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Using Swahili and English to test explanations of agrammatism

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Background: This study is on time reference through verbs in two Swahili-English bilingual agrammatic speakers. Recent studies in several languages have shown that time reference through verb inflection, and more specifically through tense, is impaired in agrammatic speakers. Consequently, several theories have been proposed to account for this phenomenon. We explore three kinds of theories of agrammatism that are eligible to account for these data: (1) *a deficit in Tense*; (2) *a deficit in Discourse Linking*; (3) *a Morphological-System deficit*.
Aims: The study investigated the patterns and degree of severity of time reference impairments in bilingual agrammatic speakers of Swahili and English. Production of past and future verb forms was examined in both languages to determine which of the explanations for verb inflection errors holds in bilingual agrammatic speakers.
Methods & Procedures: A sentence completion test was developed in two languages to elicit sentence constructions that refer to the past and the future. This test was administered to two bilingual agrammatic speakers of Swahili and English and three age- and education-matched control participants.
Outcomes & Results: The performance of the control participants on the two tests was perfect in both languages. Similarly, the two agrammatic speakers' performance in Swahili as well as future tense in English was at ceiling. However, both agrammatic speakers had selective deficits in the production of English past tense.
Conclusions: The discrepancy between the English and Swahili data cannot be explained by a syntactic or discourse linking theory. Only a morphological deficit in terms of number of possible candidates for a particular inflectional form fits with the data.

Keywords: Agrammatism; Syntactic deficit; Morphological deficit; Discourse linking.

Agrammatism is commonly associated with the clinical syndrome of Broca's aphasia, and traditionally defined as a disorder of language production that is characterised by simplification of grammatical structure and the omission and/or substitution

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of bound and free grammatical morphemes (e.g., Goodglass, 1968; Jarema, 1998; Marshall, 1986).

The present study focuses on verb morphology, in particular verb morphology expressing time, in two English–Swahili agrammatic speakers. Tense and time-reference have been shown to be especially vulnerable in agrammatic aphasia. We will first present some recent findings on this topic, followed by a description of verb morphology in English and Swahili. Subsequently, several morphological theories of agrammatic speech will be discussed, followed by a short summary on multilingual aphasia as it motivates our study, and the predictions made by the various theories.

TENSE AND TIME-REFERENCE PROBLEMS IN AGRAMMATIC APHASIA

In English, reference to a time-frame in which an event takes place is expressed by verb inflection: the verb is either (1) inflected for tense or (2) used in a periphrastic form, with (as in 1) or without (as in 2) temporal adverbs:

1. yesterday, he wrote a letter
2. he will read the letter.

Sentence (1) is in past tense and it refers to an event that took place in the past. In sentence (2) the finite verb is in present tense ("will") but the periphrastic form ["will read"] refers to the future. Thus, tense is a feature of the finite verb and is not always a direct indicator of the time-frame in which an event takes place.

It has been argued that tense is vulnerable in agrammatic production. The reasons that have been given differ. According to Friedmann and Grodzinsky (1997), the agrammatic syntactic tree is "pruned" at the tense node, and hence agrammatic speakers make tense errors and errors with *wh*-words and complementisers that are above the pruned site, in the CP and C' nodes respectively. This is formulated in the so-called tree pruning hypothesis (TPH), which is purely syntactic in nature: the position of tense in the syntactic tree determines the production deficit in agrammatic aphasia. Wenzlaff and Clahsen (2004, 2005) agree that tense is impaired in agrammatic aphasia, but they argue that the interpretable features of tense are underspecified. This is formulated in their tense underspecification hypothesis (TUH). There are studies that show that the TPH does not predict agrammatic production correctly. Arabatzi and Edwards (2002), Lee, Millman, and Thompson (2008), and Penke (2001, 2003) report patients who have problems with tense, yet their production of *wh*-words and complementisers is much better preserved.

However, tense plays a special role among the constituents high in the syntactic tree. CP, C', and Agreement express intrasentential relationships. Tense is different in that it has interpretable features; that is, the tense morphemes refer to a certain time-frame. The same holds for aspect. For example, past tense refers to an event in the past ("the man wrote a letter") and so does the present in perfect aspect ("the man has written a letter"). It has been demonstrated for several languages that time reference through verb forms is a problem for agrammatic speakers. What these studies also show is that it is not just a general tense problem, but that aspect plays a role as well. Nanousi, Masterson, Druks, and Atkinson (2006) and Stavrakaki and Kouvava (2003) reported data from Greek agrammatic speakers who have problems with perfective and perfect verb forms, whereas the imperfective forms are relatively spared.

Yarbay Duman and Bastiaanse (2009) showed that past tense / perfect aspect was more difficult than future tense / imperfect aspect for Turkish agrammatic speakers. These data, taken together, suggest that reference to the past is more impaired than reference to the present and future in production tasks, regardless of whether this is done through tense or through aspect, and whether this is done by tensed verbs or by periphrastic verb forms. Jonkers and De Bruijn (2009) and Bastiaanse et al. (2009) show that the problem is not restricted to agrammatic production: processing and comprehension of past-time reference through verb inflection are impaired as well and significantly worse than reference to the present and the future. This means that the cross-linguistic data show that a theory of pruned trees or a deficit in the interpretable features of tense is both too narrow and too broad. The problem of agrammatic speakers is not restricted to tense, but rather to all verb forms expressing time reference, including when it is indicated via aspect inflection and when it is indicated by periphrastic forms. Moreover, this holds true for both production and comprehension. However, this impairment is most serious for reference to the past; reference to the present and future is relatively unaffected.

The question, then, is why reference to the past is more difficult than reference to the present and future. A recent explanation has been given in Dragoy, Stowe, Bos, and Bastiaanse (2010). Reference to the present can be considered as a kind of binding relation: there is a simultaneity between the evaluation time ("speech time") and the "event time". This is a co-reference relation and can be interpreted as a "bound" reading (Zagona, 2003). When referring to the past, a relation should be established to an earlier event, where speech time and event time coincide. This implies that reference to the past is discourse-linked, rather than bound within the sentence. Reference to the future is not discourse-linked, nor bound within the sentence: a reference to a certain time point (or "event time") cannot be made, as there is no event yet.[1] This distinction between bound and discourse-linked reference has been demonstrated to be relevant in relation to aphasia. Avrutin (1999, 2000) and Grodzinsky et al. (1993) argued that individuals with Broca's aphasia have more problems with the interpretation of pronouns—which are discourse-linked—than with reflexives, which are bound within the sentence. The same holds for the comprehension of discourse-linked wh-words (*which*-questions) compared to locally bound wh-words (*who*-questions): the latter are better understood (Hickok & Avrutin, 1995; but see Thompson, Tait, Ballard, & Fix, 1999 and Edwards & Varlokosta, 2007, for data not supporting this theory). Similar findings have been reported for normal language processing: Shapiro (2000) used a cross-modal lexical priming task and showed that gap filling was slower for *which*-questions (such as "Which boy is the girl chasing ___") than for *who*-questions ("Who is the girl chasing ___").

Avrutin (2000) therefore suggests that discourse-linked relationships are hard to interpret for individuals with Broca's aphasia, because establishing the relation with extra-sentential information requires more processing load than establishing relationships within the sentence. Generalising this idea about the difference between discourse-linked and sentential relationships from comprehension to production, one expects that reference to the past is more difficult for agrammatic speakers than reference to the present or future, as reference to the past is discourse-linked and reference to the present and future is not.

[1]Note that the theoretical linguistics literature, such as Zagona (2003) considers Tense reference as anaphoric. Linguists do not take time-reference as a whole into account, but we broaden the distinction on the basis of the aphasia data so far.

Before turning to morphological accounts and the implications for verb inflection in English and Swahili, it is necessary for us to provide a description of the Swahili verb inflection paradigm.

VERBS IN SWAHILI

Swahili is one of the most widely spoken languages in the world, with somewhere between 45 and 100 million people who use it as their first or second language. For our purposes, the agglutinative nature of the Swahili verb is of particular interest. In order to be functional, to be inflected, and to be part of the sentence, a number of affixes must be added to a root which thus can never occur alone. These affixes include prefixes, infixes, and suffixes, each with their specific positions and functions. The general position scheme of these affixes in relation to the verb root is as shown in (3a). Some examples are given in (3b–d):

(3a) Pre-prefix+Subject prefix+Tense marker+Object infix+ROOT+derivation+Suffix+Post-suffix

(3b) A + li + m + pig + a
Sp + T + Oi + ROOT + d
"S/he hit him/her"

(3c) Ha + tu + ta + m + pig + a
Pp + Sp + T + Oi + ROOT + d
"We will not hit him/her"

(3d) Tu + na + pig + a + n + a
Sp + T + ROOT + d + S + Ps
"We are hitting each other"

Note that it is not possible for a verb to possess all these affixes at one and the same time.

With respect to verbs, even the usually unmarked form of the infinitive is marked in Swahili, generally by the prefix KU- attached to the verb root. The root for "to arrive" is "fika". The infinitive is "kufika".

Unlike the Nilotic languages also spoken in Kenya (e.g., Luo, Kalenjin), Swahili shares explicit morphological marking of tense with the other Bantu languages. Unlike their particularly rich tense system, however, Swahili has only three marked tenses: past, present, and future, which take different forms depending on their function. For example, the present definite tense in Swahili is primarily used to describe actions that take place at the time one is speaking. It is anchored in the present moment and has the same value as the present continuous in English (e.g., "She is singing"). Present indefinite tense describes usual or permanent actions or "scientific" truths that are not necessarily connected to the present time and is comparable to the present simple tense in English. The tense marker of the present definite, which is used in the present study, is the infix -NA-. It is placed between the affirmative subject-prefix and the verb root: "a-na-gonga" means "s/he (=a) is knocking".

There are different ways to refer to the past in Swahili. In the current study, the simple past was used. When past marks a clear rupture between the present moment and

TABLE 1
The relevant verb forms in Swahili

	Swahili	*English counterpart*
Present definite	a<u>na</u>gonga	s/he is knocking
Simple past	a<u>li</u>gonga	s/he knocked
Future	a<u>ta</u>gonga	s/he will knock

Tense inflection <u>underlined</u>.

the past, it is often accompanied by precise marks of time such as: date, day, month, year, dated event. This tense is naturally translated by the simple past in English. It is formed by insertion of the infix "li": "a-<u>li</u>-gonga": "s/he knocked". For reference to the future, future tense is used. A similar form does not exist in English, which uses a periphrastic form ["will" + infinitive]. For forming a future tense verb in Swahili, the infix "ta" is used: "a-<u>ta</u>-gonga" means "s/he will knock". The tense system is summarised in Table 1.

MORPHOLOGICAL ACCOUNTS FOR AGRAMMATIC ERRORS

Bates, Friederici, and Wulfeck (1987) presented data from a cross-linguistic study of the production of grammatical morphemes. From these data they concluded that the richer the morphology of a language, the fewer the morphological errors. This theory was supported by data presented by Bastiaanse (2009) on a study of reference to past, present, and future in English (poor morphological paradigm) and Turkish (rich inflectional paradigm). The English agrammatic speakers performed worse than the Turkish agrammatic speakers. However, both groups were selectively impaired on reference to the past, which is not predicted by the theory of Bates et al. (1987).

In the summary chapter of their volumes on agrammatic production studied in 14 languages, Menn and Obler (1990, vol. 2, p. 1385) conclude, however, that "grammatical morphemes (. . .) that are part of an extensive paradigm are likely to be wrong". They say: "The ideal test case for [their] hypothesis would be a patient who spoke two languages, one with complex paradigms and one with simple paradigms; to the extent that such a patient was clinically agrammatic in both languages with an equal degree of severity, we could expect more affix substitutions in the language with the complex systems" (vol. 2, p. 1387.) In the present study we have tested precisely such participants speaking precisely such languages.

A third account of morphological errors was given by Jones (2002). In this study of an agrammatic bidialectal speaker of African American Vernacular English (AAVE) and Standard American English (SAE), Jones demonstrated that the patient was able to flawlessly repeat the habitual "be" form in AAVE. This was surprising because the copula is reported impaired across all of the 14 language studied in the Menn and Obler (1990) volumes and, most recently, in O'Connor Wells, Obler, and Goral (2009). Jones (2002) explained her data by the fact that the form of habitual "be" is an invariant form (quite different from the highly irregular form copular lexicon takes in most languages; consider Standard American English: "be", "am", "are", "was") which permitted it to be spared. This idea predicts that invariant (verb) inflections may be relatively unaffected, whereas variant forms may be impaired.

Whereas Bates et al., Menn and Obler, and Jones make predictions on the relative number of errors different paradigmatic systems will induce in individuals with

agrammatism, Grodzinsky (1991, 1999) hypothesises on the kind of morphological errors such speakers will make in different languages. In languages where omission of a bound grammatical morpheme results in a real word, agrammatic speakers might omit these grammatical morphemes. In English, for example, omission of the third person singular "-s" results in the verb stem, which is a word: "reads" → "read". In a language like Swahili, omission of the grammatical morphemes results in a nonword: *asoma* "he reads" → **som*. In these instances, agrammatic speakers, when unable to produce the right form, will substitute another form from the same paradigm for the morpheme in question (e.g., "nasoma": I read), in order to avoid producing a non-existing word.

Before turning to the hypotheses of the present study, we will shortly address the issue of multilingualism and aphasia, because testing our hypotheses relies crucially on the fact that our speakers speak two different languages with quite different morphological systems for indicating tense and aspect.

MULTILINGUALISM IN KENYA

In Kenya, the country in which this study was conducted, the two dominant languages across the population are English and Swahili, but most Kenyans speak one of the 42 languages linguists term "ethnic languages" at home as well. English and Swahili have the same status as second languages since both are acquired around the age of 4, after native language acquisition by the majority of Kenyans. The English language is used as the official language of instruction in all educational institutions from primary school to university; it is also the language of news broadcasts, parliamentary proceedings, and business. Swahili is the national language taught as one of the subjects from kindergarten to university; it is the language of politics, business, and daily interactions of people from different ethnic backgrounds. As far as we know, there has been only one study of aphasia in a speaker of a Bantu language, the study of Traill (1970), which focused on a patient's prefixal errors in the NP concordial system.

For our purposes, the crucial findings concerning bilingual aphasia are that, for the vast majority of multilingual individuals, the patient will suffer from the same type of aphasia in all languages, and to a degree proportionate to their pre-morbid proficiency (e.g., Charlton, 1964; Karanth, Ahuja, Nagaraj, Pandit, & Shivashankar, 1991). Those interesting cases where one language recovers disproportionately to expectations, of course, form the bulk of the literature on bilingual/multilingual aphasia (for an overview, see Fabbro, 2001), but they do not apply here. Rather, it is important to note that when differential recovery is seen, the more likely language to return first is often either the language used around the time of the aphasia-producing incident or the first-learned language (Obler & Albert, 1996; Obler & Mahecha, 1991).

Because the standard pattern of deficit and recovery is parallel and proportionate to relative premorbid proficiency, in the present study we investigated agrammatic speakers of Swahili and English so that participants could serve as their own controls, permitting us to determine the differences in the manifestations of agrammatism in these two second languages with strikingly different verb morphology for tense. A factor that is regularly discussed in the psycholinguistic and neurolinguistic bilingualism literature is age of acquisition, as it appears to interact with brain processing for the different languages of the bilingual (e.g., Albert & Obler, 1978; Fabbro, 1999). In the current study both the languages under consideration are studied from about the same age as children start their schooling. Swahili is taught as a subject from kindergarten to university, whereas English is taught as a subject and is also the language of instruction of all other subjects from kindergarten to university. Therefore, if there is

a difference between proficiency levels for adults, this is likely higher in English than in Swahili.

THE CURRENT STUDY

The aim of the current study was to investigate the patterns and degree of severity of inflectionally marked time-reference impairments in agrammatic speakers of both Swahili and English. Past and future tense production were examined in both languages. The following predictions can be made on the basis of the theories mentioned above. If the underlying impairment in agrammatic production is due to a deficit of *syntactic* representation, as suggested by Friedmann and Grodzinsky (1997), then one expects the patients to have similar problems in Swahili and English; that is, general problems with tense. Since the TPH does not say anything about which time frame might be more impaired, the prediction is that past tense and the present form (*will*) of the periphrastic future form in English (e.g., *will read*) and the past and future tense in Swahili will all be equally impaired. If there is a problem with discourse linking, resulting in a problem with encoding a verb form for reference to the past, then past tense will be more difficult than the future forms in both languages.

With respect to the errors across the two languages, the morphological explanation of Bates et al. (1987) would predict equal numbers of errors in English verb forms and Swahili ones, because in each language, the morphemes for tense carry only tense information. Menn and Obler (1990) and Jones (2002), by contrast, predict more errors for English than for Swahili because tense morphemes in Swahili have only a single form, whereas in English they have several different forms. Indeed, Jones (2002) further predicts most errors in the English past verb form, as this is the only morpheme tested that has different forms (/t/, /d/, /Id/). "Will" in English, like "be" in AAVE, is a habitual form (there is hardly any inflection for this verb, except for past tense "would") and is, therefore, expected to be spared.

Apart from such quantitative predictions regarding grammatical morphology, a qualitative prediction can be made on the basis of Grodzinsky's (1991, 1999) idea that omissions will occur in a language where omission of inflection results in a word (English past tense) and substitutions will be made in languages where omissions of the inflection lead to a non-word (Swahili past and future tense).

METHOD

Participants

Three non-brain-damaged bilingual speakers of Swahili and English participated in the study as controls for the agrammatic speakers. They were two males and one female of the ages of 35, 46, and 43 years old. They all had over 12 years of education and no history of neurological disease. Their performance on the two tests was at ceiling for both languages. Since these participants match the two agrammatic speakers in age, gender, and education level obtained, it is safe to assume that the errors made by the agrammatic speakers are caused by their aphasia.

Two agrammatic speakers of Swahili and English, one woman (Participant 1) and one man (Participant 2) participated in the study. Because there are no formal aphasia tests for Swahili and the standard ones for English are culturally problematic, we considered the patients to have agrammatism based on the criteria employed in Menn and Obler (1990): they had slow, effortful speech with reduced syntactic complexity

relative to controls. For our purposes it would have been sufficient for a patient to have the reduced syntactic complexity evident in only one of the two languages tested here, but in fact both patients manifested it in both languages.

Participant 1. Participant 1 is a 43-year-old, right-handed, bilingual agrammatic speaker, who was a clerical officer at a local post office before her stroke at age 35. She had over 12 years of education. Her records from the hospital show she suffered a left hemisphere temporoparietal infarction resulting in a dense right hemiplegia with "complete motor aphasia" in all three of her languages. The patient had no prior medical history of head trauma, heart disease, diabetes, speech-language deficits, epilepsy, or psychiatric or learning disability. At the time of our testing, both her hearing and vision were normal.

She spoke English, Swahili, and Kalenjin (a Nilotic language) proficiently prior to stroke. She acquired Kalenjin, her native language, from birth. She then acquired both English and Swahili in school, starting at the age of 5. As an adult she used English at work and Swahili at home when communicating with members of her family; that is, with her husband and three children. Kalenjin she used regularly when she visited her relatives in the countryside.

After undergoing a series of physiotherapy and speech therapy sessions (the latter exclusively in English), the patient gradually began showing signs of recovery in both physical movement and speech. One year post stroke she began to speak Kalenjin (despite the fact that her therapy continued to be exclusively in English), in a telegraphic manner, but was still unable to speak English at all. She continued to undergo therapy in English for a period of 5 years before stopping, gradually recovering both English and Swahili while in therapy. She is still non-fluent, as her speech is telegraphic in all the three languages. At the time of this assessment, she had not received physiotherapy or speech therapy for 3 years and remained telegraphically non-fluent in each of her three languages.

Participant 2. Participant 2, a 38-year-old right-handed computer technician, is a non-fluent agrammatic speaker with over 16 years of education. He had a serious car accident that left him in a coma for 2 years, 15 years prior to assessment, at the age of 23. When he came out of the coma 2 years later, the right side of his body was paralysed. The patient was subsequently confined to a wheelchair for 7 years. He could not speak at all during this period, but his language comprehension seemed relatively well preserved in the three languages he used prior to the accident. He had no medical history of stroke, heart disease, diabetes, head trauma, speech-language deficits, psychiatric problems, or learning disability before the injury. His hearing and vision remained intact.

This participant's native language was Luo (a Nilotic language), but he also spoke Swahili and English before the accident. He acquired the three languages simultaneously before the age of 6. In the 2 years prior to the accident he used predominantly English, as he was a computer engineering student in a country (India) where he could only use English. He could not speak at all in any of these languages after the accident, despite undergoing regular physiotherapy and speech therapy for 7 years.

After 7 years the patient began to walk again, though with a limp, and he started to speak again in English, but his speech was telegraphic. He continued to undergo speech therapy in English for 3 more years then stopped. At the time of assessment, 15 years after the accident, the patient could communicate only in Swahili and English, but not in Luo (his native language). His speech remained severely telegraphic and included mixing Swahili and English.

Materials and procedure

A completion test was developed to elicit sentence constructions that refer to the past and the future. Each test had 40 items, 20 to elicit reference to the past and 20 to elicit reference to the future. Similar tests were used for elicitation of Swahili and English. Since time-reference was the critical issue, there was no variation in agreement: only the third person singular was elicited and only verbs with regular past tense in English were used. A list of the sentences in each language is provided in the Appendix.

In the English test, Condition 1 required the use of [verb stem + inflection] for reference to the past, while Condition 2 required the use of [auxiliary + verb stem] for reference to the future. In the Swahili test, both tense conditions required the use of [verb stem (root) + inflection]. Pictures showing actions were used to illustrate the sentences. The materials for the tests in English and Swahili were translation equivalents of each other. An example of the pictures is given in Figure 1.

The participant was always prompted with the present tense, shown by both the temporal adverb ("now" or "sasa") and the form of the finite verb. For eliciting the past and future forms, a second sentence was given, starting with a temporal adverb referring either to the past ("yesterday" or "jana") or the future ("tomorrow" or "kesho"), and the participant was encouraged to finish the sentence in a construction similar to the prompting sentence. The sentences corresponding to the picture in Figure 1 are:

English

- Now the man paints the door
- Yesterday, the man . . . (past)
- Tomorrow, the man . . . (future)

Swahili

- Sasa, huyu mwanamme anapaka rangi mlango
- Jana, huyu mwanamme . . . (past)
- Kesho, huyu mwanamme . . . (future)

Each agrammatic speaker was tested twice (individually), on different days, one language per session. For both participants, the English version was presented first. Each session for a test lasted 1 hour and was conducted in a quiet therapy room at the hospital.

Figure 1. Sample picture used in both test 1 and test 2.

At the beginning of each test the participants were told that they would hear a sentence and that they were supposed to complete a second sentence in a similar and grammatical way. There were three trial items. If the participants did not use the intended sentence during the trial items, the correct answer was provided with an explanation. This was repeated until it was clear to the examiner that the participant understood what he/she was expected to do. For the tests themselves each item consisted of three sentences: the present tense sentence was completed by the experimenter as an example for the participant in order to eliminate any confounding effect of word retrieval problems. The participant was then asked to complete the sentences in both the future and past tense by inserting the correct form of the verb. For each item, 60 seconds were allowed for a response.

If the participants requested it, the prompting sentences were repeated once. Self-corrections were allowed and the final answer was scored. The same procedure was repeated for the Swahili language test. General encouragement was provided throughout the test with no specific feedback as to the accuracy of the responses (e.g., "you are doing fine").

Scoring

Both quantitative and qualitative coding were used to analyse the data. Quantitative analysis involved tallying of the number of correct and incorrect responses, while for the qualitative analyses the most frequent errors made in both languages were classified. Responses were considered correct when the correct form of the verb inflection and auxiliary were produced with respect to reference to the past and future in English (*-ed* for simple past and *will* + verb stem for future), and the correct form of verb inflection for past and future tense were produced in Swahili (*-li-* for simple past and *-ta-* for future).

Post hoc, the following error categories were established: (1) omission of the verb inflection (2) substitution for the verb inflection.

RESULTS

Participant 1

On the English version, Participant 1 had notable difficulties with reference to the simple past in English, illustrated by a score of only 5% accuracy in past tense. Her accuracy score for the future verb forms was 100%. This is a significant difference (Fisher's exact: $p = .0001$). This shows that reference to the past is impaired in English, whereas reference to the future is intact. On the Swahili version of the test, her percentage accuracy scores in simple past tense and future tense was 100%, meaning that reference to the past is significantly better preserved in Swahili compared to English (Fisher's exact: $p = .0001$).

Qualitative analyses of the errors shows that both omissions (8/20: 40%) and substitutions (11/20: 55%) of the verb form occurred in the English past condition. Only one type of substitution error was produced: the past form [V+ed] was replaced by the present form [V+s], the form that was used in the prompting sentence. An overview of the patient's performance is given in Table 2.

TABLE 2
Performance of both participants on the Swahili and English versions of the test

		Swahili		*English*	
		Past	*Future*	*Past*	*Future*
Correct	Participant 1	20	20	1	20
	Participant 2	20	18	9	20
Omission	Participant 1	–	–	8	–
	Participant 2	–	2	2	–
Substitution	Participant 1	–	–	11	–
	Participant 2	–	–	9	–

Maximum score is 20 per category.

Participant 2

The performance of the second participant (see Table 2) is strikingly similar to that of Participant 1. His production of simple past in English is significantly worse than his production of the future verb form (9/20 (45%) correct for past; 20/20 correct for future; Fisher's exact: $p = .0001$). Just like Participant 1, Participant 2 showed a perfect performance in simple past in Swahili (100%), but he made a few errors with verbs in future tense: 18/20 (90%) correct. The difference between past and future tense is not significant (Fisher's exact; $p = .4872$). A comparison of Participant 2's accuracy in simple past in both tests shows that his performance is significantly better for past tense on the Swahili version (Fisher's exact: $p = .0001$), but that his performance on the future verb forms is similar (Fisher's exact: $p = .4872$).

In the English past conditions most errors were substitutions (9/20; 45%). Again, third person past was replaced by third person singular present. Participant 2 omitted the verb inflection twice (10%). The errors on the Swahili future condition were both omissions of the verb inflections: Participant 2 left out "ata" (where "-*a*-" is for agreement and "-*ta*-" is for tense) twice. This resulted in a verb stem, which is not a nonword but used as an imperative form.

In sum, the behaviour of the two agrammatic speakers was remarkably similar: their performance in Swahili was at ceiling; only Participant 2 made errors: two on future tense. Production of future verb forms in English was also perfect, but many errors were made on English past tense.

DISCUSSION

Although the data set of the present study is limited, a clear pattern emerged: in these two Swahili–English balanced agrammatic speakers, there was a selective deficit in the production of English past tense. Both agrammatic speakers omit the past tense "–ed" suffix or substitute present tense "-s" for it. These findings will be discussed in relation to the theories brought up in the Introduction: on (1) tense, (2) discourse linking, and (3) contrasting morphological systems. However, before addressing these issues, an alternative explanation for the results must be excluded: the explanation of the possible influence of the native language of the agrammatic participants. It is always hard to study bilingual or multilingual speakers, since it is rarely the case that a person is a fully "balanced" bilingual. The same holds for these two agrammatic speakers.

Although they learned both Swahili and English at an early age, they both acquired another language from birth; that is Kalenjin (Participant 1) and Luo (Participant 2). Might it be the case that the verb inflection structure of these native languages is similar to Swahili and therefore this verb inflection paradigm is more anchored in their language system? We do not think that this is a likely explanation for the results. As mentioned above, Swahili is a Bantu language; both Kalenjin and Luo are Nilotic languages. In Nilotic languages tense is not marked but, rather, aspect takes on its function. Moreover, in these languages, perfective and imperfective aspect are distinguished on the basis of tone, rather than on the basis of grammatical morphemes. Other Bantu languages like Swahili, by contrast, are characterised by the richness of their tense distinctions. Hence, although both Bantu and Nilotic languages have complex systems for time reference, the way of expressing them is different: aspect versus tense, tone versus grammatical morphemes (Dimmendaal, 2001). Therefore we do not think that the structure of the earliest learned language is the explanation for the participants' excellent performance in Swahili.

A deficit in tense?

Recall that the tree pruning hypothesis (TPH; Friedmann & Grodzinsky, 1997) gives a syntactic account for the problems with tense that agrammatic speakers encounter. The theory is that the representation of the syntactic tree is pruned at the position of the tense node. This account is only compatible with the present data if the authors assume different representations (syntactic trees) for the different languages within one multilingual speaker. If only one syntactic tree is assumed and the tense node is absent, then the deficit should be the same in all languages of the agrammatic speaker. Moreover, according to the TPH, the errors should be distributed randomly over the tested categories (past and future in English and Swahili) and this was not the case, neither in the present study nor in the studies of agrammatic speakers of Dutch (Bastiaanse, 2008), Greek (Nanousi et al., 2006; Stavrakaki & Kouvava, 2003), and Turkish (Yarbay Duman & Bastiaanse, 2009).

As mentioned in the introduction, Wenzlaff and Clahsen (2004, 2005) found selective deficits in tense in German agrammatic speakers. The same was reported for some of the patients studied by Burchert, Swoboda-Moll, and De Bleser (2005). In both studies it is assumed that in agrammatic production the interpretable features of tense are underspecified in patients with agrammatism. Tense inflection requires an extrasentential computation: the inflection must be checked against the time-frame to which the proposition is referring. This extra computation explains why tense is usually more difficult than agreement for agrammatic speakers: Agreement only requires intrasentential computation. However, this explanation cannot account for the specific problems with reference to the past evidenced across a number of studies; so our two remaining explanations must be considered: the discourse-linking one that considers the semantic features of verb inflection and the morphological-system complexity ones.

A deficit in discourse linking?

As mentioned in the introduction, reference to the past requires discourse linking, whereas reference to the present and future does not. As suggested by Avrutin (1999, 2000) discourse-linked elements are difficult for agrammatic speakers, since they

require extra processing load, as shown by his studies of wh-questions and free and bound anaphora. Although this account can explain the selective deficit for reference to the past by both tensed verbs and by other inflected, non-inflected and periphrastic verb forms, it is only partially supported by the current data. In these languages studied in these multilingual agrammatic speakers, reference to the past is only impaired in English. Hence there is no general problem with expressing reference to the past by verb inflection. Apparently there is another factor interfering with reference to the past and, we maintain, this factor has to do with the complexity of the morphological paradigms involved.

A morphological-system deficit?

Recall that in the Introduction we discussed several accounts of the morphological errors produced by agrammatic speakers. Although the morphological accounts appear not to account for the selective deficit for reference to the past (including past tense) that has been reported for Dutch (Bastiaanse, 2008), Greek (Stavrakaki & Kouvava, 2003), and Turkish (Yarbay Duman & Bastiaanse, 2009), it serves as the best description of the data from the Swahili–English bilingual agrammatic speakers.

First, recall the qualitative morphological account that we presented: Grodzinsky's (1991, 1999) prediction that the patterns of omission and substitutions of grammatical morphemes are dependent on the language of the agrammatic speakers. When a language allows bare stems (as in English) the agrammatic speaker will omit inflectional morphemes. When the bare stem is a nonword (e.g., in Italian or Swahili) an agrammatic speaker will substitute the inflectional morpheme, rather than producing a nonword. Thus Grodzinsky's approach would predict tense-marking omissions in English and substitutions in Swahili. However, this is not what we have found. Only two errors were made in Swahili and in both cases the tense prefix was dropped, together with the agreement prefix. Note that the suffix "a", was retained, though, resulting in an imperative form. This would be consistent with Grodzinsky's theory. However, most errors made in English were substitutions: the suffix for past tense was replaced by the suffix for third person singular present tense. Since bare stems are allowed in English, omissions were expected in English but, instead, substitutions occurred. This does not necessarily falsify Grodzinsky's hypothesis, we would note. One might argue that the agrammatic speakers could have been simply repeating the verb form used by the experimenter. In that case, Grodzinsky's hypothesis would be applicable only to non-prompted conditions.

Let us turn, then, to the first morphological-paradigms explanations we have considered. The first is the one based on Bates et al. (1987) in which the presence or omission of grammatical morphemes in agrammatism is determined by the amount of information borne in the inflectional items. According to this explanation agglutinative inflections that convey less information are more prone to errors than multi-valent synthetic ones. This theory would predict no difference between past or future verb inflection in Swahili, but that is not what we found. Also, Bates et al. (1987) predict omission errors in English, where the unmarked form is a real word (unlike in Swahili where such omissions would render words nonwords), but these do not occur less often in English. The most common error is substitution by the present tense. Therefore we do not think that the competition model is adequate for explaining the data.

Menn and Obler (1990) concluded from their extensive corpus of cross-linguistic data that grammatical morphology was least prone to errors in languages where the

paradigmatic systems are minimal. In languages with a broader range of choices within a paradigm, more errors obtain. Because Swahili has only a single invariant form for each tense marker, one would expect fewer errors in Swahili than in English past tense (because the English future-tense marker "will" is invariant, too, with only the reduced clitic contraction form /əl/ alternating with it in some varieties of English, but not Swahili.) Thus a variant on the Menn and Obler form of the morphological hypothesis, which was argued by Jones (2002), appears to work particularly well for our data. Recall that Jones found that her agrammatic bidialectal speaker of AAVE and SAE was able to flawlessly include the habitual "be" form in repeating AAVE sentences. The relatively uniform English future marker "will"—like the Swahili, past, present, and future tenses that are each marked by a sole, invariant syllable—was indeed spared in our two bilingual agrammatic speakers. The only forms that were impaired, English past-tense forms, by contrast, have differing phonetic realizations (/d/, /t/, and /Id/), and, as well, the English verb-tense system has many high-frequency irregular forms. Even though we were not testing the irregular forms in this study, it is plausible that English speakers organise past-tense forms differently from Swahili speakers, knowing that they must monitor, for each verb produced in the past, whether it takes a regular or irregular form. Similar findings have been reported before, for example, by Tsapkini, Jarema, and Kehayia (2001) who found severe problems with reference to the past in a Greek agrammatic speaker, linked, they argued, to Greek's many allomorphs designating tense and aspect.

In sum, while we have not resolved the consistent finding in much of the literature that reference to the past seems to pose particular difficulties for speakers with agrammatism, our study of two high-proficiency languages in the same individuals with agrammatism in both suggests that while Bates and her colleagues may be right that semantically packed inflections are clearly prone to sparing, inflections with complex paradigms (morphologically, phonologically, and mixing regular and irregular forms) are clearly prone to impairment.

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APPENDIX

Test items used in both tests

Yesterday, the man . . . (painted the door)
Tomorrow, the man . . . (will/shall paint the door)
Yesterday, the woman . . . (cleaned the floor)
Tomorrow, the woman . . . (will/shall clean the floor)
Yesterday, the man . . . (milked the cow)
Tomorrow, the man . . . (will/shall milk the cow)
Yesterday, the woman . . . (stirred the pot)
Tomorrow, the woman . . . (will/shall stir the pot)
Yesterday, the woman . . . (folded the cloth)
Tomorrow, the woman . . . (will/shall fold the cloth)
Yesterday, the man . . . (watered the plant)
Tomorrow, the man . . . (will/shall water the plant)
Yesterday, the boy . . . (bounced the ball)
Tomorrow, the boy . . . (will/shall bounce the ball)
Yesterday, the woman . . . (combed her hair)
Tomorrow, the woman . . . (will/shall comb her hair)
Yesterday, the man . . . (chopped the wood)
Tomorrow, the man . . . (will/shall chop the wood)
Yesterday, the woman . . . (cooked a meal)
Tomorrow, the woman . . . (will/shall cook a meal)
Yesterday, the man . . . (ploughed the field)
Tomorrow, the man . . . (will/shall plough the field)
Yesterday, the woman . . . (cycled down the road)
Tomorrow, the woman . . . (will/shall cycle down the road)
Yesterday, the doctor . . . (injected the patient)
Tomorrow, the doctor . . . (will/shall inject the patient)
Yesterday, the man . . . (picked the plant)
Tomorrow, the man . . . (will/shall pick the plant)
Yesterday, the man . . . (pumped water)
Tomorrow, the man . . . (will/shall pump water)
Yesterday, the man . . . (greeted the woman)
Tomorrow, the man . . . (will/shall greet the woman)
Yesterday, the boy . . . (climbed the tree)
Tomorrow, the boy . . . (will/shall climb the tree)

Yesterday, the woman . . . (walked to the car)
Tomorrow, the woman . . . (will/shall walk to the car)
Yesterday, the man . . . (jumped over the ditch)
Tomorrow, the man . . . (will/shall jump over the ditch)
Yesterday, the woman . . . (ironed the cloth)
Tomorrow, the woman . . . (will/shall iron the cloth)