
(Peter stands on the chair)
- (12) *Peter hofft auf den Sommer*—[PP,VP]
(Peter hopes for the summer)
- (13) *Peter ruft den Schuler auf*—[P,V]
(Peter calls the students)

The other results are less clear, because the materials seem to mix cases of the (b(ii)) type, like *John put the flowers on the table*, [PP,VP], with cases of type (e), like *John walks by the river*, [PP,S]. While the issue still remains to be clarified, it seems that agrammatics do well with type (e), and badly with the rest. Consequently, the condition on structure must allow them to be represented, and block the rest.

As for the remaining closed-class items, namely inflections, pronouns and determiners, we have to account for lexical well-formedness, since it is a constraint on agrammatic production, yet allow for patterns of mis-selection. The evidence for such patterns in the agrammatic inflectional system has been presented earlier. As for the pronouns and determiners, the issue is less clear, but see Linebarger *et al.* (1983) for evidence on pronouns, and Goodenough *et al.* (1977) regarding determiners. To account for these patterns, one must invoke a syntactic representation that includes phrase markers for the inflectional dimensions (tense, person, gender, etc.), but these will lack their specification at the terminal nodes of the tree structure, so that patterns of mis-selection may be accounted for.

This condition may be formally stated in terms of a particular linguistic model, given that the model has a level where members of major categories are specified lexically, whereas the rest, (i.e. the closed-class items except prepositions) are specified only by features. S-structure level in Chomsky (1981) has precisely these properties.

(3) John plays tennis on Sundays and Jim does so on Mondays
(4) *John put the book on the table and Jim did so on the couch

(see Jackendoff, 1977).

I will start with examples from English and Hebrew, and then state a general condition on that level.

S-structure representation for the sentence

(14) *The boy kissed the girl*

is (15):

(15) [[[+def.] [boy]] [[kiss] [+tense]] [[+def.] [girl]]]⁷
 S NP DET N VP V INFL NP DET N

The terminal nodes of DET, INFL are not lexically specified at this level. Rather, these categories are filled with grammatical features. In agrammatism, then, a node like this should be unfilled, enabling the grammatical dimensions to be selected freely from within their range. Thus, by hypothesis the agrammatic S-structure representation of the same sentence will be (16):

(16) [[[*] [boy]] [[kiss] [*] [*] [girl]]]
 S NP DET N VP V INFL DET N

The symbol '*' denotes that the value is not fixed (and does not stand for an empty category) and so, any optional value may be selected, and the sentence will be 'well formed' in the agrammatic system.

Similarly, for the Hebrew sentence '*ani hifsakti* (I stopped)', S-structure representation in the agrammatic system will be

(17) [[['ani]] [[f s k] [*]]]⁸
 S NP N VP V INFL

Assuming the morphology to be a part of the phonological component (see McCarthy, 1980), there is now a vast number of phonological values (any possible expansion of the root *f s k*), each of which is 'well formed' in the agrammatic system. In particular: *nifsakti*, *hifsika*, *hifsakti*, all produced in the same sentence by one patient I interviewed.

Similarly, in Italian and Russian this representation will have some unspecified terminal nodes, so that the agrammatic model will account for the 'well-formedness' of agrammatic sentences in these languages.

⁷Although INFL is usually assumed to be attached either to S or to INFL' which, in turn, is attached to S at S-structure level, for convenience I will represent it as following the verb, to avoid making reference to rules like Affix Hopping, which are irrelevant in the present context.

⁸There may be some notational variants for this representation, depending on the view one takes of the Hebrew lexicon. Thus, for example, one may claim that the verb class (*binyan*) is lexically specified at S-structure representation. This variance, however, is irrelevant for my purposes, as there is, on any view, some grammatical information at S-structure that is not lexically specified, and this information is claimed to be unspecified in agrammatism.

As for prepositions, we now have to allow only for one configurational type to be retained in the agrammatic representation, if we make the reasonable assumption that a particle at S-structure is analyzed as a part of the verb. We can now state the agrammatic condition in terms of current linguistic theory (Chomsky, 1981):

(18) *The Agrammatic Condition:*

- (1) if a terminal element at S-structure is not lexically specified, then it will be unspecified at this level.
- (2) every preposition at S-structure will be deleted, unless it is a head of a prepositional phrase attached to S.

Part (1) of the condition is necessary to ensure lexical well-formedness (as phrase markers are left in the representation, and only their specific values are absent), and to allow for the syntactic aberrations that agrammatic patients exhibit. Part (2) is necessary in order to distinguish between prepositions that are retained and prepositions that are missing in agrammatic sentences.

Note that the first part of the proposed condition explicitly assumes that even the 'omitted' elements are structurally represented, namely, that there are positions for them in the syntactic tree. The need for this assumption with regard to the abstract inflectional element—INFL—as well as determiners, has been explained above.

This condition has further properties. First, it accounts for agrammatic language without 'artificially' lumping determiners, prepositions and auxiliaries. Rather, the distribution of these elements in agrammatic speech is explained from within the linguistic model in a natural way (for a critique of the open-class/closed-class partition, see Kean (1980)).

Second, it sharpens the claim that the availability of closed-class items is functionally determined, by specifying the structural relations these items have to enter into in order to be represented in agrammatism (although it is possible to formulate part 2 of (18) in non-configurational terms, namely to partition the prepositions to assigners and non-assigners of θ -role—see Rizzi, (1982)). Thus, if we take the element *for*, it can either be in COMP position, or in a subcategorization of a verb, and in each case it is predicted to be unavailable (19–20). By contrast, when in adjunct position, it is predicted to be retained (21):

- (19) It is hard *for* John to cry (COMP)
- (20) John bought a present *for* Bill (subcategorized)
- (21) John read to book *for* 2 hours (adjoined)

Third, there are elements of S-structure which are not members of the closed-class group, yet are not lexically specified at this level, and hence by the Agrammatic Condition they are unspecified. These are the empty categories 'trace' and 'PRO' (for discussion of their properties see Chomsky (1981, 1982)). Briefly, trace is what a moved element leaves behind as a result of either Wh- or NP-movement (22–23), and PRO stands for a subject of an infinitive (24), which may have an antecedent (24a), or may have arbitrary reference (24b):

- (22) a. John saw Bill
b. Who_i did John see t_i ?
- (23) a. John killed Bill
b. Bill_i was killed t_i
- (24) a. John_i planned PRO_i to leave
b. It is time PRO_{ARB} to leave

Could these elements, now missing at S-structure, be related in any way to agrammatics' linguistic abilities? An examination of the literature shows that the present account, which was originally motivated by cross-linguistic production patterns, can be extended to account for comprehension data by invoking empty categories, most crucially, traces.

Consider, in this respect, the following sentences, taken from previously performed experiments, where on a picture-matching measure of sentence comprehension, agrammatic patients failed to assign semantic roles consistent with syntactic structure:

- (25) The cat that the dog_i is biting is black (Caramazza and Zurif, 1976)
(26) The boy is followed by the girl (Schwartz *et al.*, 1980)

Both types of sentences involve movement which leaves a trace: the first is a result of Wh-movement, and the second of NP-movement. Consequently, a trace is left at the position from which the element is moved, which is co-indexed with the noun phrase in its new position. Further, the trace and its antecedent constitute a chain (NP_i, t_i), and thus grammatical function (Subject, Object, etc.) can be transmitted from one member of the chain to others, most importantly, from the trace to the moved lexical element. Every grammatical function is associated, in turn, with thematic role. As for the Wh-trace, it functions as a variable which is bound by an operator. Thus, S-structure representations of sentences (25)–(26) are:

- (27) [the cat]_i [that[the dog is biting t_i]] is black
(28) [the boy]_i is followed t_i [by the girl].

Returning now to the Agrammatic Condition, these representations will crucially lack the traces (as they are not lexically specified, that is, by part (1) of the condition), and grammatical function, therefore, will not be properly assigned.

Further, the Agrammatic Condition accounts for the fact that passive sentences are harder for agrammatics than their active counterparts. In fact, the prediction is that simple active sentences will be fully represented, hence performance should be perfect, while the interpretation of passive sentences should be random, because the representation consists of conflicting information: the element in subject position is not a part of a chain with a trace in object position, the passive morphology is unspecified, but the *by* phrase is, because it is adjoined to S:

- (29) [[John] [*] [[kill]] [*] [by Bill]]
 NP AUX VP NP PP

There are, for the purpose of θ -role assignment, two candidates for agenthood in this sentence (given that it is reversible): John and Bill, and there is no way, with this representation, for getting the right interpretation.

This result is precisely the one obtained in a recent study (Futter and Caplan, 1983).

One kind of comprehension result still remains unaccounted for. Kolk (1978) has found that agrammatic aphasic patients fail to integrate modifying adjectives in sentences like *Old sailors tell sad stories*. Adjective is a lexical category, hence this account fails to accommodate these data (but see Rizzi (1982), for an attempt to interpret these data in terms of θ -theory).

To summarize so far, the proposed condition on S-structure not only accounts for patterns of spontaneous speech cross-linguistically, but it also reflects the correlation observed in agrammatism between these patterns and certain aspects of sentence comprehension.

Some comparisons with other recent analyses are in order here. Kean (1977, 1980) seeks to form a partition between the informally grouped closed-class items, on the one hand, and the major lexical categories (N,A,V) on the other, within a formal linguistic model. The need for such a partition derives, of course, from descriptions of agrammatism that stress omission of closed-class elements, descriptions which were discussed in the first part of this paper. The problem is that prepositions, determiners, auxiliaries, complementizers and the like do not constitute a natural class within the theory of syntax, hence one must seek a linguistic characterization which will be capable of partitioning the two groups. Kean finds the mechanism of word-boundary assignment at the phonological level as capable of doing so, and then claims that the formal description of agrammatism is phonological. In

English the result is the distinction between stressed elements—N,A,V and the unstressed ones—monosyllabic prepositions, determiners, inflections etc., which indeed tend to be omitted in agrammatism.

There are several problems with this characterization, which are raised by the foregoing discussion. First, the formal system which it assumes is incapable of handling non-concatenative morphologies (like the Semitic one); thus it cannot achieve generality, unless modified substantially. Second, even if modified, Kean's account would still have problems with the data presented here: the new phonological account (which presumably would now invoke lexical well-formedness criteria in addition to boundaries) would not be capable of predicting patterns of mis-selection, since it would say nothing about agreement or tense which are not features at the phonological level.

Consider now Caplan's account: he views agrammatism as an impairment that is formally best characterized at the syntactic level of an adequate grammar. Specifically, he claims that only major lexical category labeling is available to the agrammatic patient, and no syntactic structure. It seems to me that sufficient evidence has been presented here to substantiate the claim that agrammatic aphasic patients retain more structure than that, and in particular, are able to construct phrasal nodes. In particular, patients never violate adjective-noun order. This is especially visible in Hebrew, where quantifying adjectives precede the noun, and the rest follow the noun. None of the patients interviewed violated this strict order.

Finally, I would like to consider the consequences of my claims for theories of processing. It was argued before that if a condition on a level of representation is compatible with the data from agrammatism, and assuming that the representation of language in the brain is consistent with processing distinctions, then there must be processing component(s) that when disrupted allow what remains of the processor to produce output that meets this condition. Processing theories, however, need to account for additional facts. The agrammatic condition (particularly its second part) suggests a default procedure without specifying a mechanism that has such a characteristic. Bradley *et al.* (1980) have suggested that closed-class items normally have a privileged status in real-time processing, which breaks down in agrammatism. This account is consistent with their model, yet restricts it in two ways: first, it points out that there are uses of closed-class items which do not go by the putative privileged route, hence are undisrupted in agrammatism. These are 'semantically based' computations (Garrett, 1982). Second, the present account puts an upper bound on the involvement of closed-class items in parsing: it makes the claim that even with a disrupted ability to access the closed-class items, an ability to construct some kind of syntactic representation remains (probably on the basis of subcategorization information alone). Agrammatic pa-

tients, on this view, have considerable, yet incomplete syntactic information available to them, and their ability is beyond inferences over lexical content of major categories, or heuristic strategies.

Another processing issue has to do with verbs. Namely, the proposed characterization is compatible with agrammatic utterances that contain *any* inflectional configuration of a verb, as long as it is well-formed lexically. But in fact, the disruption is such that in English, Italian and probably French, one observes pervasive use of infinitives (although other forms appear, if less frequently), while in Russian and Hebrew there seems not to be a preferred form. Processing models have to confront these facts. Again, this has to be formulated in relation to the syntactic level.⁹

In summary, I have argued that agrammatism should not be viewed as omission of closed-class items, but rather as a mis-selection + default, and I have suggested a condition on linguistic theory to account for agrammatic utterances. I then extended the scope to account for a variety of previously charted performances of agrammatic aphasic patients. This characterization is intended to serve as a basis for advancing the construction of processing models consistent with distinctions that are honored by the brain.

Appendix

This appendix contains additional speech samples I collected from two Hebrew speaking agrammatic aphasics, and some Russian samples from Tsvjetkova and Glzman (1978).

Hebrew

Patient Y.D. is a 56-years-old right handed female, a native Hebrew speaker (immigrated from Russia at the age of 10, but spoke Hebrew at home in Russia). She has been agrammatic since 1977. Her CT scan shows low density in the vicinity of Broca's area. She is college educated and was a college teacher. Her speech was non-fluent, limited to short sentences.

⁹Notice, incidentally, that the proposed analysis provides the background against which an explanation for this phenomenon can be formed. That is, we can say, reformulating the vague 'default' notion of part I, that for verbs, the default option is actually the [-tense] value of INFL, instead of its being unspecified (what was marked '•' before). We thus achieve not only a more abstract formulation of the empirical facts, namely, that in Italian and French the patients use infinitives, and in English they use gerunds, but also get rid of the need to invoke lexical well-formedness criteria, when Italian and French are discussed in this respect. Still the data from Hebrew remains unexplained if we choose to make such a statement.

Errors of plural morphemes: while referring to her fellow teachers:

...*xaverot* (F) *morim* (M)...
 friends (F), teachers (M)

xameš (F) *yamim* (M)
 five (F) days (M)

šaloš milim...lo...šloša milim va-'arba'a ne'elam
 three (F) words (F)...no...three (M) words (F) and four (M) disappear (M sing.) (As far as context could tell, she was trying to say that when asked to repeat a sentence of more than three words, the fourth word disappears—she cannot remember it).

tiyul leylit
 nightly (F) walk (M)

Errors in verbs:

...*tiylu 'anaxnu ba'ali ve'ani*
 took-a-walk (III M + F) we my-husband and I

garim...hexlifu...xolon
 living (M & F pl. present)...switched (III pl. past)...[apartments] [from] xolon

nas'u ba'ali...'anaxnu nasanu be-beit [ha]-xolim
 drove (III M + F) my-husband...we drove (correct) in [the] hospital

'aval hakita ha-xadaša, 'ani lo yexola, ve-'ani nifsakti...lo...hifsika... lo tov...hifsakti

but the new class (correct agreement), I cannot (present, correct gender), and I was stopped (past, passive, correct gender, person and number)...no stopped (correct verb class—active, III person, correct gender)...no good...stopped (correct).

Description of the 'Cookie Theft' picture

ha-yeladim, bat ve-ben, ha-'ole el ha-kise..hu mexapes 'et ha'ugiyot, ve-natan...sam...lo...loke'ax...sam 'axot.

The children, girl and boy, the climbing (correct inflection) to the chair, he searches (correct, present) for the cookies, and gave (past tense)..put (past or present)...no...takes (present) put sister.

Patient M.B. is a 41-years-old right handed male. He is college educated, and was a high rank executive. He was interviewed about two months post

onset. He is non-fluent, omits prepositions and free morphemes. He suffers right hemiplegia. No CT scan information was available.

While talking to a female nurse:

'ata bata lo?
you (M) came-in (M), didn't you?

about his children:

...ha-mevugar ben 17, bat ben 13...
the eldest (M) is 17 y.o. (M), [the] daughter is 13 y.o. (M)

Russian

<i>Grustnaja malčik</i>	<i>Visjat na stolje časi</i>
Sad (F) boy	Clock hanging on table
<i>Malenki doč</i>	<i>Osjen pered zimji</i>
Little (M) daughter	Fall before winter (wrong case)
<i>Zajats sidjit [na] djerevo</i>	
Rabbit sitting [on] tree (wrong case)	
<i>Ja pašol [v] magazin</i>	
I went [to] store	
<i>Sinjaja platok</i>	<i>Ispuganaja kot</i>
Blue (F) scarf (M)	Frightened (F) cat (M)
<i>Snjeg mnogo</i>	
Much snow (wrong case)	

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Résumé

On suggère une nouvelle caractérisation qui s'appuie sur des données d'aphasiques agrammatiques parlant hébreux et sur le réexamen de données de patients russes et italiens. Cette caractérisation est en relation avec les niveaux linguistiques de représentation.

Les données analysées permettent de remettre en cause la description de l'agrammatisme. Il est proposé une description en termes de: sélection erronée d'items + défaut. En anglais la procédure par défaut peut toujours être utilisée tandis que dans d'autres langues le patient est contraint, pour des raisons structurelles,

à des conjectures inconscientes. Dans de nombreux cas, ce procédé conduit à des phrases syntaxiquement aberrantes dans lesquelles chaque item lexical est bien formé.

Après une discussion des relations entre les théories linguistiques et les modèles de traitement, il est proposé une condition sur le niveau syntaxique (S-Structure) dans la théorie linguistique de Chomsky. Cette proposition doit rendre compte des données de l'agrammatisme dans les langues considérées. On montre ensuite que la performance agrammatique dans des tâches variées (y compris la compréhension) est une conséquence naturelle de cette condition.

Enfin, plusieurs solutions reliées sont envisagées, en particulier, la relation entre l'interprétation structurale proposée et le modèle présenté par Bradley *et al.* (1980).