

# Chapter 9

## Moving verbs in agrammatic production

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### Introduction

Broca's aphasics with agrammatism suffer from a severe deficit in their ability to handle verbs. Until the early 1980s, the accepted account was that verb inflections are omitted in agrammatism. This was probably due to the fact that in English, patients produce bare verbs. In 1984, Grodzinsky looked at cross-linguistic data, and showed that the appropriate description of the data is substitution rather than omission of inflections: in languages in which the bare verb is well formed, the inflection is substituted by a zero morpheme; in languages in which a bare verb is not an option, substitution with a different inflection occurs. This ends up in inflection omission in languages like English, and in inflection substitution in languages like Hebrew.

In this chapter cross-linguistic data will be further used to show that agrammatics know even better than that: not only do they know not to omit the inflection when inflection omission creates a non-word, but their substitutions are also very constrained, in a way that lends itself to a syntactic description.

The structure of the argument advocated in this chapter will be as follows. First, it will be shown from a study in Hebrew and Arabic that not all inflections (and therefore not all functional categories) are impaired in agrammatic production. Some, subject-verb agreement for example, are preserved. Then, cross-linguistic data will be presented to show that even in the impaired domains, the bare verb (zero inflection) is not always preferred over other forms. The claim will be that the preference is not for bare forms, but for non-finite forms. Then it will be shown from a study of 11 Hebrew-speaking agrammatics that the infinitive is not always the preferred form as well. The conclusion will be that verb forms are chosen according to their syntactic properties of movement within the syntactic tree.

### Are all function words equally impaired?

When looking at the empirical evidence to examine the extent of function word impairment, it seems that not all of them are impaired in agrammatic production. Some non-lexical nodes are indeed impaired, yet nodes in other parts of the structure (the phrase marker) are spared. Several non-lexical elements have already been shown to be intact in agrammatic production: among them case (Menn and Obler, 1990 for Finnish and Polish), coordination conjunctions (Menn and Obler, 1990; Friedmann, 1998) and negation markers (Lonzi and Luzzatti, 1993).

Even in the domain of inflections, not all inflections are equally impaired. A study of 13 Hebrew and Palestinian Arabic speaking agrammatic patients used sentence repetition and inflection completion tasks to examine the production of verb inflections (Friedmann, 1998). When looking at the agrammatics' production in these tasks, a dissociation between tense and agreement is apparent: tense inflection is impaired (even in an easy task such as repetition of a simple four-word sentence), but subject-verb agreement is almost intact. The difference between tense and agreement is significant both for Hebrew repetition,  $X^2 = 142.96$ ,  $p < < 0.0001$ ; for Hebrew completion,  $X^2 = 258.38$ ,  $p < < 0.0001$ ; and for Arabic completion,  $X^2 = 34.82$ ,  $p < < 0.0001$ . Patients produced tense errors almost exclusively - they substituted tense inflection, but did not make agreement errors in agreement completion or in repetition tasks (Tables 9.1 and 9.2). Each individual patient tested has shown this pattern of results.

**Table 9.1.** Verb inflection production tasks in Hebrew (11 patients) % substitution errors (number of errors/total)

	Tense errors		Agreement errors	
Repetition	16%	(143/912)	0%	(4/912)
Completion	42%	(322/760)	4%	(24/596)

**Table 9.2.** Verb completion task in Palestinian Arabic (two patients) % substitution errors (number of errors/total)

	Tense errors		Agreement errors	
Completion	69%	(31/45)	9%	(4/46)

Studies in other languages point in the same direction. For example, De Bleser and Luzzatti (1994) have examined past-participle agreement in a structured production task, and found a considerable preservation of this agreement inflection. (Most of the tasks in non-embedded sentences were performed at around 90% correct for both patients.)

In Spanish, verb agreement was also found to be much better preserved than tense inflection: using a sentence completion procedure, Benedet, Christiansen and Goodglass (1998) found that their six Spanish-speaking agrammatics produced only 5.5% correct verbal tense, but produced 63.8% correct subject-verb agreement. In English they found a similar pattern of results for the seven agrammatics they examined, but with a smaller difference: the English-speaking agrammatics produced 42% correct agreement and around 15% correct tense.

The same was found in French: the agrammatic patient Mr Clermont, reported in Nespoulous, Dordain, Perron, Jarema and Chazal (1988, 1990), had only tense errors in spontaneous speech, but no verb agreement errors.

The finding of intact agreement again rebuts the claim that agrammatics do not have syntactic trees at all, or lack all functional categories (Goodglass and Mayer, 1958; Myerson and Goodglass, 1972; Caplan and Futter, 1986; Ouhalla, 1993). Without the lower part of the syntactic tree, a correct verb agreement would be impossible. This situation calls for a more refined structural description that enables a distinction between the spared and impaired elements.

## What are the types of verb inflection errors across languages?

After delimitating the substitutions to a subpart of verb inflections, the next step is to specify the exact types of inflection substitutions that do occur across languages.

Studies of agrammatic production in various languages have reported that patients tend to fall back on certain verb forms and use them excessively and incorrectly. These forms exist in most of the reported languages, but, interestingly, they exhibit cross-linguistic variation: agrammatics in different languages use different replacing forms. Therefore, these phenomena have also received different accounts. (See Table 9.3 for the data and related accounts.)

### The use of bare verbs in English

Errors like the use of the verb 'give' instead of 'gives' in sentences like the following (1) were first described as *omissions* of inflectional morphemes.

1. The *boy give* to the girl a cookie. (Mr Franklin, in Menn, 1990)

These omissions were mainly attributed to one of two factors:

- (i) Phonological characteristics of the non-stressed morphemes: Kean (1977) for example, argued that phonological words are preserved in agrammatic output, whereas clitics are omitted.

- (ii) Lexical access deficit: the 'closed class lexicon' was said to be impaired in agrammatism, and because inflections are part of this lexicon, they are impaired and omitted (Bradley, Garrett and Zurif, 1980).

**Table 9.3.** Verb forms used in different languages: data and related accounts

Data	Accounts
Use of bare verbs in English	Inflection omission a. Phonological impairment (Kean, 1977) b. Closed class impairment (Bradley, Garrett and Zurif, 1980)  => Inflection substitution Preferred substitution to zero morpheme (Grodzinsky, 1984)
Use of gerunds in English and infinitives in German	Nominalization (Goodglass and Geschwind, 1976; Saffran, Schwartz and Marin, 1980)
Use of participles in Italian	Preference of less marked forms over marked forms (Lapointe, 1985)
Finite verb omission in spontaneous speech	=> 'Averbia' -verb retrieval deficit (Zingeser and Berndt, 1990)

### The use of gerunds in English and infinitives in German

Another fact observed in the agrammatic verb production was that: in English, agrammatics also use the gerund form (-ing) rather frequently, and in German they use the infinitive (-en). An example in English is given in (2) and in German (3).

2. Baby, baby crying (R.H., in Goodglass, Gleason, Bernholtz and Hyde, 1972)
3. Drci Monate ich iiberhaupt nicht reden (Mr Meyer, in Stark and Dressler, 1990)

Because these are suffixed verb forms, this could not be explained by pure omission, and it was related to the idea that agrammatics use the verb to name an action. These forms were considered as *nominalizations* of the verb (Goodglass and Geschwind, 1976; Saffran, Schwartz and Marin, 1980).

### The use of participles in Italian

Still, omission and nominalization do not cover the whole variety of overused verb forms. In Italian, patients also use the participle, as shown in (4) from Mr Verdi, in Miceli and Mazzucchi (1990).

4. Non c'e it polio **mangiato** it cane.  
Not there-is the chicken eat-participle the dog.

In light of this (and other problems in the omission and nominalization descriptions) Lapointe (1985) and Lapointe and Dell (1989) argued that agrammatic aphasics have a problem accessing syntactic stores, and have fewer processing resources than normals, a fact which prevents them from accessing the more complex items in every verb-group. This, in turn, leads them to either replace the complex forms with morphosemantically less complex (less marked) forms, or to omit the verb altogether. The markedness metric is different for every language, and consequently, bare verbs and gerunds are used in English, but infinitives and participles are used in Italian.

### Consideration of the accounts

The inflection omission account that claims that bare verbs are a result of omission of morphemes is both too strong and too weak. It is too strong, because it predicts all inflectional affixes to be omitted, contrary to fact. It can not explain why some inflectional suffixes (such as the German infinitival suffix *-en*, and the English progressive suffix *-ing*) are preserved, and even overused, whereas other suffixes (such as the English suffix *-ed*) are omitted.

The omission account is also too weak, because it fails to explain the difficulties agrammatics have with inflectional morphology in languages with non-concatenative morphology. Recall that the phonological account claimed that agrammatics simply omit clitics, because they are not stressed. If so, agrammatics in languages in which inflectional morphology constitutes part of the 'phonological word' are predicted to be lucky, and not to have trouble with inflections. Nevertheless, Grodzinsky (1984) brought evidence from several languages to show that even in these languages, agrammatics' ability to inflect is not spared. In Hebrew, for example, the errors are substitution rather than omission errors: agrammatics do provide inflections - only they are the wrong ones.

Grodzinsky (1984) therefore proposed a unified syntactic account for both omissions and substitutions. According to him, non-lexical terminals (namely, everything which is not a noun, a verb or an adjective) are deleted from the agrammatic representation. The inflectional errors result from the underspecification of inflectional terminals. In languages in which the verb is well formed without inflection, a bare verb (or a verb with zero inflection) is produced. In languages in which bare verbs are not well-formed words (when zero inflection is not an option), the inflection is randomly chosen, and a substitution occurs. Omissions, then, are substitutions with zero morpheme, and this is the preferred substitution. Later studies proved that indeed, cross-linguistically, this generalization holds: agrammatics do not omit inflections in a way that creates verb forms which are non-words in their languages (Menn and Obler, 1990; Mimouni and Jarema, 1997).

Although this zero-morpheme approach accounts for a much bigger part of the data, it has two major problems. First, it cannot account for the

dissociation just sketched between tense and agreement, and for the other preserved non-lexical categories. Secondly, it cannot account for languages in which the bare verb (verb + zero inflection) is a well-formed existing word, yet agrammatics do not use it, or prefer a suffixed infinitive over it. Apparently this is the case in German, Dutch and Icelandic, where the bare verb is used in some singular imperatives and singular present tense forms, and the infinitive is suffixed.

The data show that although in German, for example, the stem is a well-formed word, it is not used. The ten German-speaking agrammatics reported in Kolk and Heeschen (1992) for instance, used the infinitive as main verbs in matrix clauses 53% of the time, but never used the stem incorrectly (0%), although the stem is an existing verb form.

In Dutch, Bastiaanse and Van Zonneveld (1998) report the use of both the stem and the infinitive, but the infinitive is preferred over the stem (13 substitutions by infinitives compared to eight by stems).

Similarly in Icelandic, the bare verb is well formed and the infinitive is inflected with the suffix *-a*. Nevertheless, Magntisdottir and Thrainsson's (1990) patient Togga did not omit verbal inflection: she either used the infinitive, or substituted the inflection.

So, the omission account does not work here, and neither does the later version of inflection substitution (Grodzinsky, 1984), because the bare form is not always the preferred form. Agrammatics do substitute and not omit, but it is not the case that they prefer the zero inflection. Sometimes (in English for example) they indeed prefer the bare forms, but for other reasons, as will be discussed shortly.

The *nominalization* account is unjustified, because there is no evidence for nominal properties of the verb forms used. In sentential contexts, the gerund and the infinitive appear in verb distribution and not in noun distribution: they never appear after determiners, with adjectives, as a complement of prepositions and non-copular verbs. They seem to preserve the predicate argument structure of the verb, appearing in NP V ing NP constructions etc. (Lapointe, 1985).

As for the *morphosemantic account* (Lapointe, 1985), a morphological account that claims that agrammatics only substitute marked forms for less marked forms cannot handle the fact that the use of an infinitive instead of an inflected verb has implications for word order as will be shown below. Furthermore, the markedness scales succeed in many cases to describe the data, but because these scales are arbitrarily ordered, they offer a well-organized description rather than an explanation for the data. This chapter will try to show how verbal complexity ordering is derived in a non-arbitrary way from the syntactic properties of the phrase marker and the agrammatic deficit.

We are left with the following set of seemingly unrelated facts: use of the verb stem without the inflections, which counted as omission and afterwards as substitution for a zero-inflection; use of infinitives and



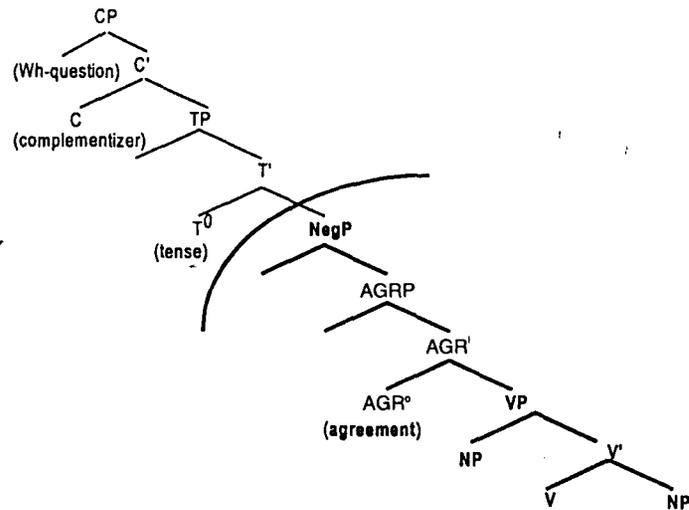


Figure 9.2. Agrammatic pruned tree (Tree Pruning Hypothesis, Friedmann and Grodzinsky, 1997).

Forms which can be licensed without movement to pruned nodes will be correctly produced, and will not suffer from pruning of functional categories. Contrariwise, forms which are not licensed in a low node, and have to move to pruned nodes in order to be licensed, can not be correctly produced. The forms that would appear instead of them would be forms that can be licensed in a lower node, that is, non-finite forms. Consequently, inflected verbs are replaced by infinitives, participles or gerunds.

Take for example the German verb 'gehen' (= go): if the sentence required the infinitive *form gehen*, which stays down in the VP, it would be produced appropriately as *gehen*. On the other hand, if the sentence required the inflected *geht, orging* (= goes, went), the verb would not be able to move to T (Tense node) and C for tense collecting/checking, and it would therefore appear in the infinitive form *gehen* instead of the inflected form.<sup>2</sup>

Agrammatics will only use forms which are licensed in nodes lower than the impaired node. These forms are in many languages the gerund, the infinitive and the participle. And indeed, these forms are the verb forms agrammatics use across languages, instead of the higher aiming inflected forms.

Thus, the tree pruning is the crucial factor here: as long as verbs move below the pruning site, no problem is expected. But when a verb needs to move to nodes in the pruned zone, then the inflection deficit arises. As a result, in each language, agrammatics use verb forms that do not have to raise higher than the pruning site in their language, instead of inflected verbs that need to move higher than the pruning site.

## The relation between verb form and word order

If the overuse of non-finite verbs should really be accounted for by a pruned tree which prevents long verb-movement, this should have implications for word order. I argued that a verb is produced in its non-finite form because it does not have finite functional categories to move to. An immediate prediction of this claim is that when the verb is non-finite it should also appear in a low node, that is, in the place which is preserved for non-finite verbs. On the other hand, if, as other accounts for the preponderance of infinitives in agrammatism suggested, agrammatics produce an infinitive instead of a finite verb because it is morphosemantically simpler, it should not affect word order, and non-finite forms should appear in the finite verb position.

In order to test the contrasting predictions, we should look at languages in which the finite and non-finite verbs appear in different structural positions. We should also choose languages in which the position of the infinitive and the finite verbs is discernible from the produced sentence.

In these languages, we shall then look at the position of the infinitive which is produced instead of the inflected verb. If the infinitive is produced in the same place as the finite - early in the sentence - it will support the morphological accounts. If, on the other hand, it appears at the infinitival position down the tree (namely, later in the sentence), it will support our claim that the verb has not moved up in the tree.

Lonzi and Luzzatti (1993) examined verb position in Romance languages such as Italian and French. They have shown that agrammatic aphasics produce finite and non-finite verbs in their correct positions. In Italian, finite verbs occur only before the adverb, and non-finites (infinitives and participles) appear both before and after the adverb. Lonzi and Luzzatti found that in spontaneous speech patients always obeyed this word order: in 41 out of 42 sentences, they put the verb in the correct position relative to the specifier-adverb, namely, they only once placed the finite verb incorrectly after the adverb. (No data is given as to the number of finite and non-finite verbs in the corpus analysed.)<sup>3</sup>

In French, finite verbs precede the negative particle *pas*, and infinitives follow it. Again, analysing spontaneous speech, Lonzi and Luzzatti found that when agrammatics produce the infinitive, they always produce it after the negation, and when a finite verb is produced, it appears before the negation.

Note, that this study included mainly correctly produced infinitives and not only infinitives replacing the finite verbs: both the French and the Italian speaking agrammatics in the corpus analysed from Menn and Obler (1990), for example, preferred to replace the inflected verbs with the participle rather than the infinitive. The two French agrammatics used only two infinitives out of 220 verbs, and the two Italian patients produced only four out of 175 verbs.

But the point remains the same: when a verb is produced correctly inflected, it has moved up and therefore it appears before the adverb. When it appears in the infinitive, both when the infinitive is required and when an inflected verb is required, it appears in the infinitival position.

Another critical case where the relation between verb inflection and verb position can be examined empirically is verb second Germanic languages. In many Germanic languages (such as Dutch, German, Icelandic and Scandinavian languages), the finite verb moves to the second position of the clause, after the first constituent - be it the subject, as in (5) or any other constituent as in (6).

### SVO

5. de jongen      **loopt**      op straat  
the boy          walks          on street

### XP VSO

6. langzaam      **loopt**      de jongen op straat  
slowly          walks          the boy on street

Whereas finite verbs move to second position, non-finite verbs (participles and infinitives), do not move and stay in final position, as seen in the sentences for German (7) and Dutch (8):<sup>4</sup>

7. a.  $V_{fin}$  2nd: Konrad **schaute** aus dem Fenster.  
Konrad looked out of the window  
b.  $V_{int}$  final: Konrad will aus dem Fenster schauen.  
Konrad wants out of the window look-inf
8. a.  $V_{fin}$  2nd: De boer **melkt** de koe  
the farmer milks the cow  
b.  $V_{int}$  final: De boer wil de koe **melken**  
the farmer wants the cow milk-inf

V2 is a movement from  $V^0$  to  $C^0$  (through  $1^0$ ). This is the reason for the difference in V2 languages between matrix and embedded clauses with respect to verb position: in embedded sentences the C node is already occupied by a complementizer, and therefore the verb cannot raise to C, and stays down in final position, as seen in sentence (9) in German. This is one of the most illustrative examples of the close connection between functional categories, head movement and verbal inflection.

9. Es ist kein Wunder, dass sich Onkel Ringelhuth fiber nichts **wunderte**.  
It is no wonder, that himself uncle Ringethuth over nothing **wondered**.

Consider how this might serve as one of the crucial tests for evaluating the accounts of infinitive use in agrammatism: a tree pruning account which entails no verb movement to T (and therefore also no subsequent movement to C) predicts that in V2 languages, the infinitive will not appear in second position but *in final position*. That is - whenever a verb appears in its non-finite form, and crucially, also when it appears inappropriately non-finite instead of finite, it should appear in the structural location of the non-finite forms - namely in its base-generated node (or after short movement to AGR to check Agreement features) at the end of the sentence. On the other hand, no consequence for word order derives from non-structural accounts: accounts of 'morphological' inflectional deficit predict a use of 'least effort' or 'default' form *in the same sentential position* of the required finite verb.

Data from structured tests and spontaneous speech in Germanic V2 languages verify the TPH prediction: when an infinitive is used even instead of a finite verb in matrix clause, it is almost always in final position. This has been found for Dutch and German, and some indications for verb position implication were also found for Swedish and Icelandic.

A study recently conducted by Bastiaanse and Van Zonneveld (1998) examined the question of the relation between finiteness and verb position. In this study, ten Broca's aphasics were required to complete sentences with a verb missing either in second or in final position, in matrix or embedded clause.

The results show that agrammatics have a hard time producing verbs in the moved position (second position), but they do not have problems producing verbs in their base-generated position, at the end of the sentence (see Table 9.4).

**Table 9.4.** The relation between verb position and verb production in Dutch: correct verb produced/total verbs produced

+fin v2 (matrix)	- fin final (matrix)	+fin final (embedded)	- fin final (embedded)
24/41	60/60	50/58	50/51

Source: Bastiaanse and Van Zonneveld (1998).

The difference between finite and non-finite verbs was striking: There was only one error out of 111 verbs in final position - in which a finite (past participle) was produced instead of an infinitive. Verbs in second position, on the other hand, were much harder to retrieve than verbs in final position, and were frequently substituted by non-finite forms. This tells us that agrammatics have difficulties in producing inflected verbs in second position, presumably because they cannot raise the verb to this position, and that the pattern of verb inflection is closely connected to the

pattern of verb movement. Recall that the patients were only asked to produce a single verb in the required position and not the whole sentence. Thus, the incorrect use of non-finites also in second position should not be taken as an indication for the use of non-finite verbs in high nodes: the verbs were wrongly inflected because the patients were agrammatic aphasics who encounter a deficit of verb raising and inflection, and they therefore produced non-inflected verbs when required to produce a finite verb. Presumably, the verbs that appeared uninflected when required-in second position would have appeared in final position in spontaneous speech.

This conjecture is borne out by data from spontaneous speech in Dutch and German: Kolk and Heeschen (1992) report use of infinitives in matrix clause in their ten German and eight Dutch patients' spontaneous speech. Their data again indicate exactly the result expected by a syntactic account: as seen in Table 9.5, almost all the inflected main verbs were produced in second position, which means that they moved to collect (or check) their inflection. Furthermore, when infinitives were produced as main verbs without an auxiliary (this analysis included only substituting infinitives [Kolk, personal communication, July 1997]), they appeared in sentence final position, the position of verbs that have not moved up the tree.

**Table 9.5.** Verb inflection and position in Dutch and German % correct (number of sentences/total)

	Infinitive in final position	Finite verb in second position
Dutch (8 patients, 139 sentences)	93% (64/69)	99% (69/70)
German (10 patients, 175 sentences)	86% (59/69)	97% (103/106)
Mean	89% (123/138)	98% (172/176)

Source: Kolk and Heeschen (1992), data processed from Table 5, p. 111.

Similar results have been reported for Dutch by Bastiaanse and Van Zonneveld (1998): in their three Dutch-speaking agrammatics' spontaneous speech, 45 out of 45 finite verbs were produced in second position, and 45 out of the 46 non-finites appeared in final position (note, also, the high rate of non-finites in agrammatic speech: half of the verbs!).

It might be that the inaccessibility of high nodes to verb movement is also the cause for word order deficit with regard to verb position noticed in SVO V2 languages such as Swedish and Icelandic.<sup>5</sup> Ahlsen and Darvins (1990) provide the spontaneous speech of a Swedish-speaking patient (Ms Garbo) who exhibits problems with tense inflection resulting both in finite tense substitutions and in infinitive for finite substitutions. This patient

also produces matrix sentences with wrong verb position: although the order SVO is kept in sentences beginning with the subject, the patient produces sequences of the type Adverb-Subject-Verb (see (10)), instead of the required Adv-V-S order with the verb in second position.

#### 10. Sen han titta

Then he go-inf/part

The same phenomenon was also observed by Magnusdottir and Thrainsson (1990) for the Icelandic patient Togga:

#### 11. Svo hann sofnaði aftur

Then he fell asleep again

The word-order deficit in these two languages may be the result of obstructed verb movement to C. Because CP is not available, the sentential adverb cannot settle in spec-CP and therefore it does not attract the verb to C°. As a result, the verb stays low, and is produced after the subject even when there are other constituents in first position.' In Ms Garbo's speech, out of 16 verbs that appeared in non-second position in matrix clauses, 11 were infinitives.<sup>7</sup>

The relation between verb inflection and verb movement in agrammatism in these Scandinavian SVO V2 languages is still not sufficiently clear, and structured production tests are required to determine whether verb movement deficit is indeed correlated to the inflectional deficit. Compared to Dutch and German, it is more difficult to determine whether the verb has moved to C or not in these languages," and the position of the non-finite verb relative to negation and sentential adverbs may come to our rescue and supply the answer. In these languages, moved verbs precede sentential adverbs and negation markers, whereas verbs that have not moved follow them. It is thus possible to enquire whether non-finite matrix verbs do not move high in the tree by eliciting sentences with adverbs or negations.

To conclude, V2 languages provide substantial evidence in favour of a syntactic account to non-finite verb use in agrammatism, and rule out lexical or morphological accounts for this phenomenon. Data from both structured tests and spontaneous speech analysis indicate that whenever a main verb appears in a non-finite form, it is also located down the tree, where non-finites live.

Note that infinitival verbs appear here in final position just as they would have appeared with auxiliary or modal in second position, but auxiliary/modal omission cannot be the right account for the abundance of infinitives, or for the infinitival final position. As Kolk and Heeschen (1992) rightfully note, normals use aux + infinitive constructions in only

10-14% of the sentences, and there is no reason to believe that agrammatics would prefer to use auxiliary constructions in 53% of the sentences, and then omit the auxiliary. True, agrammatics do use forms that usually require an auxiliary verb, but only because the forms they use are forms that do not carry tense, and therefore in normal syntax require an auxiliary to carry the inflection.

### Verb omission: averbia or inflectional deficit?

Agrammatics frequently omit verbs in spontaneous speech and in picture description. This led researchers to claim that agrammatics have an additional problem: averbia (see for example Zingeser and Berndt, 1990). That is - in addition to their other deficits, they also have a special problem in the lexicon that prevents them from retrieving verbs.

In the Bastiaanse and Van Zonneveld (1998) study, Dutch-speaking agrammatics had 'verb retrieval' deficits in second position only (where the verb has to be inflected) but not in sentence final position (where it appears in a low node). This finding cannot be explained by lexical retrieval deficit. It indicates, rather, the strong relation between verb production and its sentential position, and raises the possibility that agrammatics omit verbs not due to a lexical retrieval deficit, but due to their inability to move them to the relevant functional categories in the syntactic tree and to inflect them correctly.

Another corroboration for this claim comes from a tense treatment study: Weinrich, Shelton, Cox and McCall (1997) report that their patients had severe tense-inflection deficit before treatment: they inflected only 5% and 17%, 22% of their verbs correctly for tense. At that stage, their patient also had verb-retrieval deficit: they produced only 36%, 43% and 53% of the required verbs. After treatment of tense production, when their tense inflection has improved significantly (to 92, 64 and 73% correct), their verb retrieval ability had strikingly doubled (to 89, 85 and 83%). This again suggests the involvement of inflection in verb production.

This poses a new type of explanation for verb omission in terms of verb movement. When agrammatics have to inflect a verb and move it to a pruned position, they sometimes prefer not to produce the verb at all. The deficit, then, is not a purely lexical deficit in the 'verb lexicon'. It is modulated, rather, by syntactic structure, and can be explained within the framework of pruned trees and the resulting verb movement deficit.

Thus, verb omissions may result from the same deficit that causes verb inflection errors: a syntactic deficit.

### Infinitives in Hebrew

One of the important properties of the infinitives that are used in agrammatic production instead of inflected verbs is that they are *bare infinitives*.

*Lives*: namely, they do not contain the 'to' morpheme. Agrammatics produce sentences of the form, but do not produce sentences like (13).

12. Dori drive a Porsche  
Dori to drive a Porsche

It is now clear why aphasics use verbs without the 'to' morpheme (see, for example, 'to' omissions in English and Dutch in Menn and Obler, 1990): 'to' is a tense morpheme, and is located in Tense node which is located in the pruned part of the tree. Whereas bare infinitives are licensed in low nodes, their inflection 'to' is not.

Consider the implications this has for the choice of replacing forms in a language that does not have a bare verb, and where its infinitive includes the 'to' as a bound inflection. In such a language, the infinitive also has to move up to tense node to collect (or check) its inflection. In this case, infinitives are expected not to be produced instead of finite verbs.

Fortunately we can test this in Hebrew, seeing as Hebrew is a language in which the infinitive is not bare. The Hebrew infinitive contains a morpheme which is the analogue of 'to' (the prefix 'le-'), and it is therefore parallel to the whole phrase 'to go' in English, and not only to the bare verb 'go'. Therefore, the infinitive in Hebrew must raise high like an inflected verb, to check its inflection. Another demonstration for the difference between the Hebrew infinitive and the English infinitive is the fact that the Hebrew infinitive does not appear as a complement of auxiliary verbs. Because it is inflected and occupies the Tense node, there is no place or need for an auxiliary. Furthermore, the movement pattern of the infinitive in Hebrew is just the same as the movement of the finite verb: arguments from word order of adverbs and infinitives show that they raise to the same high node in the syntactic tree as finites (Shlonsky, 1997).

The prediction, then, is that in Hebrew, unlike in German and Dutch, for example, infinitives will not be overused in agrammatic production. This prediction was tested in 11 Hebrew-speaking agrammatic patients (Friedmann, 1998).

Sentence repetition and verb completion in sentential context were used to assess inflection abilities and to find out whether agrammatic aphasics use infinitives instead of finite verbs in Hebrew. Errors were analysed in order to determine whether agrammatics substituted the infinitive for finite verbs, or kept all verb inflection errors within the finite paradigm.

The results were clear-cut: substitution errors were almost always within the finite paradigm (or possibly included substitution of the participle which is identical to the present tense). Errors were substitution of one tense for another, but almost never substitution of infinitival form for the finite.<sup>9</sup> Again, each individual patient showed the same pattern of

results. The results for verb repetition and completion are presented in Table 9.6. The difference between finite infinitival substitutions is significant both for repetition:  $X^2 = 148.95$ ,  $p < 0.0001$ , and for completion:  $X^2 = 471.70$ ,  $p < 0.0001$ .

**Table 9.6.** Verb inflection production tasks in Hebrew (11 patients): comparing substitution errors of infinitives and wrongly inflected finites for a finite verb

	Finite verb for finite verb (Tense substitution)		Infinitive for finite verb	
	% errors	(errors/total)	% errors	(errors/total)
Repetition	16%	(143/912)	0%	(2/912)
Completion	42%	(322/760)	2%	(16/1021)

The results show that all the Hebrew-speaking patients keep the distinction between finite and non-finite forms. They have a clear boundary between the two, and they do not cross it when substituting. The reason, we suggest, is that unlike in Germanic languages, the Hebrew infinitive also has to raise high in the tree, and therefore there is no use for it instead of other forms that have to raise. The conclusion is that the preference of agrammatics is not always for the infinitive, but rather for forms that do not have to raise high in the syntactic tree.

It seems, then, that the choice between the non-finite forms is dictated by the nature of their movement in each particular language: if the infinitive has to raise but the participle stays low, the participle will be the preferred form in this particular language. When the infinitive is not an option, tense substitutions will occur within the finite paradigm.

## Summary

Although agrammatic production is usually described as impaired in all aspects of grammar and in all types of inflections, structured tests have shown that not all the inflections are equally impaired in agrammatic production. A study of 13 Hebrew- and Arabic-speaking agrammatics has shown that although tense inflection is severely impaired, agreement is unimpaired.

Therefore, a Tree Pruning Hypothesis was proposed (Friedmann and Grodzinsky, 1997), according to which the agrammatic phrase marker is pruned from the Tense node and up, thus impairing tense inflection and subordination, but leaving agreement inflection intact.

The main claim here is that the Tree Pruning Hypothesis is able to account for an additional phenomenon in agrammatic production: the overuse of some verb forms in various languages instead of inflected verbs, such as the bare verb in English, the infinitive in German and the participle in Italian.

Until now, the use of different verb forms in agrammatism has received different explanations. Here we suggested that the verb forms that are substituting for other forms are always forms that do not have to raise to pruned nodes of the syntactic tree in order to be licensed. Because non-finite forms - the infinitive, the participle and the gerund are in many languages the forms that do not move high in the tree, these are the forms that are abundant in agrammatic speech.

As a result, verb form substitution is tightly related to word order: in Germanic V2 languages such as Dutch and German, whenever an infinitive is used instead of an inflected verb, it also appears in a position within the low part of the tree, in final position, where verbs that did not move reside.

In addition, it has been shown that in Hebrew, where the infinitive has to move high in the tree, agrammatics do not use the infinitive instead of the finite verb. They only substitute within the finite paradigm, and they keep the finiteness distinction. This means that there is no general preference for the infinitive, but only when the infinitive does not have to move to high nodes of the phrase marker. This induces the diversity between substituting forms in different languages: in languages like Dutch and German, where the verb can stay down, it is produced as an infinitive. But in languages like Hebrew, where it does not have this option, a random tense is chosen.

In order to test this claim further empirically, more structured tests should be undertaken in languages with different patterns of verb movement. These tests should enable us to determine the target verb form, and the verb position within the tree, which can be established based on the relative order of the substituting form and clitics, adverbs and negation markers.

## Notes

<sup>1</sup> In this respect, this claim is reminiscent of the conceptual move made by Wexler (1994) for children's use of infinitives, but with a different underlying cause: it is not the case that agrammatics think that tense is optional. Tense is defected and inaccessible to them, and so is the rest of the tree above it. Also in contrast to children, agrammatics make tense substitutions, which children never make.

<sup>2</sup> When it is a language in which this is not possible, namely, in case all verb forms have to raise to higher nodes, it is not directly predicted what would be produced in this case: the options are non-licensed, random form [to avoid phonological well-formedness violations (Grodzinsky, 1990)] a nominalization of the verb, or verb omission.

<sup>3</sup> Correct verb-adverb order was also found in a card-ordering task, but it is unclear whether this type of task is a pure production task or whether it involves grammaticality judgment, especially given that the patients decided on the final correct ordering after the experimenter had read the sequence to them.

<sup>4</sup> As Zwart (1993) notes, this final position may be followed by complement clauses and adjuncts.

<sup>5</sup> In Swedish only M<sub>S</sub> Garbo's data was analysed, and in Icelandic only Toggá's data, as

the two other cases were mildly impaired: the Swedish-speaking Mr Bergman had only three word order errors with respect to verb position, and the Icelandic-speaking Kiddi was very mildly impaired with an exceptionally low rate of errors in all measures, and therefore was not very informative for agrammatic production analysis.

<sup>6</sup> The relative order of the subject and the verb is kept either because they both stay in VP or because both undergo short movement to a low maximal projection within the intact part of the tree - the subject to the specifier of the functional category, and the verb to its head.

<sup>7</sup> A similar word order deficit with adjuncts in first position was also described by Hackl (1995) for German.

<sup>8</sup> In SOV V2 languages such as German and Dutch there is abundant indication as to whether or not verb movement to second position has taken place, because their I and V are both final and therefore any content of VP makes it possible to judge whether the erroneously produced non-finite verb has moved to a finite position. Things are more complicated with SVO V2 languages, such as Scandinavian languages. Scandinavian languages (Swedish, Norwegian and Danish but not Icelandic) do not allow V-to-I movement, due to their poor inflectional paradigm. Yet, they do contain V-to-I-to-C movement.

<sup>9</sup> Interestingly, this was also found for Hebrew-speaking normal children and SLI children: they do not use infinitives instead of finite verbs even in stages where their English-, French-, Dutch- and German-speaking counterparts do. (See Dromi, Leonard and Shteyman, 1993, for SLI children; Armon-Lotem, 1996; Berman and Armon-Lotem, 1996, for normal children.)

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