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## **Tense/agreement in Moroccan Arabic: The Tree-Pruning Hypothesis**

### **Abstract**

The present study presents results from picture description, sentence completion and grammaticality judgment tasks with four MA-speaking Broca's aphasic subjects and four age, sex, and education matched control subjects investigating tense and agreement markers. Specifically, the study explores tense and agreement disassociation in agrammatic speakers of Moroccan Arabic as predicted by the Tree-Pruning Hypothesis (Friedmann & Grodzinsky 1997) with extension of the inquiry to determine whether the disassociation is production-specific and/or modality-specific. For all experimental tasks, it was found out that the 4 MA-speaking Broca's aphasic subjects achieved high correctness scores for agreement, while tense was impaired. The results of the study suggest that the tense/agreement dissociation reported for Hebrew (Friedmann & Grodzinsky 1997) and German (Wenzlaff & Clahsen 2004) can be replicated in Moroccan Arabic. However, the syntactic account as outlined in Friedmann and Grodzinsky (1997) cannot account for the tense/agreement dissociation because Moroccan Arabic has the agreement node above the tense node. Based on results from the study, it is argued that the production deficit in Moroccan Arabic agrammatism cannot be explained in terms of the Tree-Pruning Hypothesis, but rather in terms of a processing account that takes the view that access to syntactic knowledge is blocked; grammatical knowledge, however, is entirely intact.

### **1. Introduction**

Agrammatism, an acquired language disorder resulting from left hemisphere brain damage, is characterised by slow and halting speech, reduction of phrase length and of syntactic complexity. One of the most puzzling dissociations in the literature on agrammatism is the apparent dissociation between the production of tense and agreement. Agrammatic subjects are not able to inflect verbs correctly for tense markers, but their ability to inflect nouns and adjectives is relatively intact (Friedmann & Grodzinsky 1997). This pattern is open to cross-linguistic variation. For example, Hebrew and Palestinian Arabic-speaking agrammatic speakers are

sensitive to tense and agreement violations, but their German counterparts are not (Friedmann 2001, 2006). Cross-linguistic investigations of agrammatic aphasia are not only of utmost importance as they allow the examination of brain/language relations, but also, are currently at the forefront, due to theoretical developments in linguistic theory (i.e., the Minimalist Program, Chomsky 1995, 2000), as well as to some progress that has been made in the neuropsychology of language (Grodzinsky 2000; Gavarro 2002, Friedmann 2006).

There is ample evidence from a wide range of studies on different languages that tense is more impaired than agreement in agrammatic production (Kolk et al. 1990, Nespoulous et al. 1990, Friedmann & Grodzinsky 1997, Benedet et al. 1998). Nespoulous et al. (1990) investigated the production abilities of their French-speaking agrammatic subject, Mr. Clement. They found out that he had only tense errors, which involved substituting a finite form with an infinitive form, but had no agreement errors. Benedet et al. (1998) found out that their six Spanish-speaking subjects produced better subject–verb agreement (63.8%), but worse verbal tense (5.5%). The English-speaking agrammatics, however, produced 42% correct agreement and about 15% correct tense. Ferreiro (2003) investigated tense and agreement in 14 Catalan and Spanish-speaking agrammatic subjects. He found out that tense was more impaired than agreement.

A prominent syntactic account that has been proposed to explain this dissociation is the Tree Pruning Hypothesis (TPH) (Friedmann & Grodzinsky 1997). Following Pollock (1989), Friedmann and Grodzinsky (1997) assume that tense and agreement are represented as separate functional categories, with AgrP located below TP. the TPH claims that agrammatic phrase-structure representations are pruned at the TP layer yielding phrase-structure trees without TP or any other functional category above TP. This then explains why subject-verb agreement is preserved (Agr-nodes are located lower than C-nodes); whereas tense marking and CP related phenomena are impaired in agrammatic production. In this respect, Friedmann and Grodzinsky (1997), Friedmann (2000) and Grodzinsky (2000) reported the case of Hebrew and Arabic-speaking subjects who made a lot of tense errors (42.4%) but very few agreement errors (3.9%). Since the tense node is impaired, no other nodes or functional projections (i.e., comp) can project. Kolk (1998) contends that

“if a patient has impairment with respect to a particular node, higher levels are also affected because, in the process of verb movement, the verb can not cross over the impaired node.”

The tense/agreement dissociation has been confirmed in a number of production studies, Wenzlaff and Clahsen (2004) examined the verbal production of tense and agreement in seven German-speaking agrammatic subjects in sentence completion and grammaticality judgment tasks. Their subjects performed worse on tense (57.5%) than on agreement (81.4%) However, they found out that the dissociation between tense and agreement holds for grammaticality judgment as well. The seven German-speaking agrammatic subjects had greater difficulty detecting tense violations than detecting agreement violations. This finding pushed Wenzlaff and Clahsen to suggest that German agrammatism results from a “central representational deficit” affecting both production and grammaticality judgment. This seems to suggest that difficulties with tense are modality-independent.

Wenzlaff and Clahsen’s (2004) study presents results from sentence-completion and grammaticality-judgment tasks with 7 German-speaking agrammatic aphasics and 7 age-matched control subjects examining verb finiteness marking and verb-second (V2) placement. The patients were found to be selectively impaired in tense marking in the face of preserved mood and agreement marking.

Similarly, in a study carried out on Greek agrammatism, Stavrakaki and Kouvava (2003) reported that in their two Greek-speaking subjects obtained almost perfect performance on both tense and agreement with 15% error rate in spontaneous speech. In grammaticality judgment, their patient 1 made 2/10 errors when presented with past tense sentences, and 1/10 when judging correct and incorrect subject/verb agreement. Their second subject made one error when judging incorrect past tense form. Stavrakaki and Kouvava concluded that tense and agreement were available to the two subjects in an equal way.

The theoretical assumptions made by the TPH are questionable, however. No current syntactic theory treats AgrP and TP as separate functional categories and posits a fixed hierarchy of functional categories for CP-TP-AgrP-VP. While these claims were originally made by Pollock (1989) within Government-Binding Theory (Chomsky 1981), Chomsky (2000) argues that agreement and tense are fundamentally different

syntactic concepts, with tense being an interpretable feature of the syntactic category T, and agreement not forming a functional category of its own. Instead, *Agree* is conceived of as an operation that establishes a structural relationship between, for example, the person and number features of a clausal subject and the corresponding uninterpretable features of a finite verb, which are checked by T. Thus, if T is pruned in the agrammatic phrase-structure tree (which according to the TPH accounts for impaired tense marking), *Agree* should not be able to operate because the host for a verb's person and number features (= T) has been deleted. This means that an impairment of tense should co-occur with impairments in agreement thus making it hard for the TPH to explain a selective impairment in tense.

Much research on agrammatic aphasia has been carried out primarily on English-speaking aphasic subjects. In contrast, very little data is available in the Arabic languages (Minouni & Jarema 1997) none whatsoever on Moroccan Arabic. Moroccan Arabic serves as excellent testing ground for verb and agreement inflections because it has a rich inflectional morphology with relatively free word order. The study of grammatical deficits in Moroccan Arabic can enhance our scientific knowledge of language processing, placed within the framework of comparative aphasiology.

The present study explores the tense/agreement disassociation in Broca's speakers of Moroccan Arabic as predicted by the Tree-Pruning Hypothesis (Friedmann & Grodzinsky 1997) with extension of the inquiry to determine whether the disassociation is production specific. The aim of the study is three-fold: (1) to assess the 4 participants' ability to inflect verbs and copulas for tense and agreement markers, and nouns and adjectives for person and number agreements; (2) to examine whether inflectional and agreement markers undergo omission and/or substitution (Friedmann & Grodzinsky 1997; Friedmann 2000, 2001; Grodzinsky 2000); (3) and to investigate whether there is a parallelism between the production of tense and agreement and grammaticality judgment tasks.

### **1.1 Verbal Morphology in Moroccan Arabic**

Verbs in MA have a complex morphology. They follow derived form patterns and each form is conjugated into the perfect tense or the imperfect tense. The two tenses share the grammatical categories of person and

number, and gender. The perfect tense is formed by a set of suffixes added to the verb stem. The imperfect tense is formed by a set of prefixes in the singular and by the same set of prefixes plus a set of suffixes in the plural. There is no dual or gender distinction in the plural form. The perfective is suffixal; the imperfective is signaled by suffixes and prefixes. The two paradigms for MA are illustrated by tables 1 and 2.

Person	Number	Gender	Affix	Verb+affix
1	Singular	M/F	-t	ktəb-t
2	Singular	M/F	-ti	ktəb-ti
3	Singular	M	Ø	ktəb
3	Singular	F	-ət	kətəb-ət
1	Plural	M/F	-na	ktəb-na
2	Plural	M/F	-tu	ktəb-tu
3	Plural	M/F	-u	kətəb-u

**Table 1.** The perfective paradigm

Person	Number	Gender	Affix	Affix+verb
1	Singular	M/F	n-	n-əktəb
2	Singular	M	t-	tə-ktəb
2	Singular	F	t___i	t-kətb-i
3	Singular	M	j-	jə-ktəb
3	Singular	F	t-	tə-ktəb
1	Plural	M/F	n___u	n-kətb-u
2	Plural	M/F	t___u	t-kətb-u
3	Plural	M/F	j___u	j-kətb-u

**Table 2.** The imperfective paradigm

## 2. Design and materials

### 2.1 Subjects

Four MA-speaking subjects, 2 males and 2 females, were identified through healthcare facilities at hôpital des spécialités, service de neurology, Rabat. The participants were evaluated and diagnosed as Broca's aphasics using the Moroccan Arabic version of the Boston Diagnostic Aphasia Examination (BDAE) (El Alaoui Faris et al. Ms.). The selected participants were right-handed native speakers of Moroccan Arabic, presented with a left hemisphere lesion and revealed features prototypical of agrammatic speech output, namely, simplified syntactic structure, effortful, non-fluent telegraphic speech, and omission and/or substitution of closed class elements. As shown in table 1, the participants ranged in age from 43 to 52, time post-onset ranged from 1 and 11 years and education ranged from 12 to 15 years. Auditory and visual processing were sufficient to complete the experimental tasks based on visual field testing and performance in connected speech. Four neurologically normal subjects were matched to

each individual with Broca's aphasia on the basis of age, gender, education. Table 3 presents background information on the aphasic subjects.

Subjects	Age	Gender	Work	Education	Etiology of brain damage	Site of brain damage	Post-onset	Classification
A1	47	M	teacher	+12	stroke	left fronto-temporo-parietal infarct	11 years	Broca's aphasia
A2	43	F	teacher	+12	stroke	left frontal infarct	1 year	Broca's aphasia
A3	45	F	house wife	+15	stroke	left fronto-parietal infarct	3 years	Broca's aphasia
A4	51	M	teacher	+15	stroke	left fronto-temporal infarct	1 year	Broca's aphasia

**Table 3.** Demographic information (aphasic subjects)

## 2.2 Tasks

The availability of tense and agreement features was investigated using picture description, repetition, sentence completion, and grammaticality judgment tasks. In the picture description task, the 4 MA-speaking agrammatic subjects were presented with the "the cookie theft picture" from the Boston Diagnostic Aphasia Examination (Kaplan & Goodglass 1983).

The purpose of the repetition task was to investigate the subjects' ability to produce verbs of different paradigms and copulas inflected for tense and agreement, and nouns and adjectives inflected for gender and

person. The question that the repetition task addressed was whether there was disassociation between tense inflection and agreement inflection. In the repetition task, participants were asked to repeat a total number of 67 utterances consisting of words and sentences; the list of words included singular and plural nouns, feminine and masculine adjectives, and verbs. The sentences varied in length and complexity. They included verbs and copulas, inflected for tense and agreement, and nouns and adjectives inflected for number and gender agreement markers (see appendix). In the sentence completion tasks, two kinds of sentence completion tasks were administered to the subjects. In the first task, the subjects had to choose between two verbs to fill out the missing part: one verb was correctly inflected for tense and agreement, while the other was not. In (1) the verb “*xərʒ-ət*” agrees with the grammatical subject “*lbənt*” in gender, person and number. Agreement is expressed through suffixation of the feminine marker “*ət*” to the verb “*xərʒ*”.

(1) <i>lbənt</i>	→	<i>a- xrəʒ</i>	<i>b- xərʒ-ət</i>
the girl		leave-past, he	leave-past she
‘the girl’		‘left-masc’	‘left-fem’

Another variant of the sentence completion task consisted of two coordinated VPs (i.e., a source sentence, and a target sentence), only one of which was fully inflected for tense and agreement. The subjects had to supply the missing verb of the second VP. Copying the features of the first VP was necessary to yield the required structure as example (2) shows.

(2) <i>rrəʒəl vadi w lə-mra (tbəʔ)</i>
the man is walking and the woman (follow)
‘the man is walking and the woman is following him’

The grammaticality judgment tasks investigated whether a parallel pattern of impairment exists in grammaticality judgment, too. Two grammaticality judgment tests were administered to the participants to examine their ability to detect tense and agreement violations: free judgment and contrastive judgment. Tense and agreement violations were tested on verbs and copulas. In free judgment (3), twenty sentences were presented orally



to the four MA-speaking agrammatic subjects. They had to decide which of the sentences presented to them were grammatical or ungrammatical. In contrastive judgment (4), the subjects were presented with a total number of twenty sentence pairs, each of which consisting of a grammatical sentence and an ungrammatical sentence. The subjects had to choose the grammatical sentence in each pair.

(3) Free judgment

<i>*l-bənt</i>	<i>m]a</i>
the girl-fem.	go out-past masc.
‘The girl went out’	

(4) Contrastive judgment

a. <i>*m]ā-t</i>	<i>l-wləd</i>
go out-past fem. she	the boy-masc.
‘the boy went out-fem’	
b. <i>m]a</i>	<i>l-wləd</i>
go out-past, masc. he	the boy-masc.
‘The boy went out-masc.’	

### 3. Results

#### 3.1 Picture description

Results of picture description are given in table 3. Let us first consider the number of utterances and the percentage of grammatical sentences. All subjects, except “A3”, produced nine utterances. However, only few utterances have a sentence level status. A sentence is grammatical if it contains a verb correctly inflected for tense and must agree with subject. “A3” is an exception since she produced three utterances, all of which were sentences. The other patients scored differently on this particular task. “A1”, being a severe agrammatic, produced a rate of 33% sentences, “A2” and “A4,” however, scored 67% and 60%, respectively. The percentage of grammatical sentences differs from one patient to another. “A1” got a score

of 11% while “A4” got 20%. “A2” produced 44%. A3’s performance was normal, with a rate of 100%. Noun production ranges from 6 to 15, while verb production ranges from 3 to 6. Overall, the performance of the four MA-speaking agrammatic subjects was worse than their control counterparts.

Agrammatic subjects	Number of utterances	Percentage of utterances as sentences	Percentage of grammatical sentences	Number of nouns	Number of verbs
A1	9	33%	11%	11	3
A2	9	67%	44%	13	6
A3	3	100%	100%	6	3
A4	9	60%	20%	15	6
Controls	12	95%	100%	12	8

**Table 4.** The “cookie theft” picture (analysis 1)

On a careful investigation of the production of the four MA agrammatic subjects on picture description, four conclusions can be made: 1) There is a difference between the number of utterances produced, and the number of utterances produced as sentences; 2) There is a difference between the percentage of utterances with a sentence level status and the percentage of grammatical sentences; 3) There is dissociation between the production of nouns and the production of verbs, 4) There is disassociation between tense production and agreement production. Examples of tense violation include tense substitution as example (5) and (6) illustrate respectively.

## (5) Aphasic production

*ʒib l-ħəlwa fū q*

bring the cookie up

'He is taking the cookie from upstairs'

## Correct production

*ʒib l-ħəlwa mən l-marijju*

bring the cookie from the cupboard

'He is taking the cookie out of the cupboard'

## (6) Aphasic production

*l-ma tʒəlla?*

'The water poured'

## Correct production

*l-ma kə-jətzəlla?*

'The water is pouring'

In example (5) the subject "A4" dropped the aspectual marker /ka-/ along with the person marker /j/. Deletion of the aspectual and the agreement markers resulted in a change from the progressive to the imperative mood. The example also shows that "A4" was unable to produce the preposition [mən] (meaning [from]) required before the preposition [fūq].<sup>1</sup> When describing the "cookie theft" picture, "A2" used the past instead of the present progressive as example (6) shows. Agreement errors are fewer compared to tense errors. Below is an instance of subject–verb agreement violation.

(7) \* *lwəld ʔāhət*

'the boy- masc. fell-she'

In (7) "A4" used the past tense to express immediate future. The resultant structure [ʔāhət] is still a real word in the language. The example also shows that there is an agreement mismatch between [lwəld] (masculine) and [ʔāhət] (feminine), hence the ungrammaticality of (7).

<sup>1</sup> Prepositions can also be impaired in Moroccan Arabic agrammatism. The subject "A4" misused the lexical item, which should be [kajāxəd], meaning [he is taking].

A second level of analysis involved the production of tense and agreement in picture description. Results of the correct use of tense and agreement are given in table 5.

Agrammatic subjects	percentage of correct tense	percentage of correct agreement
A1	33%	67%
A2	33%	67%
A3	100%	100%
A4	33%	100%
Controls	100%	100%

**Table 5.** Tense and agreement in picture description (analysis 2)

A look at table 4 shows there is dissociation between tense production and agreement production. For example, “A1,” “A2,” and “A4” produced just 33% of verbs, correctly inflected for tense. “A3, however, had both correct tense and correct agreement. The other subjects made exclusive tense errors, or “mixed” errors involving both tense and agreement. Exclusive agreement errors were very few. This finding has been reiterated by various researchers in Menn (1990), Jarema (1998) and Friedmann (2006).

Friedmann and Grodzinsky’s (1997) patient made more tense errors (42.4%) than agreement errors (3.9%). Friedmann (2000) tested a large group of Hebrew and Arabic speaking subject and found that agreement was relatively normal; tense, however, was severely impaired. Gavarro (2002) provides examples from Hebrew, Spanish, and Russian to show that in agrammatic production, there are agreement violations, but compared to tense errors, they constitute a relatively small number.

### 3.2 Repetition

As in the previous task, the performance of “A1” is worse; he repeated 20 structures out of 67. The performance of “A4” and “A3” was relatively

better; they repeated a total number of 49 structures. “A2” produced 50 items out 67. Compared to their control counterparts, the performance of the four MA-speaking agrammatic subjects is significantly worse.

A second analysis of the repetition task involved the patients' ability to inflect verbs, adjectives, and nouns. The data are found in table 6.

Repetition	Percentage of correct verb tense and agreement		Percentage of correct adjectives		Percentage of correct nouns			
	Tense	Agreement	Masc.	Fem.	Singular	Plural	Masc.	Fem.
Agrammatic subjects								
A1	33%	67%	100%	100%	100%	100%	100%	90%
A2	36%	64%	100%	100%	100%	100%	100%	90%
A3	36%	64%	100%	100%	100%	100%	100%	100%
A4	33%	67%	100%	100%	100%	100%	100%	100%
Controls	100%	100%	100%	100%	100%	100%	100%	100%

**Table 6.** Repetition (analysis 2)

On a careful examination of table 6, we can draw the following conclusions. There is disassociation between tense and agreement. The four MA-speaking agrammatic subjects achieved high correctness scores for agreement, while tense was severely impaired. The ability of the four MA agrammatics to inflect adjectives for gender is entirely intact (100%). Noun repetition showed a slight difference between person and gender. While all of the four MA agrammatics repeated all nouns in the singular and the plural and in the masculine forms, they failed to inflect some nouns for the feminine. This is the case of “A1,” and “A2” who both got a rate of 90%.

A third analysis involved the percentage of verb omissions and verb substitutions. The results are given in table 7.

Agrammatic subjects	verb omission	verb substitution
A1	36%	64%
A2	32%	68%
A3	12%	88%
A4	17%	83%
Controls	0%	0%

**Table 7.** Repetition (verb omission and substitution: analysis 3)

As reported in Grodzinsky (1990), Friedmann and Grodzinsky (1997), Friedmann (2000) and Grodzinsky (2000), tense substitution rather than tense omission is a characteristic feature of agrammatic production in richly inflected languages (-Zero-morphology). The findings of the current investigation point in the same direction. Tense errors were mostly substitutions of inflection. The percentage of tense omission was very low, compared to tense substitution. For example, both “A4” and “A3” omitted tense inflections with a rate of 17% and 12%, respectively. However, the percentage of tense errors involving substitutions was 83% and 88%, respectively. The percentage of tense markers omissions reached 36% in the case of “A1”. Substitution rate, however, was 64%.

### 3.3 Sentence completion tasks

The results of the sentence completion tasks are given in table 8. They show that the four MA-speaking agrammatic subjects had problems supplying the missing verb. While sentence completion task 1 involved choosing an answer out of two, sentence completion task 2 involved copying the form of the conjugated verb in the first part of the compound sentence. Except for “A1,” whose performance was different in both tasks, there was no significant difference in performance between task 1 and task 2 in the case of “A2,” “A3,” and “A4.”

Agrammatic subjects	Number	Sentence completion task 1		number	Sentence completion task 2	
A1	11	(5/11)	45%	10	(3/10)	30%
A2	11	(7/11)	63%	10	(6/10)	60%
A3	11	(7/11)	63%	10	(6/10)	60%
A4	11	(6/11)	54%	10	(5/10)	50%
Controls	11	(11/11)	100%	10	(10/10)	100%

**Table 8.** Sentence completion (tasks 1 and 2)

A second analysis examined the ability of the four agrammatic subjects to correctly inflect verbs for tense and agreement. The analysis shows that patients produced more tense errors than agreement errors both in sentence completion tasks 1 and 2. While “A2” and “A3” produced tense errors (100%) almost exclusively, they did not make any agreement errors in sentence completion task 1. In sentence completion task 2, they made fewer agreement errors (25%), but more tense errors (75%). “A1” and “A4” scored differently in both tasks, though the dissociation between tense errors and agreement errors is still maintained. In A4’s case, the percentage of tense errors is 80% in task 1 and 60% in task 2. “A1” produced a rate of 66% in task 1 and 72% in task 2. Agreement errors, however, were relatively few. The results of these data can be found in table 9.

Agrammatic subjects	Sentence completion: task 1		Sentence completion: task 2	
	Percentage of tense errors	Percentage of agreement errors	Percentage of tense errors	Percentage of agreement errors
A1	66%	34%	72%	28%
A2	100%	0%	75%	25%
A3	100%	0%	75%	25%
A4	80%	20%	60%	40%
Controls	0%	0%	0%	0%

**Table 9.** Sentence completion tasks 1 and 2 (tense and agreement)

### 3.4 Grammaticality judgment tasks

The results of the grammaticality judgment tasks can be found in table 10.

Agrammatic subjects	Number	Free judgment		Number	Contrastive judgment	
A1	10	(8/10)	80%	10	(7/10)	70%
A2	10	(9/10)	90%	10	(10/10)	100%
A3	10	(9/10)	90%	10	(7/10)	70%
A4	10	(8/10)	80%	10	(7/10)	70%
Controls	10	(10/10)	100%	10	(10/10)	100%

**Table 10.** Grammaticality judgment (free judgment and contrastive judgment)

We can deduce the following noteworthy remarks from table 10:

1) Comprehension of tense and agreement is better compared to production. Still, individual variation in grammatical sensitivity is



exhibited, since both “A2” and “A3” performed better (90%) than “A1” and “A4” (80%) in free judgment. “A2” showed a high degree of grammatical sensitivity in contrastive judgment (100%). However, “A1,” “A3” and A4's performance was lower (70%) in contrastive judgment than their performance in free judgment.

2) All the four agrammatic subjects exhibited increased sensitivity to ungrammatical sentences compared to their performance in picture description. Linerbarger, Schwartz and Saffran (1983) argue that agrammatic subjects perform better when judging the grammatical well-formedness of sentences although they seem to experience difficulties at the level of production and comprehension. That is, they are able to detect ungrammatical sentences.

## **4. Discussion**

### **4.1 Summary**

The results of the present study reveal characteristic features prototypical of agrammatism as outlined in Menn and Older (1990), Grodzinsky (1990), Mimouni and Jarema (1997), Jarema (1998) and Kolk (1998). The four MA agrammatic subjects had agrammatic output, defined by short utterances, a slow rate of speech, and reduced “syntactic grammatical forms,” with almost no embedded structures. They also experienced verb retrieval problems, referred to as “Averbia” (Zingeser & Berndt 1990). Verbal morphology is also impaired. The four MA-speaking agrammatic subjects omitted and/or substituted grammatical forms relating to tense, aspect, agreement, and negation. The results of the experimental tasks show that the four MA-speaking agrammatic subjects performed worse on tense than on agreement. In fact, in oral production, patients were good at producing subject-verb agreement. However, it must be stressed that not all verbal affixes are equally impaired. Most of the errors involve omission and substitution of verbal affixes. The four MA-speaking agrammatic subjects substituted rather than omitted inflections; omission of tense markers would result in non-inflected stems. These are considered to be non-words and as such they cannot be pronounced. Furthermore, when the subjects

make recourse to substitution, they still keep the “inflectional paradigm” (Mimouni and Jarema 1997; Jarema 1998). Witness the following example:

(8) Aphasic production

*xərɜ-ət*

leave-past-3<sup>rd</sup>. p. sg. fem.

‘She left’

Target

*xrɜɜ-∅*

leave-past-3<sup>rd</sup>. p. sg. masc.

‘He left’

In the above examples, the unmarked masculine morpheme /-∅/ was substituted by the feminine marker /ət/, thus resulting in gender substitution. Both [xərɜ] and [xərɜ-ət] are real words in MA. This is consistent with the findings reported in Mimouni and Jarema (1997), and Jarema (1998). They found out that their three Algerian Arabic-speaking agrammatic subjects substituted verbal affixes and never produced non-words. Nevertheless, they argue that “omissions never lead to the production of non-words” (Mimouni & Jarema 1997: 134).

The account advanced by Friedmann and Grodzinsky (1997) can account for the tense/agreement dissociation attested in MA-speaking agrammatic subjects. In fact, it explains the pattern of verbal breakdowns observed in diverse languages (i.e., German, Hebrew and Dutch). Friedmann & Grodzinsky maintain that tense can be selectively impaired, while agreement cannot. For example, Benedet et al. (1998) state that their six Spanish-speaking subjects were better at producing subject–verb agreement (63.8%) but worse at producing verbal tense (5.5%). Friedmann (2000), in turn, argues that her two Palestinian Arabic speakers made more tense errors (69%) than agreement errors (9%) in repetition and grammaticality judgment.

Overall, the cross-linguistic data discussed above confirm the claim that the four MA agrammatic subjects substituted inflectional markers and that they seemed to be able to produce better subject-verb agreement, but are poor in inflecting for tense. In addition, when the verb was inflected for tense and agreement, they avoided its use. In other words, when the verb

involved complex syntactic processing, MA agrammatics simply dropped it. This explains why their utterances were characterized by “non-fluency” and reduced syntactic complexity, i.e., “telegraphic style.”

#### **4.2 Tense/agreement: a linguistic account**

Friedmann and Grodzinsky’s syntactic account of agrammatic production (1997) claim is that agrammatic production is caused by a deficit of functional categories which dominate grammatical morphology. Both the tense node and the agreement node have a position in the “phrase structure hierarchy.” For example, Agr-nodes are located lower than C-nodes. The claim of the structural account is that grammatical morphemes dependent on lower nodes are spared; those dependent on higher nodes are disrupted. This explains the existence of the within-category variation. In this respect, Friedmann and Grodzinsky (1997), Friedmann (2000) and Grodzinsky (2000) reported the case of Hebrew and Arabic-speaking subjects who made a lot of tense errors (42.4%) but very few agreement errors (3.9%). This finding has pushed them to posit a pruned-tree structure, according to which their patients fail to project the tense node. This explains why the functional category Agr is intact: it is located lower than the tense node. Since the deficit lies in the tense node, no other nodes or functional projections (i.e., comp) can project. Kolk (1998: 257) contends that “if a patient has an impairment with respect to a particular node, higher levels are also affected because, in the process of verb movement, the verb can not cross over the impaired node.”

Another consequence of the syntactic account is that agrammatics omit verbs because they cannot move them to the relevant tense node to correctly inflect them. Arguably, this could be due to simple lexical retrieval deficit, and not due to deficits in inflecting the verb. In short, according to Friedmann (2000) and Grodzinsky (2000), Hebrew and Arabic agreement markers are located lower in the tree than tense and this explains why they are spared. Friedmann and Grodzinsky’s syntactic account is interesting, but it cannot explain MA agrammatic production for the following reasons: firstly, Friedmann and Grodzinsky’s account (Friedmann & Grodzinsky 1997; Friedmann 2001; Grodzinsky 2000) postulates that the order of functional categories in the extended projection of the Arabic verb is as follows:

## (9) TP &gt; AgrP &gt; VP

Most studies in Moroccan Arabic syntax, however, argue that the order of functional categories is AgrP>TP>VP (Akkal 1993; Akkal & Gonegai 2002). Akkal (1993) maintains that both the VSO and SVO orders derive from the same underlying structure. The AgrP takes the TP as a complement, i.e., TP is internal to AgrP. V-movement and NP-movement are motivated by morphological considerations, i.e., to have features checked. The features of NPs include case and phi-features (person and number). The inflectional elements T and Agr heads have two sets of features: V-features and N-features. These features check properties of the verb that adjoins to them. They also check properties of the NP that raises to their specifier position. The VSO order is derived by a single head movement, overt V-movement to T because the V-features of T are strong. The V-features of Agr are weak, and the verb can not move to this position until LF. In contrast, the SVO order is derived when the V-features of Agr and the N-features of T are strong, making it possible for the verb to move to further to AgrP, and the NP to move to its specifier position.

Secondly, within the hierarchy projection, there exists a within-category variation. The evidence comes from the aspectual marker /ka-/, which is impaired in MA agrammatism as shown by the picture description task. The four MA-speaking agrammatic subjects failed to produce the aspectual marker /ka-/, required for ongoing activities. The negative marker /ma-ʃi/, however, is spared. If the analysis of Akkal (1993) and Benmamoun (2000) is correct, then the aspectual functional category should be located just above the VP, the negative marker is the next projection. So, the order of the functional categories in MA should be as follows:

## (10) AgrP &gt; TP &gt; NegP &gt; AspP &gt; VP

In the VSO order, the verb checks first the aspectual marker, the negative marker, tense and finally ends up in agreement. If the four MA-speaking agrammatics experienced problems at the level of the tense node then, one would wonder how the verb ends up having agreement affixes. The latter are located higher, and given the deficient lower tense node, they are not

expected to project. In short, the Tree-Pruning Hypothesis fails to account for the tense/ agreement dissociation in MA.

Thirdly, in Chomsky (2000) it is argued that tense is an interpretable feature; agreement, however, is a process through which the “uninterpretable features of person/number of T are valued against the interpretable person/number features of the subject.” Therefore subject-verb agreement presupposes that T hosts the features for agreement, making the latter redundant. Put differently, agreement is omitted because it has no interpretable features that can converge at the PF or LF levels, i.e., it has no role in feature checking since it does not host case or person/number features.

According to Chomsky (1998, 2000) the features of the probe and the goal have to match, the goal has to be c-commanded by the probe, and there should be no intervening elements if feature attraction is to take place. A goal moves when its “unvalued” features are not checked by Agree. For example, the tense node has two uninterpretable features, phi-features (case, agreement) and the External Projection Principle (EPP) features. The specifier of the functional category of T is the landing site for the subject. That T has a specifier is a consequence of the EPP which requires that all sentences must have a subject. Once the uninterpretable case feature of the subject has been checked, the subject can remain in situ.

Viewed in this way, the deletion of features is a consequence of the “valuation” of features that entered the derivation “unvalued.” Put differently, the valuation of a feature which entered the derivation without a value plays the role of marking the feature for deletion, which takes place at the end of the derivation. Agree serves to establish a connection between a head and a lexical item; the features of the head and those of the lexical item enter into the Agr relation, but no overt movement of the lexical items takes place.

The fact that agreement is largely preserved in MA agrammatism indicates that T/INF is generated in agrammatism. If this is the case, then how can the TPH explain the tense deficit? Put differently, the whole argument of the TPH should be abandoned since agreement has no longer a category of its own in recent syntactic theory. In addition, Wenzlaff and Clahsen (2004) argue that syntacticians working in the same framework have since posited the reversed order of AgrP and TP. This is the case of Moroccan Arabic and German.

Nevertheless, the TPH requires that the tense node is higher than the agreement node, and that the tense node is pruned. Therefore, all functional categories above it should be lacking. In MA and German to name just two, the TPH predicts that agrammatism affects both tense and agreement. The results of Wenzlaff and Clahsen's study and the present study argue against the predictions of the TPH.

### **4.3 Tense and agreement: a processing account**

Results from the present study are consistent with previous findings on agrammatic production in diverse languages (Friedman 2006) and thus, provide further support for the cross-linguistic validity of a tense-agreement dissociation in agrammatic aphasia. In Moroccan Arabic Agr is located higher than TnsP, so the Tree-Pruning Hypothesis would predict Agr to be more impaired than Tense. This prediction is not borne out as tense was more impaired than Agr.

Therefore, agrammatism in Moroccan Arabic cannot be described in terms of a structural account but rather by difficulties in the implementation of grammatical knowledge. The linguistic problems attested in the performance of the patients is the result of impaired ability to access and exploit grammatical knowledge. Results indicate that agrammatic speakers are able to behave according to the task demands and, thus, to produce more complete sentences than those produced in free conversations. Interestingly, incorrect agrammatic performance in free conversations is analyzed as the effect of computational load. It requires integration of information at the grammatical and conceptual levels. Production of agreement inflection only requires activation at the grammatical level. Integration of information at the grammatical and discourse level of representation leads to overload of the computational capacities of agrammatic individuals. The effects of processing load are explained by assuming that less working memory capacity is available for the computation of verb inflection. MA agrammatics suffered limitations in processing capacities that affect their ability to "synchronize" morphological and syntactic information. This resulted in "resynchronization of the phrase structure," and dropping inflectional and/or lexical elements such as verbs resulted in "pruning." For example, it was easier for the four MA-speaking agrammatic subjects to process plural

nouns than verbs. Verbal inflections are hard to process because they carry more inflectional weight, determine the number of arguments, require a TensePhrase projection, and move higher in tree to check features against inflectional morphemes; nouns, on the other hand, are easy to process because they carry less inflectional weight, fill out arguments (NPs), require a Determiner P projection (NP), and undergo one movement to get its features valued. Thus, agrammatics show a “slow activation” / a processing “delay” when they are asked to produce verbs which are syntactically and morphologically complex in Moroccan Arabic. Resource demands for complex structures exceed the limit. So, storage and computational processes compete with each other for the remaining limited resources, resulting in production deficits. Lexical elements are already decaying and are suffering from response competition with other lexical items. If a morpheme is selected at this stage, there is a high chance that it will be an erroneous one (Kolk 1998). Put differently, agrammatic speech is the result of the effect of computational load. Agrammatics use utterances requiring a reduced processing capacity in spontaneous speech, but selection of complete sentence types characterized by paragrammatic output.

To avoid structures that require a “computational load” or a complex syntactic processing, the four MA-speaking agrammatic subjects used simplified structures. This explains the high rate of verb omissions in free tasks such as picture description. Two key notions characterize agrammatic production: “low activation” and “fast decay of phrase information” (Kolk 1998: 258). The latter processes result in “resynchronization of the phrase structure” (Kolk 1998: 258). To process verbal inflections successfully, the agrammatic subjects need first to produce correct verbal inflections and then merge them with the lexical category. So, it seems that agrammatic production does affect the patients’ choice of lexical elements, which enter into competition when merging is delayed.

If slot delivery is delayed, the lexical element is already decaying and is suffering from response competition with other lexical items. If a morpheme is selected at this stage, there is a high chance that it will be an erroneous one. (Kolk 1998: 258)

In sum, the four MA-speaking agrammatic subjects suffer from a processing deficit that does not affect their grammatical knowledge of verbal elements. That this is the case is shown by the results of the

grammaticality judgment tasks. All the four MA-speaking agrammatic subjects were sensitive to the well-formedness of sentences with tense and agreement markers. This means they had no problem judging the grammaticality of elements they found difficult to produce. Furthermore, the results of grammaticality judgment allowed us to deduce that the tense/agreement dissociation is a production-specific phenomenon. Deficient tense does not implicate comprehension and grammaticality judgment. There is cross-linguistic support for lack of parallelism. Goodglass et al. (1993), Friedmann and Grodzinsky (1997) and Stavrakaki and Kouvava (2006) all argue that grammaticality judgment and comprehension of verbal morphology are unimpaired, indicating that the dissociation between tense and agreement does not hold across modalities other than production.

A further advantage of the processing account is its ability to handle variation within the closed class items and for the effect of task variation. For example, in spontaneous speech production, agrammatic patients omitted verbs; in picture description, however, the number of omissions went down, that of substitution went up (see also Stavrakaki and Kouvava 2003; Kofstede & Kolk 1994; Kolk 1998). Kolk and his colleagues (1985, 1990, 1992) found out that their German and Dutch agrammatic data were characterized by omission of grammatical morphemes in free conversation. In picture description, however, substitution of grammatical morphemes characterized the deficit. Crucially, the results obtained by the picture-description task indicate that agrammatic speakers are able to behave according to the task demands and, thus, to produce more complete sentences than those produced in free conversations (Stavrakaki & Kouvava 2003: 138). In other words, “an economy hypothesis” or “adaptation theory” explains the task variation observed in agrammatic speech. The four MA-speaking agrammatics avoided using complex structures that require “convergence” (i.e. computing) and omitted or/and substituted verbal affixes; their speech was telegraphic, defined by ellipsis. However, in picture description tasks and in recitation, they adapted to a certain extent and ellipsis was less conspicuous.



## 5. Concluding remarks

Friedmann and Grodzinsky's linguistic model (1997) is interesting because it holds the view that tense is deficient while agreement is spared. Nevertheless, their model fails to provide evidence relating to the order of functional categories in MA. Friedmann and Grodzinsky (1997) claim that their syntactic tree is pruned at the level of tense; this is so because in their account the tense node is higher up in the tree than the agreement node. Following Akkal (1993), Akkal and Gonegain (2000) and Benmamoun (2000), I argue that the ordering of functional categories in Moroccan Arabic is AgrP>tenseP. If agreement is above tense, then how can one explain deficient tense, but spared agreement? Adding to that, their linguistic model argues that agrammatic aphasia affects the patients' grammatical knowledge: the agrammatic subjects lose all of their syntactic ability. Such an idea runs contrary to common belief; the four MA-speaking agrammatic subjects still retain their ability to judge the well-formedness of sentences though their production is much affected.

The claim being made in the present paper is that production results from limitations in processing capacities. These are affected by "slow activation" of lexical items and "decay of rate." In the processing account, grammatical knowledge is not disrupted; agrammatism is viewed as a "computational" rather than a "conceptual" deficit. The four MA-speaking agrammatic subjects had difficulty accessing syntactic knowledge. The fact that syntactic knowledge is not accessed pushes them to recourse to adaptation as a strategy. As a result of adaptation, they drop items that are difficult to process. In brief, the four MA-speaking agrammatic subjects suffer from a processing disorder that affects their ability to "synchronize" morphological and syntactic information, a fact which is apparent in the failure to produce complex syntactic structures. This explains the use of simplified grammatical structures by the four MA-speaking agrammatic subjects.

## References

- Akkal, Ahmed (1993) *Syntactic Derivation of the Inflections of the Verb in Moroccan Arabic*. Doctorat d'Etat. Faculté des Lettres I, Casablanca.
- Akkal, Ahmed & Gonegai, Abdelkader (2000) On the status of agrS in null subject languages. In Jacqueline Lecarme, Jean Lowenstamm & Ur Shlonsky (eds.), *Research in Afro-Asiatic Grammar 202*: 1–22.
- Baker, Marc (1985) The Mirror Principle and morphosyntactic explanation. *Linguistic Inquiry* 16: 373–416.
- Bastiaanse, Roelien & van Zonneveld, Ron (1998) On the relation between verb inflection and verb position in Dutch agrammatic aphasics. *Brain and Language* 64: 165–181.
- Benedet, Maria, Christiansen, Julie & Goodglass, Harold (1998) A cross-linguistic study of grammatical morphology in Spanish and English speaking agrammatic patients. *Cortex* 34: 309–336.
- Benmamoun, Abbas (1996) The Derivation of the Imperative in Arabic. In Mushira Eid (ed.), *Perspectives on Arabic Linguistics IX*, pp. 151–164. Amsterdam/Philadelphia: John Benjamins.
- (2000) *The Feature Structure of Functional Categories: A Comparative Study of Arabic Dialects*. New York: Oxford University Press.
- Caplan, David (1985) Syntactic and Semantic Structures in Agrammatism. In Marie-Louise Kean (ed.), *Agrammatism*, pp. 125–152. New York: Academic Press.
- Caplan, David & Hildebrandt, Nancy (1986) Language deficits and the theory of syntax: A reply to Grodzinsky. *Brain and Language* 27: 168–177.
- Chomsky, Noam (1993) A Minimalist Program for Linguistic Theory. In Morris Halle & Samuel Keyser (eds.), *The View from building 20*, pp. 1–52. Cambridge: MIT Press.
- (1995) *The Minimalist Program*. Cambridge: MIT press.
- (2000) Minimalist Inquiries: The Framework. In Roger Martin, David Michaels & Juan Uriagereka (eds.), *Step by step: Essays on Minimalist Syntax in Honor of Howard Lasnik*, pp. 89–155. Cambridge: MIT press.
- El Alaoui Faris, Mustapha, Ettahiri, Laila & Benbelaid, Fatiha (Ms) *The Boston diagnostic aphasia examination: Arabic version*. Faculty of Medicine, Rabat.
- Fassi-Fehri, Abdelkader (1993) *Issues in the Structure of Arabic Clauses and Word Order*. London: Kluwer Academic.
- Ferreiro, Silvia (2003) *Verbal Inflectional Morphology in Broca's Aphasia*. Unpublished MA Thesis, Universitat Autònoma de Barcelona.
- Friedmann, Naama (2000) Moving Verbs in Agrammatic Production. In Roelien Bastiaanse & Yosef Grodzinsky (eds.), *Grammatical Disorders in Aphasia: A Neurolinguistic Perspective*, pp. 152–170. London: Whurr.
- (2001) Agrammatism and the psychological reality of the syntactic tree. *Journal of Psycholinguistic Research* 30: 71–90.

- (2002) Question production in agrammatism: The tree pruning hypothesis. *Brain and language* 80: 160–187.
- (2006) Speech Production in Broca's Agrammatic Aphasia: Syntactic Tree Pruning. In Yosef Grodzinsky & Katrin Amunts (eds.), *Broca's Region*, pp. 63–82. New York: Oxford University Press.
- Friedmann, Naama & Grodzinsky, Yosef (1997) Tense and agreement in agrammatic production: Pruning the syntactic tree. *Brain and Language* 56: 397–425.
- (2000) Split Inflection in Neurolinguistics. In Naama Friedmann & Luigi Rizzi (eds.), *The Acquisition of Syntax: Studies in Comparative Developmental Linguistics*, pp.84–104. London: Longman.
- Gavarro, Anna (2000) Failure to Agree in Agrammatism. In Elisabetta Fava (ed.), *Clinica Linguistics: Theory and Applications in Pathology and Therapy*, pp. 267–278. Amsterdam/Philadelphia: John Benjamins.
- Goodglass, Harold (1993) *Understanding Aphasia*. San Diego: Academic Press.
- Goodglass, Harold & Kaplan, Edith. (1983) *The Assessment of Aphasia and Related Disorders*. Philadelphia: Lea and Febiger.
- Goodglass, Harold, Christiansen, Juan & Gallagher, Roberta (1993) Comparison of morphology and syntax in free narrative and structured tests: Fluent vs. nonfluent aphasics. *Cortex* 29: 377–407.
- Grodzinsky, Yosef (1984) The Syntactic characterization of agrammatism. *Cognition* 16: 99–120.
- (1986) Language deficits and the theory of syntax. *Brain and Language* 27: 135–159.
- (1990) *Theoretical Perspectives on Language Deficits*. Cambridge: MIT Press.
- (2000) The neurology of syntax: Language use without Broca's area. *Behavioral and Brain Sciences* 23: 1–23; 55–71.
- Haarman, Henk & Kolk, Herman (1994) On-line sensitivity to subject-verb agreement violations in Broca's aphasics: The role of syntactic complexity and time. *Brain and Language* 46: 493–516.
- Haegeman, Lillian (1994) *Introduction to Government and Binding Theory*. 2nd Edition. Oxford: Blackwell Publishing.
- Harrell, Richard (1962) *A Short Reference Grammar of Moroccan Arabic*. Washington: Georgetown University Press.
- Heeschen, Claus (1985) Agrammatism versus paragrammatism: A fictitious opposition. In Marie Louise Kean (ed.), *Agrammatism*, pp. 207–248. Orlando: Academic Press.
- Heeschen, Claus & Kolk, Herman (1988) Agrammatism and paragrammatism. *Aphasiology* 2: 299–302.
- Izvorsky, Roumyana & Ullman, Michael (1999) Verb inflection and the hierarchy of functional categories in agrammatic anterior aphasia. *Brain and Language* 69: 288–291.

- Jarema, Gonia (1998) The Breakdown of Morphology in Aphasia: A Cross-Language Perspective. In Brigitte Stemmer & Harry Whitaker (eds.), *Handbook of Neurolinguistics*, pp. 221–234. New York: Academic Press.
- Kolk, Herman (1998) Disorders of Syntax in Aphasia: Linguistic-Descriptive and Processing Approaches. In Brigitte Stemmer & Harry Whitaker (eds.), *Handbook of Neurolinguistics*, pp. 249–260. New York: Academic Press.
- Kolk, Herman, van Grunsven, Marc & Keyser, Antoine (1985) On Parallelism Between Production and Comprehension in Agrammatism. In Marie Louise Kean (ed.), *Agrammatism*, pp. 165–206. Orlando: Academic Press.
- Kolk, Herman & van Grunsven, Marc (1985) Agrammatism as a variable phenomenon. *Cognitive Psychology* 2: 347–384.
- Kolk, Herman, Heling, Geert & Keyser, Antoine (1990) Agrammatism in Dutch: Two Case Studies. In Lise Menn & Loraine Obler (eds.), *Agrammatic aphasia: A Cross-Language Narrative Sourcebook*, pp. 179–280. Amsterdam/Philadelphia: John Benjamins.
- Kolk, Herman & Heeschen, Claus (1990) Adaptation symptoms and impairment symptoms in Broca's aphasia. *Aphasiology* 3: 221–231.
- (1992) Agrammatism, paragrammatism, and the management of language. *Language and Cognitive Processes* 7: 89–129.
- Koopman, Hilda & Sportiche, Dominique (1991) The position of subjects. *Lingua* 85: 211–258.
- Mahfoudi, Abdessatar (2003) *Agreement lost, agreement regained: A minimalist account of word order and agreement in Arabic*. Ms., University of Ottawa.
- McCarthy, John (1981) A Prosodic Theory of Nonconcatenate Morphology. *Linguistic Inquiry* 12: 373–418.
- McCarthy, Rosaleen & Warrington, Elizabeth (1985) Category specificity in an agrammatic patient: The relative impairment of verb retrieval and comprehension. *Neuropsychologia* 23: 709–727.
- Menn, L. and Obler, L. (eds.) (1990) *Agrammatic Aphasia: A cross-Language Narrative Sourcebook*. Amsterdam/Philadelphia: John Benjamins.
- Miceli, Gabriele & Mazzucchi, Anna (1990) Agrammatism in Italian: Two Case Studies. In Lise Menn & Loraine Obler (eds.), *Agrammatic Aphasia: A cross-Language Narrative Sourcebook*, pp. 717–816. Amsterdam/Philadelphia: John Benjamins.
- Miceli, Gabriele, Silveri, Maria, Villa, Giampiero & Caramazza, Alfonso (1984) On the basis of agrammatic's difficulty in producing main verbs. *Cortex* 20: 207–220.
- Miceli, Gabriele, Silveri, Maria, Romani, Cristina & Caramazza, Alfonso (1989) Variation in the pattern of omissions and substitutions of grammatical morphemes in the spontaneous speech of so-called agrammatic patients. *Brain and Language* 36: 447–492.
- Mimouni, Zohra (1997) *Noun and Verb forms in Algerian Arabic: A Neuropsychological Study*. Unpublished Doctoral Dissertation. University of Montreal.

- Mimouni, Zohra & Jarema, Gonia (1997) Agrammatic aphasia in Arabic. *Aphasiology* 11: 125–144.
- Nespoulous, Jean-Luc, Dordain, Monique, Perron, Cécile, Jarema, Gonia & Chazal, Marianne (1990) Agrammatism in French: Two case studies. In Lise Menn & Loraine Obler (eds.), *Agrammatic aphasia: A cross-language narrative sourcebook*. Amsterdam/Philadelphia: John Benjamins.
- Ouhalla, Jamal (1993) Functional categories, agrammatism, and language acquisition. *Linguistische Berichte* 143: 3–36.
- (1994) Verb Movement and Word order in Arabic. In David Lightfoot & Norbert Horstein (eds.), *Verb Movement*, pp. 41–72. Cambridge: Cambridge University Press.
- Pollock, Jean-Yves (1989) Verb movement, universal grammar, and the structure of IP. *Linguistic Inquiry* 20: 365–424.
- Saffran, Eleanor, Brendt, Rita & Schwartz, Myrna (1989) The quantitative analysis of agrammatic production: procedure and data. *Brain and Language* 37: 440–479.
- Stavroulaki, Stavroula & Kouvava, Sofia (2003) Functional categories in agrammatism: Evidence from Greek. *Brain and Language* 86: 129–141.
- Wenzlaff, Michaela & Clahsen, Harald (2004): Tense and agreement in German agrammatism. *Brain & Language* 89 : 57–68.
- Youssi, Abderrahim (1992) *Grammaire et Lexique de l'Arabe Marocain Moderne*. Casablanca: Wallada.
- Zingeser, Louise & Berndt, Rita Sloan (1990) Retrieval of nouns and verbs in agrammatism and anomia. *Brain and Language* 39: 14–32.
- Zhou, Xiaolin, Ostrin, Ruth & Tyler, Lorraine (1993) The noun-verb problem and Chinese aphasia: Comments on Bates et al. (1991). *Brain and Language* 45: 86–93.

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