Aphasiology

ISSN: 0268-7038 (Print) 1464-5041 (Online) Journal homepage: www.tandfonline.com/journals/paph20

Production and comprehension of reference of time in Swahili–English bilingual agrammatic speakers

Tom O. Abuom & Roelien Bastiaanse

To cite this article: Tom O. Abuom & Roelien Bastiaanse (2013) Production and comprehension of reference of time in Swahili–English bilingual agrammatic speakers, Aphasiology, 27:2, 157-177, DOI: 10.1080/02687038.2012.699632

To link to this article: https://doi.org/10.1080/02687038.2012.699632

Aphasiology, 2013
Vol. 27, No. 2, 157–177, http://dx.doi.org/10.1080/02687038.2012.699632

Routledge
Taylor & Francis Group

Production and comprehension of reference of time in Swahili–English bilingual agrammatic speakers

Tom O. Abuom[1,2] and Roelien Bastiaanse[2]

[1]Graduate School for the Humanities (GHS), University Groningen, The Netherlands
[2]Center for Language and Cognition Groningen (CLCG), University of Groningen, The Netherlands

Background: Several studies on time reference show that monolingual agrammatic speakers have difficulty producing and/or comprehending verb forms referring to past events or actions. The PAst Discourse LInking Hypothesis (PADILIH) has been formulated to account for this phenomenon (Bastiaanse et al., 2011). In the current study on bilingual aphasia we examine whether time reference problems, especially reference to the past, extend to both languages of bilinguals with agrammatic aphasia. The two languages, Swahili and English, have different verb morphology for expressing reference of time.
Aims: The current study tested the production and comprehension of reference of time through verb morphology in two languages of Swahili–English bilingual agrammatic speakers.
Methods & Procedures: A total of 13 agrammatic speakers and 13 non-brain-damaged individuals were tested using an adaptation of the Test for Assessing Reference of Time (TART; Bastiaanse, Jonkers, & Thompson, 2008; Swahili version: Abuom & Bastiaanse, 2010). Reference to the past, present, and future conditions were examined through a sentence-completion and a picture–sentence-matching task.
Outcomes & Results: While the non-brain-damaged participants performed at ceiling in both languages, the agrammatic individuals' performance showed a selective deficit of reference to the past on both comprehension and production tasks. A similar pattern was observed in the two languages in spite of the structural differences.
Conclusions: The PAst Discourse LInking Hypothesis (PADILIH) was supported by these results. Furthermore it has been revealed that time reference deficits extend to both tested languages of bilingual speakers with agrammatic aphasia regardless of the structure of languages mastered pre-morbidly. The implications of these findings for the theories of bilingual agrammatism are discussed.

Keywords: Agrammatism; Bilingual aphasia; Time reference; Verb inflection; Discourse linking; Swahili.

Address correspondence to: Mr Tom Abuom MA, Center for Language and Cognition Groningen (CLCG), University of Groningen, PO Box 716, 9700 AS Groningen, The Netherlands. E-mail: t.o.abuom@rug.nl

We would like to thank Emma Shah and the administration of the Aga Khan University hospital for granting us full access to facilities at the SLT department at the hospital. We express our sincere thanks to Sanne Brederoo, Trevor Benjamin, and the three anonymous reviewers who provided very insightful and valuable comments and suggestions on the previous versions of this paper. Finally we express our gratitude to all the participants (aphasic and healthy speakers) in this study.

In daily life communication it is often easy and rather effortless not only to talk about, but also to understand, events or actions that: happened in the past, are happening at the present, or will happen in the future. The use of verb inflections to communicate time reference is generally not a problem for most people. However, there is evidence that this may not be the case with brain-damaged individuals suffering aphasia. Recent cross-linguistic studies on time reference indicate that individuals with agrammatic aphasia have problems with verb inflections for reference to the past timeframe (e.g., for Greek: Nanousi, Masterson, Druks, & Atkinson, 2006; Stavrakaki & Kouvava, 2003; for Dutch: Bastiaanse, 2008; Jonkers & de Bruin, 2009; for Turkish: Yarbay Duman & Bastiaanse, 2009; for English: Abuom, Obler, & Bastiaanse, 2011, Bastiaanse et al., 2011; for Swahili and English: Abuom & Bastiaanse, 2012). However, it is not clear how these problems with time reference are reflected in both languages spoken by a bilingual agrammatic individual. This is particularly interesting when the languages have very different verb inflection paradigms, as in this case Swahili and English. The verb inflection paradigm of Swahili is very large, whereas it is relatively small in English.

The current study investigates the performance of pre-morbidly highly proficient Swahili–English bilingual agrammatic speakers on production and comprehension of time reference in both languages. The question is how time reference problems, especially reference to the past, are manifest in both production and comprehension of the Swahili–English bilingual agrammatic speakers. The study will determine whether the size of the verb inflection paradigm influences the performance of the agrammatic speakers quantitatively and qualitatively, and whether the language with a larger paradigm (Swahili) is more or less impaired than the one with a smaller paradigm (English).

In the next sections we will first present a description of time reference morphology in Swahili, followed by an overview of the literature on time reference problem among monolinguals and bilinguals with agrammatic aphasia. The predictions for the current study will conclude this introductory section.

TIME REFERENCE MORPHOLOGY IN SWAHILI

Swahili, a Bantu language spoken mostly in Africa including Kenya, has Subject – Verb – Object as the basic word order (Ashton, 1982). Kenya is a multilingual society with an average person speaking at least three languages. Swahili and English are the two most dominant languages across the country, used both as official and as national languages, but most Kenyans speak an extra language from the 42 languages linguists refer to as "ethnic languages" (classified under four broad categories: Bantu, Nilotic, Indo-Aryan, and Cushitic languages) at home as well. Swahili and English have the same status as second languages since both are acquired around the age of 4, after acquiring the native language.

Swahili's most distinguishing characteristic is its agglutinative aspect; and of greatest interest to this study is the size of the verb structure consisting of prefixes and suffixes. Time reference for tense and aspect in Swahili is done through verb inflection as a prefix in the verb complex. The complete structure of the Swahili verb paradigm is illustrated in (1). It is important to note that the subject agreement (Sp), tense (T), root, and the derivation (d) are obligatory in every affirmative Swahili utterance.

The tense system used for time reference in Swahili is given in examples (1a–e).

(1) Pre-prefix (Pp)[1] + Subject prefix (Sp) + Tense prefix (T) + Object prefix (Op) + ROOT + derivation (d) + Suffix (S) + Post-suffix (Ps)[2]

(1a)	LEO	[Wa + na + tak + a]	*ku* + m + pig + a
	TODAY	[Sp + T + ROOT + d]	Pp + Op + ROOT + d
		"TODAY [they want] to hit him/her"	
(1b)	JANA	A + *li* + m + pig + a	
	YESTERDAY	Sp + T + Op + ROOT + d	
		"YESTERDAY she/he hit him/her"	
(1c)	LEO	U + *me* + m + pig + a	
	TODAY	Sp + T + Op + ROOT + d	
		"TODAY you have hit him/her"	
(1d)	SASA	Tu + *na* + pig + a + n + a	
	NOW	Sp + T + ROOT + d + S + Ps	
		"NOW we are hitting each other"	
(1e)	KESHO	Ha + tu + *ta* + m + pig + a	
	TOMORROW	Pp + Sp + T + Op + ROOT + d	
		"TOMORROW we will not hit him/her"	

As illustrated in (1a–e), Swahili has three explicit morphological markers of tense: past, present, and future. The infinitive (1a) is also marked in Swahili by the prefix KU- attached either directly to the verb root as in 'to hit' (**ku**piga) or attached to the object prefix with the verb root as in "to hit him/her" (**ku**mpiga). This prefix KU- corresponds to the English infinitive generally signalled by the use of "to" before the verb. The past tense marker formed by the insertion of the prefix -LI, as in (1b), refers to a past activity without reference to a specific time. The prefix -LI corresponds to the simple past in English (Verb + ed: he painted). The present perfect tense inserted as a prefix -ME- (1c) refers to a past activity which has relevance to the present time. The prefix -ME- is comparable to the present perfect in English (has/have + Verb + *ed*: he has painted). The present tense -NA- describes actions taking place at the present moment (1d) comparable to either the English present progressive (Verb + ing: he is hitting him) or simple present (Verb + s: he hits him). The future tense marker -TA- describes events assumed to follow the present moment (1e), corresponding to reference to the future through periphrastic form in English (will + infinitive: he will paint).

It is generally considered ungrammatical to omit tense markers in any Swahili utterance whether or not the temporal reference is clear from the discourse or any other sources (with the exception of imperative sentences such as "Nenda nyumbani", a translation equivalent of "go home" in English). The grammatical structure of time reference morphology for the two languages is clearly different: Swahili has a large verb inflection paradigm that can function as a complete sentence on its own, whereas English has a rather small verb paradigm that requires other sentence constituents.

In sum, verb morphology in Swahili appears complex due to its relatively large number of affixes on the verb paradigm, but it is completely regular. Also, time reference is simple: there are only three tenses expressed through affixes which are inserted in the same position for every single verb. No irregular verbs exist. In English the finite verb itself is simpler than in Swahili, but there is a wider variation in inflection for time reference, since it is inflected for both tense and aspect. The inflection is

[1] The pre-prefix is a negation marker found in all negative sentences. However, it has not been included in the present test.

[2] It is not possible for a verb to possess all these affixes at the same time.

done by both analytical verb forms ("wrote") and periphrastic verb forms ("has written"). Additionally, English has regular and irregular verbs. This means that overall the Swahili finite verbs are more complex, because Swahili is an agglutinative language where the finite verbs incorporate more information, although inflection for time reference is simpler than in English.

TIME REFERENCE PROBLEM IN MONOLINGUALS WITH AGRAMMATIC APHASIA

Most languages express time reference through tense and aspect. A number of studies that have compared the processing of tense and agreement in individuals with agrammatic aphasia show that tense inflections are more prone to impairment than agreement inflections. Friedmann and Grodzinsky (1997) found impaired tense inflection, but intact agreement inflection, in a Hebrew aphasic speaker. As a result they proposed the so-called tree pruning hypothesis (TPH), which attributes the difficulty with tense to its higher position in the syntactic tree. Wenzlaff and Clahsen (2004) found similar results for German aphasic speakers. However, they proposed the tense under-specification hypothesis (TUH), which relates the tense problem to the fact that tense carries extra-sentential information. Burchert, Swaboda-Moll, and De Bleser (2005) found that both tense and agreement can be difficult for German agrammatic speakers. They proposed the tense and agreement hypothesis (TAUH), arguing that both tense and agreement can be affected independently in agrammatic speakers. However, what these studies fail to show is whether aspect is impaired as well, and whether past tense inflections are impaired selectively or not.

The findings by Stavrakaki and Kouvava (2003) and Nanousi et al. (2006) for Greek; Bastiaanse (2008) and Jonkers and de Bruin, (2009), for Dutch; Yarbay Duman and Bastiaanse (2009), for Turkish; and Bastiaanse et al. (2011) for English, Chinese, and Turkish, show a selective impairment of reference to the past through tense and/or aspect. Stavrakaki and Kouvava (2003) analysed the production of tense, aspect, and agreement in the spontaneous speech of two Greek agrammatic speakers and found that past tense was more difficult to produce than the present tense. Furthermore, the past tense with the perfective aspect ("I wrote") was more difficult to produce than the past tense with the imperfective aspect ("I was writing"). However, the production of subject–verb Agreement was relatively spared. Nanousi et al. (2006) also reported impaired perfective aspect in a group of Greek agrammatic speakers. Bastiaanse (2008) used a sentence completion task to assess the performance of a group of Dutch agrammatic speakers on production of time reference through tense (past tense versus present tense) and periphrastic forms (non-finite participle versus infinitive). The results were in line with the findings of Stavrakaki and Kouvava (2003): past tense forms were more difficult to produce than the present tense forms. Interestingly, however, for the non-finite forms, the production of the participle (used, in combination with a present tense auxiliary, to denote perfect aspect; and not marked for gender or number) was more impaired than the production of the (uninflected: with no tense or agreement) infinitive.

Yarbay Duman and Bastiaanse (2009) examined the performance of a group of Turkish agrammatic speakers on the production of tensed finite verbs and participles referring to the past and the future through a pictured sentence completion task. Their findings revealed past tense/perfect aspect to be more difficult than future

tense/imperfect aspect for the Turkish agrammatic speakers. In another study on time reference in Dutch agrammatic speakers, Jonkers and de Bruin (2009) tested both production and comprehension of the present and the past tenses in seven individuals with Broca's aphasia and five individuals with Wernicke's aphasia using a sentence-to picture matching task for comprehension and a sentence completion task for production. Jonkers and de Bruin (2009) observed that past tense forms were more impaired than present tense forms in both production and comprehension. They noted, however, that past tense deficit was a general problem that affects Broca's and Wernicke's aphasic individuals alike.

The results of these studies raised the question of why reference to the past is more difficult for agrammatic individuals. Bastiaanse et al. (2011) formulated the PAst DIscourse LInking Hypothesis (PADILIH) which is based on the idea of Zagona (2003) that when referring to a present event through tense, speech time and event time are the same and hence are locally bound. When referring to the past through tense an extra-sentential reference is made, because speech time and the (earlier) event time are different. Therefore discourse linking is required. For reference to the future, Bastiaanse et al. (2011) suggest that the relationship is neither discourse linked nor locally bound since the event has not yet happened (see also Zagona, in press). Avrutin (2000, 2006), based on findings from a number studies, suggests that the interpretation of discourse-linked relationships is a problem for individuals with Broca's aphasia. He distinguishes "narrow syntax", that is, syntax processes that are taking place within the sentence structure, and "discourse syntax", that is, processing syntactic information at the discourse level. According to Avrutin (2000, 2006) more processing resources are required to establish relationships with discourse syntax information than with narrow syntax.

Bastiaanse et al. (2011), in proposing the PADILIH, expanded Zagona's (2003) theory on tense and discourse linking to include not only past tense, but all verb forms referring to the past, including periphrastic verb forms and verb forms in perfect aspect. The PADILIH therefore predicts that all verb forms referring to a past or finished event, regardless of tense, are discourse linked and therefore require more processing resources, leading to more errors by grammatically impaired individuals.

In a cross-linguistic study Bastiaanse et al. (2011) tested the PADILIH. Agrammatic speakers of Chinese, English, and Turkish were assessed on both comprehension and production of time reference morphology (in three conditions: past, present, and future) using the Test for Assessing Reference of Time (TART; Bastiaanse et al., 2008). Their results were in line with previous findings on time reference: both Turkish and English agrammatic speakers showed a selective deficit with reference to the past through verb inflections in production and comprehension. The Chinese agrammatic speakers' performance on comprehension was relatively similar to those of Turkish and English. However, the Chinese agrammatic speakers' performed poorly on production of all the three time-frames: reference to the past, present, and the future. The authors attribute the Chinese production results to a general difficulty with aspectual adverbs: time reference is expressed through aspectual adverbs rather than verb inflections. These findings were taken as support for the PADILIH, attributing the problem with reference to the past, through tense and/or aspect, to impaired discourse linking in agrammatic aphasia.

What all these studies on tense and time reference have in common is that they have mainly investigated monolingual agrammatic speakers. In the present study with bilingual agrammatic speakers, the performance in both Swahili and English can be

compared to evaluate the influence of the verb inflection paradigm on the severity of the time reference deficit.

TIME REFERENCE PROBLEMS IN BILINGUAL INDIVIDUALS WITH AGRAMMATIC APHASIA

In the current study we use the term "bilingual" to include both bilingual and multilingual persons who make use of two or more languages or dialects in their everyday lives (Grosjean, 1994). Most bilingual aphasic individuals suffer from the same type of aphasia in all their languages mastered pre-morbidly; and the recovery pattern commonly observed is parallel (Abutalebi, Cappa, & Perani, 2005; Fabbro, 1999, 2001; Miozzo, Costa, Hernandez, & Rapp, 2010; Paradis, 2001). Non-parallel recovery patterns have also been reported and are usually attributed to differences in either the age of acquisition, frequency of use or proficiency level between the languages mastered pre-morbidly (Albert & Obler, 1978; Fabbro, 1999). In early balanced and proficient bilinguals, languages acquired early are generally assumed to be represented in shared processing regions (e.g., Abutalebi et al., 2005; Miozzo et al., 2010).

When it comes to time reference problems among bilingual aphasic speakers, so far only two studies have investigated the tense and time reference problem in bilingual agrammatic speakers. In the first study Abuom et al. (2011) tested two Swahili–English bilingual agrammatic speakers on production of reference to the past and the future, using a sentence completion task. The English data confirmed the findings of the previous studies on tense and reference to the past. However, reference to both the future and the past was intact for Swahili in both agrammatic speakers. For the second study, Abuom and Bastiaanse (2012) analysed the use of verb inflections for tense and time reference to the past and to the present in the spontaneous speech of six Swahili–English agrammatic speakers. The results showed that the use of verb inflections for reference to the present was normal in their spontaneous speech, but the number of verb forms referring to the past was significantly lower than normal. However, overall, the use of verb inflections was better preserved in Swahili than in English.

While the results of both studies on bilingual Swahili–English agrammatic speakers concur with respect to the difficulty with producing reference to the past in English, it is not yet clear whether Swahili is similarly affected. Furthermore, the comprehension of time reference in Swahili–English agrammatic speakers has not been investigated. Therefore it is unclear whether the predictions of the PADILIH apply similarly to the two languages of bilingual agrammatic speakers.

THE CURRENT STUDY

The current study examined the production and comprehension of time reference to the past, the present, and the future in the two languages, using the Test for Assessing Reference of Time (TART: Bastiaanse et al., 2008; bilingual English–Swahili version: Abuom & Bastiaanse, 2010). We assume that balanced bilinguals who acquired their languages from an early age use a shared grammatical device (Abutalebi et al., 2005; Miozzo et al., 2010). The key research questions this study addressed were as follows:

(1) Is production of time reference to the past through verb inflection impaired in both languages of a bilingual?

(2) Is comprehension of time reference to the past through verb inflection impaired in both languages of a bilingual?
(3) Is reference to the past similarly impaired in both Swahili and English?

According to PADILIH: (1) the production of time reference to the past through verb inflection is impaired, whereas reference to the present and future are relatively spared; (2) the comprehension of time reference to the past through verb inflection is impaired, whereas reference to the present and the future is relatively intact; (3) the impairment is language independent, hence both Swahili and English will be impaired similarly. However, according to Bates, Friederici, and Wulfeck (1987), in a language with a more complex inflectional paradigm, the *cue cost* is higher to produce the grammatical morphemes. This predicts that the bilingual agrammatic speakers will make more errors in Swahili, where the verb inflection paradigm is larger (more complex). However, Bates, Wulfeck, and MacWhinney (1991) introduce the notion of *cue validity*: inflectional markers that are more informative are better preserved than inflectional markers that are less informative. With respect to the present study, this theory predicts that past, present, and future morphology will be equally affected, since all three are used for reference to a time frame. Also, cue validity is the same in English and Swahili. In sum: the cue cost in Swahili is higher, so more errors are expected in Swahili; the cue validity in the two languages is the same, so no differences are expected. Another interesting idea was expressed by Goral (2011). She assumes that, in bilingual agrammatic aphasia, regular paradigms are better preserved than paradigms with irregular members. Goral (2011) thus expects Swahili with its fully regular, though larger (complex), paradigm to be better preserved than English with its smaller (simple) paradigm for reference to the past that nevertheless contains three different regular (-t, -d, -ed) allophones and irregular forms.

METHOD

Participants

There were a total of 26 participants in this study: 13 Swahili–English bilingual agrammatic speakers from Aga Khan University hospital Nairobi-Kenya and 13 non-brain-damaged speakers (NBDs) matched in age, gender, native language, and education level to agrammatic speakers. All participants were aged between 20 and 49 years, with over 12 years of education, and none had any history of neurological, hearing, or vision problems.

The agrammatic speakers had all suffered from single stroke with the exception of one, EA, who had left hemisphere brain damage due to a car accident. They were early balanced bilinguals, equally proficient in English and Swahili pre-morbidly; any Kenyan adult with over 12 years of uninterrupted education is generally expected to be equally highly proficient in both Swahili and English. The demographic details of the agrammatic participants are shown in the Table 1.

Participants'spontaneous speech was judged to be telegraphic with reduced speech rate in both languages by a practising speech therapist, and further confirmed by the experimenter based on the criteria of Menn and Obler (1990).[3] However, due

[3] There was spontaneous speech available of six of the patients, who also participated in Abuom and Bastiaanse, 2012. Their speech was characterised by significantly (1) lower speech rate; (2) shorter sentences; (3) fewer grammatical sentences; (4) fewer embeddings in both Swahili and English.

TABLE 1
Demographic details and results: Agrammatic speakers

Agrammatic participants	*Age (years)*	*Gender*	*Handed-ness*	*Education (years)*	*Years post stroke/ head trauma*	*Native language*	*Swahili BDAE – subtest*	*English BDAE-subtest*
SW	20	M	R	12	2	Bantu	98.6%	99%
HJ	45	F	R	14	10	Nilotic	100%	100%
LA	43	F	R	16	1	Bantu	100%	100%
MM	47	F	R	16	10	Nilotic	100%	100%
JK	49	M	R	17	1	Bantu	100%	100%
EA	42	M	R	16	17	Nilotic	100%	99%
PN	36	F	R	14	1	Bantu	100%	100%
JA	46	M	R	16	1	Bantu	100%	100%
MW	50	F	R	16	1.5	Bantu	98.6%	100%
VK	25	F	R	16	2	Bantu	100%	98.6%
HS	64	M	R	16	1	Indo-Aryan	99%	98.6%
JN	50	F	R	13	10	Bantu	100%	100%
SS	30	F	R	12	17	Indo-Aryan	100%	99%
mean	42.1			14.9	4.4		99.7%	99.5%

Demographic details and the results on the test for auditory comprehension of words (on an adapted version of the BDAE-test in Swahili and English) of the agrammatic speakers.

to lack of most relevant standardised tests for establishing the aphasia syndrome in Kenya, we administered an adapted version of a sub-test from the *Boston Diagnostic Aphasia Examination* (Goodglass & Kaplan, 1972) to ensure their good comprehension abilities. They all had good comprehension in both languages on the subtask for auditory comprehension of single words (nouns, verbs, colours, shapes, letters, and numbers) from the *Boston Diagnostic Aphasia Examination*. Some pictures were substituted due to cultural differences, for instance, a hammock was changed to a swing since no Swahili word for hammock exists. Unfortunately there is no information as to the possible extent of cognitive damage in agrammatic participants. The agrammatic speakers' scores on the BDAE subtest for auditory word comprehension are included in Table 1.

Materials and procedure

The African version (an adaptation for English and Swahili) of the Test for Assessing Reference of Time (TART: Abuom & Bastiaanse, 2010) was used. The TART was developed for cross-linguistic investigation of comprehension and production of reference of time and it has been used in several other languages including: Dutch, English, Indonesian, Chinese, and Turkish. The test has two sections with pictures of 20 verbs depicting actions in three time-frames: the present (an ongoing action), the past (a completed action) and the future (an action about to start).

The production section consists of a sentence-completion paradigm with prompting to elicit the intended verb forms. There are 20 items for each of the three conditions: the simple past, the present continuous, and the future. The following forms were elicited in the two languages: simple past (an infix *-li-* for Swahili, and a suffix *-ed* for English); present continuous (an infix *-na-* for Swahili, and *is* + *V -ing*

for English); future (an infix *-ta-* for Swahili, and *will + infinitive* for English). The participants were presented with a pair of pictures of contrasting actions in a particular time-frame (past, present, and future; see Figure 1 and the examples in 2a–c below) with the same object. The infinitive form of the verb was printed above the pictures on the same page (e.g., "write" and "read"). The experimenter constructed a sentence for the picture on the left using the appropriate temporal adverb with the correct form of the verb. The participant was expected to complete the second sentence for the other picture using the right form of verb after the experimenter has given the temporal adverb and the subject (see examples 2a–c for eliciting: present continuous, past, and future tenses in Swahili and English). Samples of pictures for the production task are given in Figure 1a–c.

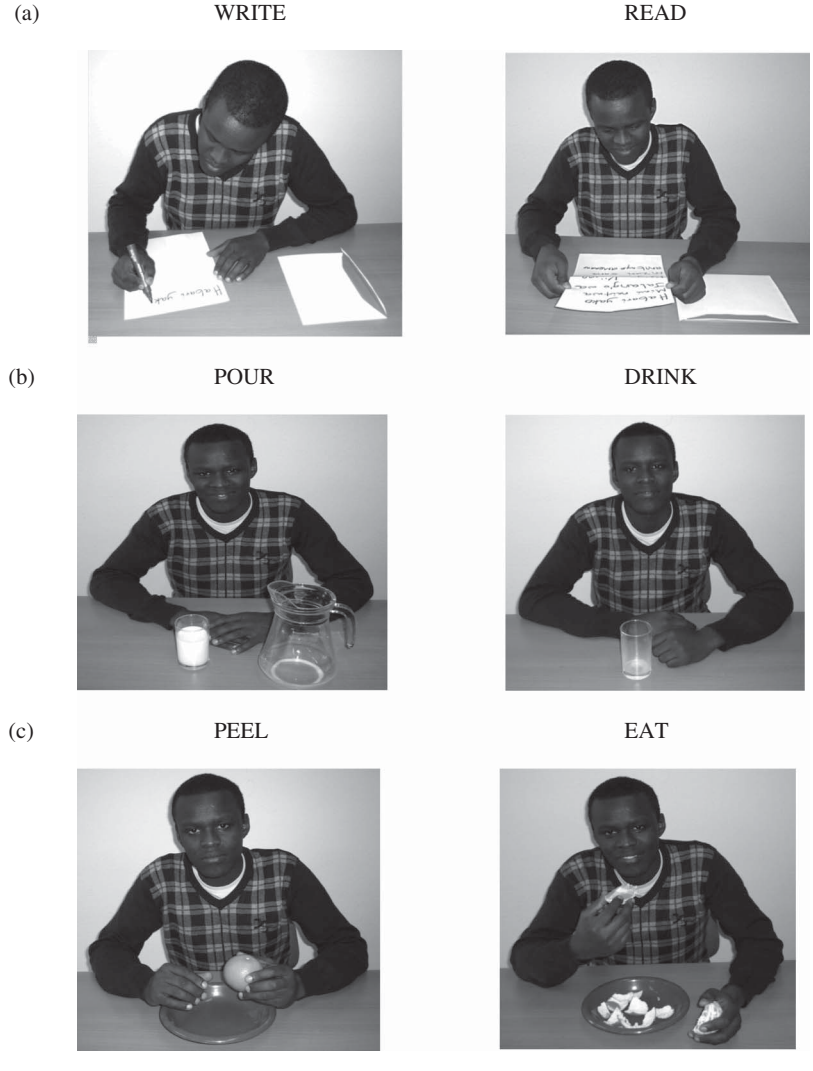

Figure 1. Samples of the pictures used for the production task: (a) to elicit time reference to the present; (b) to elicit time reference to the past; (c) to elicit time reference to the future.

(2a) Examiner:
Sasa huyu mwanamme a-na-andika barua. Sasa huyu mwanamme...
Now this man he-Present-write a letter. Now this man . . .
"Now this man is writing a letter. Now this man . . . "
Participant:
a-na-soma barua
he-Present-read a letter
"is reading a letter".

(2b) Examiner:
Hapo-mbeleni huyu mwanamme a-li-mwaga maziwa. Hapo-mbeleni huyu mwanamme...
Previously this man he-Past-pour milk. Previously this man . . .
"Previously this man poured milk. Previously this man . . . "
Participant:
a-li-kunywa maziwa
he-Past-drink milk
"drunk milk".

(2c) Examiner:
Hivi-punde huyu mwanamme a-ta-menya chungwa. Hivi-punde huyu mwanamme...
Soon this man he-Future-peel orange. Soon this man . . .
"Soon this man will peel an orange. Soon this man . . . "
Participant:
a-ta-kula chungwa
he-Future-eat orange
"will eat an orange".

The comprehension section consists of a spoken sentence–picture-matching task. The pictures of 20 verbs depicting actions in three time frames from production task were also used in the comprehension task. Constructions in three time-frames (the simple past, the present continuous, and the future) were used with each time frame consisting of 20 items. A pair of pictures was presented to the participants and a sentence with the target inflected form of the verb was read aloud by the experimenter. The participants chose a picture from the given pair that corresponds to the sentence read by the experimenter (see example 3). The pictures depict actions in two contrasting time-frames (see Figure 2).

Figure 2. A sample of the pictures used for the comprehension task.

(3) Experimenter:
Mwanamme a-na-kula chungwa
Man he-Present-eat an orange
"The man is eating an orange"

The TART has been translated into more than 15 languages, and the same verbs are used for each language. Therefore there were verbs with regular ($n = 13$) as well as irregular ($n = 7$) past tense included in the English version (see Appendix 2).

The tests in each of the languages were administered on two different days with an interval of 2 weeks for each of the agrammatic speakers. The order of the tests was varied for each participant: either English first, followed by Swahili, or vice versa, but all participants were tested on production first before comprehension in each language. The tests were conducted in a speech therapy room at the Aga Khan University Hospital in Nairobi, Kenya. Each test session began with six practice items to ensure the participants understood the task before starting the test. The participants were corrected and given feedback during the practice. No further feedback was given once the test had begun. Each test session of the agrammatic speakers lasted 1.5 hours, with a break.

Analysis

The 13 non-brain-damaged Swahili–English bilingual speakers, matched in age, gender, native language, and education level to the agrammatic speakers, performed at ceiling on the two tests for both languages. We therefore assume that all errors made by the agrammatic speakers are a result of their aphasia. The agrammatic speakers' data were analysed both quantitatively and qualitatively. For quantitative analysis the number of both the correct and incorrect responses produced, and the number of correctly identified pictures, by each participant were tallied. Self-corrections were permitted during the test and the final response was scored. Produced responses were considered correct when the correct form of verb inflection was produced for the three time-frames in Swahili (*-li* for simple past, *-na* for present continuous, and *-ta* for future) and English (*-ed* for simple past, *-ing* for present continuous, and *will + infinitive* for future). Omission of the object was ignored. For the qualitative analysis the three most frequent error types were distinguished in the production task: substitution (e.g., "anakula" "he is eating" instead of "alikula""he ate"), omission (e.g., "*sukuma toroli" "pull the trolley" instead of "alisukuma toroli" "he pulled the trolley"), and other errors (e.g., "*he sweeped the floor" instead of "he swept the floor"). For statistical analysis we used repeated-measures ANOVA (for main effect of language, sub-test, and time reference); *t*-tests (for differences between the time-frames within each language, and between the two languages) and correlations (for relationship in performance within and between the two languages)

RESULTS

Overall analysis

A repeated-measures analysis of variance was performed to investigate main effects of language (English and Swahili), sub-test (production and comprehension), and time reference (past, present, and future) on agrammatic performance. There was a statistically significant effect for language: $F(1, 12) = 19.340$, $p = .001$; Swahili was better

preserved than English. There was also statistically significant effect for Sub-test: $F(1, 12) = 7.256$, $p = .020$; production was worse than comprehension in both languages, which is to be expected, since there is a 50% chance level for the comprehension test. Furthermore, there was a statistically significant main effect for time reference: $F(2, 12) = 48.230$, $p = .000$; reference to the past was worse than reference to both the present and the future in the two languages.

Production in English and Swahili

The production results are presented in Table 2. On the English version of the test the results showed a significant main effect for production of reference of time: $F(2, 12) = 65.730$, $p = .000$. Reference to the past was significantly impaired compared with reference to the present, $t(12) = 8.23$, $p = 0.0001$, and to the future, $t(12) = 8.09$, $p = .0001$. There was no difference between regular and irregular past tense forms, $t(12) = 0.71$, $p = .49$ (see Appendix 1). There was also no significant difference between reference to the present and to the future, $t(12) = 0.00$, $p = 1.000$. The results on the Swahili version of the test showed a similar pattern: there was again a significant effect for reference of time: $F(2, 12) = 13.551$, $p = .002$. The agrammatic speakers performed poorly on reference to the past compared with reference to the present, $t(12) = 3.39$, $p = .0054$, and to the future, $t(12) = 4.28$, $p = .0011$). However, no significant difference between reference to the present and the future was found, $t(12) = 0.62$, $p = .5486$. Overall, the production of English past (mean = 9.69) was significantly worse than the production of Swahili past (mean = 16.46) $t(12) = 6.60$, $p = .0001$.

Comprehension in English and Swahili

The comprehension results are presented in Table 3. The pattern of performance on comprehension of reference of time was quite similar to that on production. For

TABLE 2
Comparison of agrammatic speakers' scores on production of reference of time in Swahili and English

	Swahili production			*English production*		
	Past	*Present*	*Future*	*Past*	*Present*	*Future*
SW	12	20	19	9	20	20
HJ	19	18	20	4	20	20
LA	20	19	20	17	20	20
MM	20	20	20	15	20	20
JK	20	19	20	18	20	20
EA	11	15	14	5	18	20
PN	17	20	20	5	20	20
JA	19	20	20	11	20	20
MW	14	20	20	7	20	20
VK	14	19	20	9	20	20
HS	17	20	20	9	20	19
JN	15	20	20	6	20	19
SS	16	20	19	11	20	20
mean	16.46	19.23	19.38	9.69	19.85	19.85

TABLE 3
Comparison of agrammatic speakers' scores on comprehension of reference of time in Swahili and English

	Swahili comprehension			*English comprehension*		
	Past	*Present*	*Future*	*Past*	*Present*	*Future*
SW	19	20	20	20	20	20
HJ	17	20	18	7	19	19
LA	17	20	19	17	20	19
MM	20	20	20	20	20	20
JK	20	20	20	20	19	20
EA	19	19	20	18	19	19
PN	15	20	19	9	20	20
JA	17	20	20	16	20	20
MW	15	20	20	15	20	19
VK	18	20	20	11	20	20
HS	19	20	20	15	20	20
JN	15	20	19	12	20	20
SS	16	20	20	14	20	19
mean	17.46	19.92	19.61	14.92	19.77	19.62

English comprehension a significant main effect was found: $F(2, 12) = 16.434$, $p = .001$. Comprehension of English reference to the past was significantly more challenging than reference to both the present, $t(12) = 4.10$, $p = .0015$, and the future, $t(12) = 4.04$, $p = .0016$. There was no effect of regularity of English past tense, $t(12) = 0.55$, $p = .59$ (see Appendix 1), meaning that the poor performance on English past tense was not due to the irregularity of some of the verbs. Again, no significant difference between reference to the present and to the future was found, $t(12) = 1.00$, $p = .3370$. The performance in Swahili showed a relatively similar pattern, there was a significant main effect for comprehension of reference of time: $F(2, 12) = 19.648$, $p = .000$. Comprehension of Swahili reference to the past was more challenging than Swahili reference to the present, $t(12) = 4.57$, $p = .0006$, and to the future, $t(12) = 4.63$, $p = 0.0006$. The difference in performance between Swahili reference to the present and to the future was not significant, $t(12) = 1.48$, $p = .1654$. The performance on comprehension of English reference to the past (mean = 14.92) was significantly worse than comprehension of the Swahili reference to the past (mean = 17.46) $t(12) = 2.75$, $p = .0177$.

Individual results on production and comprehension of English and Swahili past

On further analysis of individual results of each agrammatic speaker, a discrepancy on individual performance is observed on production as well comprehension of time reference on both languages. The English production data show that all the agrammatic speakers had problems with reference to the past. However, on the Swahili production data, three agrammatic speakers (LA, MM, and JK) did not make any errors with past tense. This shows that with respect to production, reference to the past was more vulnerable in English than Swahili (see Table 2 above).

For comprehension the English comprehension data show that three agrammatic speakers (SW, MM, and JK) performed quite well on reference to the past whereas, on Swahili comprehension, two of them (MM and JK) performed similarly quite well on reference to the Swahili past tense. It is clear that the two patients (MM and JK) had no difficulty comprehending past tense in both Swahili and English (see Table 3).

In conclusion, all agrammatic speakers had difficulty with production of the English past tense, implying that reference to the past is a problem to all the agrammatic speakers, but not all agrammatic speakers are equally affected on both languages. However, further analyses of all the data show a significant correlation in agrammatic performance between English and Swahili in production, $R(37) = 0.68$, $p < .001$, and in comprehension, $R(37) = 0.80$, $p < .001$; implying that agrammatic speakers who are poor in English are also poor in Swahili and the other way around. Again, at the subtest level, there was a significant correlation between production and comprehension[4] in English, $R(37) = .81$, $p < .001$, and in Swahili, $R(37) = .35$, $p < .029$, indicating that agrammatic speakers who performed poorly in production also performed poorly in comprehension (and vice versa).

Error types

The distribution of error types of the agrammatic speakers is presented in Table 4. Incorrect responses of the agrammatic speakers on the production task were distinguished into three error types: substitutions by other forms of the same verb, omissions of verb inflections, and others. Substitution errors were equally prevalent in both Swahili and English tasks, $t(12) = 0.73$, $p = .48$. On the Swahili task the past tense marker "li" was frequently substituted with the present tense marker "na"

TABLE 4
Distribution of error types on production of individual agrammatic speakers

	Swahili production errors			*English production errors*		
	Substitutions	*Omissions*	*Others*	*Substitutions*	*Omissions*	*Others*
SW	9	0	0	6	5	0
HJ	1	2	0	10	5	1
LA	0	1	0	3	0	0
MM	0	0	0	0	5	0
JK	0	1	0	2	0	0
EA	15	5	0	0	16	1
PN	3	0	0	9	6	0
JA	1	0	0	5	4	0
MW	6	0	0	11	2	0
VK	6	1	0	3	8	0
HS	3	0	0	6	5	0
JN	5	0	0	11	5	0
SS	5	0	0	4	5	0
mean	4.15	0.78	0	5.38	5.08	0.15

[4] The comprehension task is a binary choice test, which makes a comparison between comprehension and production based on raw scores less valid. Therefore the scores on the comprehension task were corrected for guessing, using the formula: Corrected score = #correct – [# incorrect : (#alternatives – 1)].

(see Appendix 3). On the English task the past time frame was substituted most frequently with the present time frame (either simple present or the present progressive). However, errors of omission were more prevalent on the English test than on the Swahili test, $t(12) = 4.9$, $p = .0004$. The agrammatic speakers quite often omitted the tense inflection in English (e.g., "–ed" for past). In a few instances in Swahili they omitted both the subject-agreement prefix and the tense prefix. Other type of errors noted were a few regularisation errors in English: some of the agrammatic speakers regularised the English past in irregular verbs (e.g., "sweeped").

DISCUSSION

The present study examined the production and comprehension abilities of bilingual agrammatic speakers in regard to time reference. The results revealed that the agrammatic speakers were impaired in their production and comprehension of time reference to the past. However, their production and comprehension of time reference to both the present and the future are relatively spared. A similar pattern of impairment is reflected in both languages, Swahili and English, irrespective of their morphological differences. These findings are discussed in relation to the theories of agrammatism mentioned in the introduction.

Why time reference to the past is difficult for agrammatic speakers

Friedmann and Grodzinsky's (1997) TPH argues that the agrammatic representation of the syntactic tree is pruned at the position of the tense node. As a result the tense node is inaccessible to agrammatic speakers. The authors therefore predict that tense should be impaired for both languages irrespective of time-frame. We do not find this account compatible with the present data because it cannot explain the selective impairment we found for reference to the past in both languages. An inaccessible tense node should lead to random distribution of errors over the tested categories (past, present, and future in English and Swahili); however, this was not the case in the present study. The TUH (Wenzlaff & Clahsen, 2004) and TAUH (Burchert et al., 2005) concur that it is not the position of tense in the syntactic tree that is causing problems, but the characteristics of tense. The authors argue that the interpretable features of tense that are used for time reference are underspecified in agrammatic speakers. Tense inflection must be checked against the time-frame to which the proposition is referring. This requires an extra-sentential computation which is usually difficult for agrammatic speakers. However, this explanation cannot adequately account the specific problem with reference to the past evidenced in this study and in several other studies (Bastiaanse, 2008; Bastiaanse et al., 2011; Jonkers & De Bruin, 2009; Nanousi et al., 2006; Stavrakaki & Kouvava, 2004; Yarbay Duman & Bastiaanse, 2009). Generally speaking, all these theories (TPH, TUH, and TAUH) restrict themselves to tense; they do not explain the problems agrammatic speakers have with verb forms expressing time reference through aspect inflection, nor through periphrastic forms.

Reference to the future is relatively spared, both in production and in comprehension. For English, that may be explained by its simple form: an invariant auxiliary that is not inflected for person and number and an infinitive. However, this does not hold for Swahili where reference to the past, present, and future are marked by inflections within the verb. In other languages performance on present and future are also relatively spared compared to reference to the past, for example, for Turkish, which is an

agglutinative language like Swahili. According to Zagona (in press), future is a variant of present. Together, they are "non-past", and therefore reference to the future is not discourse linked.

The PADILIH of Bastiaanse et al. (2011) apparently accounts best for the current data. The PADILIH is based on the idea that reference to the past through grammatical morphology (tense and aspect) is discourse linked; reference to the past therefore requires extra processing load (Avrutin, 2000, 2006). These extra processing resources are not sufficiently available in the affected brain areas of the agrammatic speakers. Notice that "discourse linking" or "processing by discourse syntax" does not mean that there should be a linguistic context. It means that a linguistic element (in this case the verb inflection for time reference) should be linked to an extra-sentential context, which may or may not be text. Thus it is processing at the syntax-semantic interface. In the sentence completion test there was linguistic discourse: there was an introductory sentence and a lexical adverb referring to past, present, or future. In the comprehension test the processing at the level of discourse context had to be done solely on the basis of the past tense inflectional marker. When hearing a past tense inflection the hearer must process at the level of discourse syntax, since the time of speaking and the time of the event do not coincide.

Why reference to the past is worse in English than in Swahili

One may propose the influence of the native language of the agrammatic speakers as an alternative explanation for the slightly better performance in Swahili past tense. However, we do not think this is the case. As mentioned, Swahili is a Bantu language, whereas English is not. Apart from the acquisition of both Swahili and English at an early age, the agrammatic speakers acquired another language from birth, which is classified as Bantu, Nilotic, or Indo-Aryan. Bantu languages, like Swahili, express time reference through a very rich and distinct tense morphology. Similarly, Indo-Aryan expresses time reference through tense. Nilotic languages, on the contrary, express time reference through aspect. Furthermore, in Nilotic languages, both perfective and imperfective aspect are distinguished based on tone rather than on grammatical morphemes (Dimmendaal, 2001). Of the 13 agrammatic participants, 8 acquired Bantu, while the rest acquired Nilotic and Indo-Aryan languages, respectively, as first languages. Although these first languages have different ways of expressing time reference, we still find a similar pattern of impaired reference to the past in Swahili in all the agrammatic speakers. Furthermore we did not find any differences on performance on reference to the past between native speakers of Bantu and native speakers of other languages (Nilotic and Indo-Aryan). Therefore we do not think that the structure of the earliest learned language explains the better performance in Swahili. The better performance on Swahili (compared to English) is shown consistently in our studies (Abuom & Bastiaanse, 2012; Abuom et al., 2011).

According to Bates et al.'s (1987) cue cost theory morphologically complex paradigms are likely to yield more errors than morphologically simple paradigms. Since the Swahili verb morphology paradigm is large compared to the English paradigm, Bates et al. (1987) predict worse performance in Swahili than English. What we found is the opposite: Swahili is better preserved than English. The cue validity theory (Bates et al., 1991) predicted equal performance in both languages and no difference between past, present, and future. This is also the wrong prediction. There is a selective deficit for time reference to the past, but past reference in Swahili is better

preserved than in English. The reason may be that Swahili's large and complex verb paradigm consists of several morphologically important affixes attached to the verb root. An omission of any single morpheme including tense prefix from the Swahili verb paradigm would render it a non-word, whereas an omission of past tense suffix (-ed) does not render the English verb a non-word. Given their morphological importance, the affixes on the Swahili verb paradigm are generally more firmly anchored in the language system than the affixes on the English verb. We therefore think Bates and colleagues' (1987, 1991) assumption cannot explain the quantitative difference between the languages, nor can it explain the selective deficit for verb forms referring to the past. Interestingly, for this single category (past tense), English is more complex with its multiple regular allophones and irregular past tense forms.

A better explanation is based on the morphological differences regarding the past tense marker on both languages. While Swahili past tense has only a single invariant, regular form marked as a prefix on the verb paradigm, the English past tense has both regular (with different phonetic realisations: /d/, /t/, and /Id/) and irregular forms. It may thus be the case that English past tense requires more processing resources compared to Swahili past tense: the agrammatic speaker has to consistently monitor whether the English past tense takes regular or irregular form; and appropriately select the correct phonetic realisation for the regular past tense. This assumption is in fact in line with the findings of Tsapkini, Jarema, and Kehayia (2001): their Greek agrammatic speaker had particular difficulty with reference to the past. They attributed this difficulty to Greek verb morphology which is characterised by several allomorphs specifying tense and aspect.

In Abuom and Bastiaanse (2012) we argued that apart from the differences in morphological complexity of the two languages, Swahili and English, the regularity of the tense affixes may also play a role. It has been suggested that bilingual agrammatic speakers are likely to perform better in a language with complex but regular morphology than in a language with simple but not regular morphology (Goral, 2011). In usage-based frameworks such as Bybee (2007) and Dressler (1985) regular morphological process is associated with affixation and considered to be more "natural", highly frequent in most languages, and generally easier to process. In contrast, irregular morphological processes are associated with stem change and considered to be less "natural", infrequent in most languages, and generally difficult to master. Although we did not find any dissociation between regular and irregular past tense verbs in English, the fact that irregular forms exist may make the whole category more difficult to process than members of the very regular Swahili paradigm. Some studies have shown that individuals with impaired linguistic abilities, such as agrammatic speakers, prefer to produce highly frequent linguistic morphemes over less frequent linguistic items in their speech (see Abuom & Bastiaanse, 2012; Centeno & Anderson 2011). This suggests that affixation is preferable to stem change in linguistically impaired populations since affixes are more common within a single language and easier to process in general than stem changes. Swahili verb morphology for past tense is regular (involves affixation) hence highly predictable and of high frequency compared to English past tense which can be both regular and irregular, consisting of instances of infrequent affixations and internal stem changes. We therefore think Goral's (2011) idea is a likely explanation for the different performance levels in Swahili and in English in the current study.

In sum, reference to the past through verb morphology was impaired in these bilingual agrammatic individuals, both in production and in comprehension in both

languages, as predicted by the PADILIH. The strong correlations in agrammatic speakers' performance between the two languages show that there is one central deficit underlying the general performance patterns. However, the impairment was less severe in the language with the most complex, but also most regular, paradigm, as suggested by Goral (2011), implying a compounding effect of the morphological system and reference to the past.

Manuscript received 13 March 2012
Manuscript accepted 20 May 2012
First published online 24 July 2012

REFERENCES

Abuom, T., & Bastiaanse, R. (2010). *Test for Assessing Reference of Time (TART): Bilingual Swahili–English version*. Groningen: University of Groningen.

Abuom, T., & Bastiaanse, R. (2012). Characteristics of Swahili–English bilingual agrammatic spontaneous speech and the consequences for understanding agrammatic aphasia. *Journal of Neurolinguistics*, *25*, 276–293.

Abuom, T., Obler, L., & Bastiaanse, R. (2011). Using Swahili and English to test explanations of agrammatism. *Aphasiology*, *25*, 559–575.

Abutalebi, J., Cappa, S. F., & Perani, D. (2005). What can functional imaging tell us about the bilingual brain? In J. F. Kroll & A. M. B. De Groot (Eds.), *Handbook of bilingualism: Psycholinguistic approaches*. (pp. 497–515). New York: Oxford University Press.

Albert, M. L., & Obler, L. K. (1978). *The bilingual brain: Neuropsychological and neurolinguistic aspects of bilingualism*. New York: Academic Press.

Ashton, E. O. (1982). *Swahili grammar*. London: Longman, Green & Co. Ltd.

Avrutin, S. (2000). Comprehension of discourse-linked and non-discourse-linked questions by children and Broca's aphasics. In Y. Grodzinksy, L. Shapiro, & D. Swinney (Eds.), *Language and brain: Representation and processing* (pp. 295–313). San Diego: Academic Press.

Avrutin, S. (2006). Weak syntax. In K. Amunts & Y. Grodzinsky (Eds.), *Broca's region* (pp. 49–62). New York: Oxford Press.

Bastiaanse, R. (2008). Production of verbs in base position by Dutch agrammatic speakers: Inflection versus finiteness. *Journal of Neurolinguistics*, *21*, 104–119.

Bastiaanse, R., Bamyaci, E., Hsu, C., Lee, J., Yarbay Duman, T., & Thompson, C. K. (2011). Time reference in agrammatic aphasia: A cross-linguistic study. *Journal of Neurolinguistics*, *24*, 652–673.

Bastiaanse, R., Jonkers, R., & Thompson, C. K. (2008). *Test for assessing reference of time (TART)*. Groningen: University of Groningen.

Bates, E., Friederici, A., & Wulfeck, B. (1987). Grammatical morphology in aphasia: Evidence from three languages. *Cortex*, *23*, 545–574.

Bates, E., Wulfeck, B., & MacWhinney, B. (1991). Crosslinguistic research in aphasia: An overview. *Brain and Language*, *41*, 123–148.

Burchert, F., Swoboda-Moll, M., & De Bleser, R. (2005). Tense and agreement dissociations in German agrammatic speakers: Underspecification versus hierarchy. *Brain and Language*, *94*, 188–199.

Bybee, J. (2007). *Frequency of use and the organization of language*. Oxford: Oxford University Press.

Centeno, J. G., & Anderson, R. T. (2011). A preliminary comparison of verb tense production in Spanish speakers with expressive restrictions. *Clinical Linguistics & Phonetics*, *25*, 864–880.

Dimmendaal, G. (2001). Language shift and morphological divergence in the Nilotic area. *Sprache und Geschichte in Afrika*, *16/17*, 83–124.

Dressler, W. (1985). *Morphonology: The dynamics of derivation*. Ann Arbor: Karoma Press.

Fabbro, F. (1999). *The neurolinguistics of bilingualism*. Hove: Psychology Press.

Fabbro, F. (2001). The bilingual brain: Bilingual aphasia. *Brain and Language*, *79*, 201–210.

Friedmann, N., & Grodzinsky, Y. (1997). Tense and agreement in agrammatic production: Pruning the syntactic tree. *Brain and Language*, *56*, 397–425.

Goodglass, H., & Kaplan, E. (1972). *Boston Diagnostic Aphasia Examination*. Philadelphia: Lea & Febiger.

Goral, M. (2011). *Treatment of grammatical disorders in bilingual aphasia*. Presentation at Science of Aphasia XII, September 1–5, Barcelona.

Grosjean, F. (1994). Individual bilingualism. In R. E. Asher (Ed.), *The encyclopaedia of language and linguistics* (pp. 1656–1660). Oxford: Pergamon Press.

Jonkers, R., & de Bruin, A. (2009). Tense processing in Broca's and Wernicke's aphasia. *Aphasiology*, *23*, 1252–1265.

Menn, L., & Obler, L. K. (Eds.). (1990). Cross-language data and theories of agrammatism. In *Agrammatic aphasia: A cross-language narrative sourcebook* (Vol. 2, pp. 1369–1389). Amsterdam: John Benjamins.

Miozzo, M., Costa, A., Hernández, M., & Rapp, B. (2010). Lexical processing in the bilingual brain: Evidence from grammatical/morphological deficits. *Aphasiology*, *24*, 262–287.

Nanousi, V., Masterson, J., Druks, J., & Atkinson, M. (2006). Interpretable vs. uninterpretable features: Evidence from six Greek-speaking agrammatic patients. *Journal of Neurolinguistics*, *19*, 209–238.

Paradis, M. (Ed.). (2001). *Manifestations of aphasia symptoms in different languages*. Oxford: Pergamon Press

Stavrakaki, S., & Kouvava, S. (2003). Functional categories in agrammatism: Evidence from Greek. *Brain and Language*, *86*, 129–141.

Tsapkini, K., Jarema, G., & Kehayia, E. (2001). Manifestations of morphological impairments in Greek aphasia: A case study. *Journal of Neurolinguistics*, *14*, 281–296.

Wenzlaff, M., & Clahsen, H. (2004). Tense and agreement in German agrammatism. *Brain and Language*, *89*, 57–68.

Yarbay Duman, T., & Bastiaanse, R. (2009). Time reference through verb inflection in Turkish agrammatic aphasia. *Brain and Language*, *108*, 30–39.

Zagona, K. (2003). Tense and anaphora: Is there a tense-specific theory of coreference. In A. Barrs (Ed.), *Anaphora: A reference guide* (pp. 140–171). Oxford: Blackwell Publishing.

Zagona, K. (in press). Tense, aspect and modality. In M. den Dikken (Ed.), *Encyclopedia of generative syntax*. Cambridge: Cambridge University Press.

APPENDIX 1

Accuracy in production and comprehension of regular ($n = 13$) and irregular ($n = 7$) past tense in English by agrammatic speakers

	Production			*Comprehension*		
	Regular past-tense (%)	*Irregular past-tense (%)*	*Prod. past-tense (%)*	*Regular past-tense (%)*	*Irregular past-tense (%)*	*Compre. past-tense (%)*
SW	9 (69.2)	0 (0)	9 (45.0)	13 (100.0)	7 (100.0)	20 (100.0)
HJ	2 (15.4)	2 (28.6)	4 (20.0)	6 (46.2)	1 (14.3)	7(35.0)
LA	11 (84.6)	6 (85.7)	17 (85.0)	10 (76.9)	7 (100.0)	17 (85.0)
MM	11 (84.6)	4 (57.1)	15 (75.0)	13 (100.0)	7 (100.0)	20 (100.0)
JK	13 (100.0)	5 (71.4)	18 (90.0)	13 (100.0)	7 (100.0)	20 (100.0)
EA	3 (23.1)	2 (28.6)	5 (25.0)	11 (84.6)	7 (100.0)	18 (90.0)
PN	1 (7.7)	4 (57.1)	5 (25.0)	6 (46.2)	3 (42.9)	9 (45.0)
JA	10 (76.9)	1 (14.3)	11 (55.0)	12 (92.3)	4 (57.1)	16 (80.0)
MW	5 (38.5)	2 (28.6)	7 (35.0)	9 (69.2)	6 (85.7)	15 (75.0)
VK	6 (46.2	3 (42.9)	9 (45.0)	7 (53.8)	4 (57.1)	11 (55.0)
HS	5 (38.5)	4 (57.1)	9 (45.0)	9 (69.2)	6 (85.7)	15 (75.0)
JN	2 (15.4)	4 (57.1)	6 (30.0)	8 (61.5)	4 (57.1)	12 (60.0)
SS	8 (61.5)	3 (42.9)	11 (55.0)	11 (84.6)	3 (42.9)	14 (70.0)
mean %	50.9	44.0	48.5	75.7	72.5	74.6

APPENDIX 2

The verb pairs used in the Test for Assessing Reference of Time (TART; Bastiaanse et al., 2008)

Examples

to read – to write the letter
Test items
to paint – to draw a square
to tear – to glue the paper
to pour – to drink the milk
to eat – to peel the apple
to push – to pull the trolley
to sharpen – to break the pencil
to knit – to sew the cloth
to empty – to fill the folder
to mop – to sweep the floor
to iron – to fold the sweater

APPENDIX 3

The actual production errors for each verb used in Swahili test

Verbs used in the test	*Verbs inflected for agreement (third person singular) and tense (present, past, future)*	*Actual errors produced*	
		Substitutions	*Omissions*
Kuchora	a**na**chora	×	×
	a**li**chora	a**na**chora	×
	a**ta**chora	a**na**chora	×
kubandika	a**na**bandika	×	×
	a**li**bandika	a**na**bandika	×
	a**ta**bandika	×	×
Kunywa	a**na**kunywa	×	×
	a**li**kunywa	a**na**kunywa	×
	a**ta**kunywa	a**na**kunywa	×
Kumenya	a**na**menya	×	×
	a**li**menya	a**na**menya	×
	a**ta**menya	×	×
Kusukuma	a**na**sukuma	×	×
	a**li**sukuma	a**na**sukuma	–sukuma
	a**ta**sukuma	×	×
Kuvunja	a**na**vunja	×	×
	a**li**vunja	a**na**vunja	×
	a**ta**vunja	×	×
Kumwaga	a**na**mwaga	×	×
	a**li**mwaga	a**na**mwaga	×
	a**ta**mwaga	×	×
Kushona	a**na**shona	×	×
	a**li**shona	a**na**shona	–shona
	a**ta**shona	×	×

(*Continued*)

APPENDIX 3

(Continued)

Verbs used in the test	*Verbs inflected for agreement (third person singular) and tense (present, past, future)*	*Actual errors produced*	
		Substitutions	*Omissions*
kurarua	a**na**rarua	×	–rarua
	a**li**rarua	a**na**rarua	×
	a**ta**rarua	×	×
Kuweka	a**na**weka	a**ta**weka	×
	a**li**weka	a**na**weka	–weka
	a**ta**weka	×	×
Kuchonga	a**na**chonga	a**ta**chonga	×
	a**li**chonga	a**na**chonga	–chonga
	a**ta**chonga	×	–chonga
Kupiga-deki	a**na**piga-deki	×	×
	a**li**piga-deki	a**na**piga-deki	×
	a**ta**piga-deki	×	×
Kukunja	a**na**kunja	a**ta**kunja	×
	a**li**kunja	a**na**kunja	–kunja
	a**ta**kunja	×	–kunja
Kupiga-pasi	a**na**piga-pasi	×	×
	a**li**piga-pasi	a**na**piga	×
	a**ta**piga-pasi	×	×
Kufagia	a**na**fagia	×	×
	a**li**fagia	a**na**fagia	–fagia
	a**ta**fagia	×	×
Kutoa	a**na**toa	×	×
	a**li**toa	a**na**toa	×
	a**ta**toa	×	×
Kufuma	a**na**fuma	×	×
	a**li**fuma	a**na**fuma	×
	a**ta**fuma	anafuma	×
Kula	a**na**kula	×	×
	a**li**kula	a**na**kula	×
	a**ta**kula	×	×
Kupaka	a**na**paka	×	×
	a**li**paka	a**na**paka	–paka
	a**ta**paka	a**na**paka	×
Kuvuta	a**na**vuta	a**ta**vuta	×
	a**li**vuta	a**na**vuta	×
	a**ta**vuta	×	×

× = no error.
There were 54 substitutions and 10 omissions.