Characteristics of Swahili–English bilingual agrammatic spontaneous speech and the consequences for understanding agrammatic aphasia

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ABSTRACT

Most studies on spontaneous speech of individuals with agrammatism have focused almost exclusively on monolingual individuals. There is hardly any previous research on bilinguals, especially of structurally different languages; and none on characterization of agrammatism in Swahili. The current study identifies the features of Swahili agrammatic narrative and spontaneous speech, and compares the use of verb inflections for tense and time reference in English and Swahili in six bilingual agrammatic speakers and 12 non-brain-damaged speakers matched on age, native language and education level to the agrammatic speakers. The results show a remarkable similarity between the agrammatic phenomena in both languages on the typical agrammatic features: utterance length and speech rate are reduced and the proportion of grammatical sentences and complex sentences is lower than normal. Analysis of verb inflection demonstrates that there are no qualitative differences between the Swahili and English samples: in both languages reference to the past is more impaired than reference to the present. However, the use of verb inflections in general is better preserved in Swahili than English. English verb inflections are frequently omitted, whereas Swahili verb inflections are substituted.

The implications of these findings for theories on agrammatism are discussed.

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1. Introduction

In the neurolinguistic literature, several studies report how agrammatism manifests itself in the spontaneous speech of individuals with Broca’s aphasia (see for English: Menn & Obler, 1990; Saffran, Berndt, & Schwartz, 1989; Thompson, 2003; for Dutch: Bastiaanse & Jonkers, 1998; for Italian: Miceli, Mazzuccini, Menn, & Goodglass, 1983; Rossi & Bastiaanse, 2008; for Indonesian: Anjarningsih, Haryadi-Soebadi, Gofir & Bastiaanse, in press; Anjarningsih & Bastiaanse, 2011). An overview of the findings of these studies consistently reveals a pattern of linguistic deficits: slow, halting, labored, non-fluent, telegraphic speech with omissions and/or substitutions of bound and free grammatical morphemes, while comprehension is relatively spared. The usage of verb morphology is impaired: verb inflections are often omitted or substituted and non-finite verbs are overused (Bastiaanse, Hugen, Kos, & Van Zonneveld, 2002; Saffran et al., 1989). While this body of research has contributed substantially to our understanding of the spontaneous speech of aphasics, it has focused almost exclusively on monolingual individuals; there is hardly any previous research on bilinguals, especially of structurally different languages. The current study focuses on agrammatism in bilingual speakers of Swahili and English, two languages which possess contrasting morphological and syntactic properties. Considering that languages differ largely in terms of grammatical morphology, the same underlying deficit may cause different surface manifestations in the different languages of a bilingual (Paradis, 1988). Given this assumption, the aim of the current study is three-fold. First, we would like determine whether there are similarities or differences in English speech production in monolingual and bilingual aphasic speakers. This will determine whether the analysis of spontaneous speech in languages for which aphasia tests are not available is sufficient to identify agrammatism. Second, we want to identify the features of Swahili agrammatic speech and compare them with those of English agrammatic speech. The final goal is to compare the agrammatic speakers’ production of verb morphology and tense reference in both Swahili and English. As these languages differ significantly in their morpho-syntax, these data provide a valuable site for testing the claim that reference to the past is impaired. We will determine whether reference to the past is impaired as has been shown in several experimental studies.

We start by giving some background on cross-linguistic variation in aphasia symptoms. Next, we provide a brief overview of bilingual aphasia. This will be followed by a neurolinguistic characterization of agrammatic speech and an introduction to relevant features of Swahili. We conclude by providing the research questions and expectations of the current study.

1.1. Cross-linguistic variations in aphasia symptoms

Aphasia research across languages has led to some important assumptions concerning the language-specific factors that influence how the same underlying deficit may cause different surface manifestations of agrammatism in different languages. Such factors are related to linguistic complexity, the semantic importance of a morpheme, and to whether or not uninflfected forms are permitted. Menn and Obler (1990) presented data from a cross-linguistic study on agrammatic production in 14 different languages. Their key findings are that grammatical morphemes such as plural endings, past-tense endings, and auxiliary verbs are generally prone to errors. Free grammatical morphemes tend to be omitted, whereas bound grammatical morphemes are substituted in agrammatic production. In a language such as English, agrammatic speakers tend to omit word endings such as markers of plural, past tense, and verb 3rd person singular. However, in a language like Italian where every noun, verb, adjective has an ending, agrammatic speakers tend to make substitution errors rather than omission errors. They concluded that the presence or omission of grammatical morphemes is determined by their semantic importance; and that grammatical morphemes which are part of an extensive paradigm are likely to be prone to more errors. Grodzinsky’s (1991, 1999) and Paradis’ (1995), however, argue that grammatical deficits in aphasia, specifically the omission and/or substitution of grammatical morphemes that characterize agrammatism, depend on the structure of each language. In languages where omission of bound grammatical morphemes results in a word (as in the case of English, for instance ‘-ed’ in picked), agrammatic speakers are likely to omit the grammatical morphemes, whereas in languages where bound grammatical morphemes results in a non-word the agrammatic speakers...
are likely to substitute the morpheme with another (as in Swahili for instance, ‘ku’ and ‘-a’ in ‘ku-pig-a’ ‘to hit’, ‘pig’ is a non-word in Swahili). In other words, the manifestation of grammatical errors depends on whether or not the uninfllected forms are permitted. Fabbro (2001) proposes that the nature of agrammatism has a universal character and follows the rule whereby aphasia impairs all grammatical aspects of a language, even if at varying degrees of severity.

1.2. Bilingual aphasia

The term ‘bilingual’ has been used in this study to refer to all those people who use two or more languages or dialects in their everyday lives (Grosjean, 1994). Presently, most work on bilingualism and multilingualism suggests that more than half the world population is bilingual or multilingual, and that the vast majority of bilingual aphasic individuals suffer from the same type of aphasia in all their languages mastered pre-morbidly (for example, Charlton, 1964; De Diego-Balaguer, Costa, Sebastián-Gallés, Juncadella, & Caramazza, 2004; Fabbro, 2001; Farooqi-Shah & Waked, 2010; Knoph, 2011). The most relevant issue in bilingual aphasia concerns differences in the pattern of recovery across the languages mastered by the bilingual speakers (see Fabbro, 2001; Paradis, 2001). The common pattern of recovery following the aphasia incident is parallel recovery where all languages of a bilingual are equally affected, and recovery is similar. Should there be a difference in recovery; the difference may only reflect a difference in premorbid proficiency level between the languages mastered. Another pattern is differential recovery where the language likely to return first is either one learnt first, or used most frequently prior to the insult (Albert & Obler, 1978). In our case, the bilinguals in this study acquired English and Swahili early (from around the age of four), and were pre-morbidly highly proficient in all their languages.

With respect to manifestations of aphasia across the languages of a bilingual individual, Paradis (1988) argues that in languages which differ largely in grammatical morphology, the same underlying deficit may cause different surface manifestations. Some recent studies show that the rich morphology of one language may be better preserved than the poor morphology of the other language. Knoph (2011), for example, found the complex Farsi morphology better preserved than the comparatively simpler Norwegian morphology in a Farsi–Norwegian bilingual agrammatic speaker, pre-morbidly proficient in both Farsi and Norwegian. Alexiadou and Stavrakaki (2006) and Abuom, Obler, and Bastiaanse (2011) showed the same pattern for pre-morbidly proficient Greek–English and Swahili–English bilingual agrammatic speakers respectively: the more complex the morphological paradigm, the better it is preserved.

One should keep in mind, however, that morphologically rich paradigms are usually more regular than morphologically simple paradigms. It may thus be the case that it is not a matter of complexity but rather of regularity (Goral, 2011). Bybee (2007) proposes two morphological processes in relation to morphologically rich and complex paradigms: the regular morphological process, which is affixal and often agglutinative in nature; and the irregular morphological process, which often involves changes in the stem or high degree of fusion between stem and affix. Regularity is associated with affixation, whereas irregularity is associated with internal stem change. While affixation has been claimed to be more ‘natural’ and highly frequent in most languages, and hence easier to process in general, internal stem changes (irregularity) are considered less ‘natural’, lexically arbitrary and of low type frequency, and hence more difficult to master (Bybee, 2007; Dressler, 1985). In situations of linguistic limitations, such as in children with SLI, bilinguals with (L1) attrition (language loss) and individuals with aphasia, high-frequency linguistic items have been found to be resistant to dissolution and are preferred in oral expression (see Centeno & Anderson, 2011).

1.3. The syntactic, lexical and morphological deficits in agrammatic aphasia

The spontaneous speech of agrammatic speakers is non-fluent. At the syntactic level, agrammatic speech is characterized by short and/or fragmentary utterances with frequent omissions of function words, such as prepositions, pronouns, articles, particles, conjunctions, and determiners (Menn & Obler, 1990). As a result, significantly fewer words are produced per utterance, generally expressed by a shorter Mean Length of Utterance (MLU: see Rossi and Bastiaanse, 2008; Sanchez, 1996;
Thompson, Shapiro, Li, & Schendel, 1995; Vermeulen, Bastiaanse, & Van Wageningen, 1989). Furthermore, a close scrutiny of the structural quality of the agrammatic productions in previous studies reveals two prominent features: the limited use of embeddings in sentences and the production of large proportions of ungrammatical sentences (Bastiaanse et al., 2002; Saffran et al., 1989). Moreover, a clear preference for shorter sentences with verbs with fewer internal arguments than normal has also been found (see Bastiaanse & Jonkers, 1998; Rossi & Bastiaanse, 2008; Thompson, Lange, Schneider, & Shapiro, 1997).

At the lexical level, it has been reported that nouns are produced to a normal extent, but fewer verbs and/or a lower diversity than normal are produced (e.g. Bastiaanse & Jonkers, 1998; Menn & Ober, 1990; Saffran et al., 1989). However, Lorch (1990) found that the production of verbs and verb types was spared in some of the agrammatic speakers in their cross-linguistic study of Hindi, Icelandic and Finnish, while Crepaldi et al. (2011) did not report a noun–verb dissociation in Italian agrammatic speech. There are also reports of a normal use of verbs in Indonesian agrammatic spontaneous speech (Anjarningsih et al., in press), but Indonesian is a language without verb inflection for tense and agreement, which may explain these results.

At the morphological level, the problems are clearly visible in verb inflection: the proportion of inflected verbs is low (Saffran et al., 1989; Thompson et al., 1995), although this inflectional problem may be restricted to finite verbs, that is, verbs that are inflected for Tense, Aspect and Agreement and excluding participles or gerunds (Bastiaanse et al., 2002).

Experimental data show that not all verb inflections (Tense, Agreement, Aspect, Mood) are equally vulnerable. According to Friedmann and Grodzinsky (1997) and Wenzlaff and Clahsen (2004), agreement inflection is spared but tense inflection is impaired. Clahsen and Ali (2009) showed that Mood is spared and Nanousi, Masterson, Druks, and Atkinson (2006) showed that in Greek Aspect is impaired, whereas Tense and Agreement are relatively spared. And recently, our group reported for several languages that it is particularly reference to the past, by Tense and Aspect, that is impaired in agrammatism (Abuom et al., 2011, for English; Bastiaanse, 2008; Jonkers & de Bruin, 2009, for Dutch; Bastiaanse et al., 2011, for Chinese, English and Turkish; Yarbay Duman & Bastiaanse, 2009 for Turkish).

Little is known about reference to the past in agrammatic spontaneous speech; however, a few studies specifically mention problems with the time reference of verb inflection. Simonsen and Lind (2002) described a Norwegian agrammatic speaker who used very few verbs and hardly any past-tense forms in his spontaneous speech. Similarly, Stavrakaki and Kouvava (2003) reported on two agrammatic Greek speakers who have problems producing verb forms with perfect aspect. Beeke, Wilkinson, and Maxim (2003) analyzed the conversation data of a monolingual agrammatic speaker of English who, they report, frequently produced either a present tense verb or an infinitive in place of a future tense verb or past-tense verb. Note that both past-tense verbs and perfect aspect verbs refer to events taking place or performed in the past.

These data underlie the Past Discourse Linking Hypothesis (PADILIH). This hypothesis is based on Avrutin’s (2000, 2006) idea that linking at the discourse level is done by ‘discourse syntax’ and linking at the sentence level is done by ‘narrow syntax’. According to Avrutin (2000, 2006) processing by discourse syntax is difficult for individuals with agrammatic speakers compared to processing by narrow syntax. Discourse linking requires more processing resources which agrammatic individuals lack. According to Zagona (2003), present tense is locally bound (or in Avrutin’s terminology, is processed by ‘narrow syntax’), since the time of the event and the time of speaking coincide. Past tense, however, is discourse linked (in Avrutin’s terminology, is processed by ‘discourse syntax’). Bastiaanse et al. (2011) modified Zagona’s (2003) theory and state that it is not past tense that requires discourse linking, but all verb forms that refer to the past, including, for example, the present perfect. For instance, In a sentence such as ‘the boy has written a letter’; the event took place in the past, although ‘has’ is present tense. The PADILIH, thus, predicts that Kenyan bilingual agrammatic speakers will have more problems producing verb forms referring to the past than verb forms referring to the future.

1.4. Relevant features of Swahili

Swahili is a Bantu language, highly agglutinative and classified as an SVO language (Ashton, 1982). It is widely spoken in most African countries, including Kenya where this study was conducted. Kenya is...
a multilingual society with an average person speaking at least three languages. The two most dominant languages across the population are Swahili and English, but most Kenyans speak one of the 42 languages linguists term “ethnic languages” at home as well. Each of the 42 languages is classified either as Bantu, Nilotic, or Cushitic. Swahili and English 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. 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. English 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. Therefore, an adult with over 12 years of uninterrupted education in Kenya is generally expected to be equally highly proficient in both languages.

Swahili has a fixed word order (SVO) at the sentence level, where the subject precedes the verb and the object (see 1). Within constituent phrases, modifiers follow the head. Therefore adjectives, pronouns, determiners etc., follow the nouns they modify while adverbs come after the verb. As in English, Swahili clause structure generally consists of a subject and a predicate. The subject always precedes the predicate (Mohammed, 2001). Swahili has three different types of sentences: a simple sentence that consists of a single clause; a complex sentence that consists of one main clause and at least one subordinate clause which obligatorily follows the main clause, and a compound sentence that consists of at least two main clauses joined by a coordinating conjunction. However, the most distinguishing feature of Swahili is its verbal system.

(1) Mama a-li-m-piga kijana
Mother she-Past-him-hit boy
“The mother hit the boy”

The Swahili verbal system is distinctly more complex than that of English, consisting of numerous affixes, both inflectional and derivational morphemes, attached to the verb root. These affixes (prefixes, infixes and suffixes) occupy specific positions and perform specific functions. The general position scheme of the affixes in relation to the verb root is shown in (2a). Some illustrations from Abuom et al. (2011) are given in (2b–d).

(2a) Pre-prefix (Pp) + Subject prefix (Sp) + Tense marker (T) + Object infix (Oi) + ROOT + derivation (d) + Suffix (s) + Post-suffix (Ps).

(2b) A + li + m + pig + a
Sp + T + Oi + ROOT + d
“S/he hit him/her”

(2c) Ha + tu + ta + m + pig + a
Pp + Sp + T + Oi + ROOT + d
“We will not hit him/her”

(2d) Tu + na + pig + a + n + a
Sp + T + ROOT + d + S + Ps
“We are hitting each other”

A Swahili verb complex, due to its agglutinative feature unlike that of English, can function as a complete sentence as illustrated in (2b–d). In the verbal complex, the subject prefix (subject–verb agreement), the tense marker (includes tense and aspect) and the verb root are generally obligatory in every grammatical Swahili sentences. Both the subject prefix and object infix must agree in number with subject and object of the sentence respectively, for instance in (1). Tense and aspect inflections are critical to time reference in Swahili. As illustrated in (2b–d), Swahili has three marked tenses: past, present and future. The past tense marked by ‘li’ describes a past activity without reference to a specific
time as in (2b). The future tense marked by ‘*tu*’ describes events predicted to follow the present time as in (2c). English, on the contrary, has no verb inflection for future tense. The Swahili present tense is marked by either ‘*a*-’ or ‘*na*-’; both can be used interchangeably to describe actions that take place at the time one is speaking as in (2d).

Other inflections that are considered to be ‘neutral’ tense markers are the infinitive, which is generally marked by the prefix ‘*ku*’ attached to verb root, and the narrative or consecutive marker ‘*ka*’, which generally express an action or state which follows another action as in (2e). For aspect in Swahili, the present perfect marker ‘*me*-’ is also frequently used to describe a past activity which has relevance to the present time and is comparable to the present perfect in English as in (2e).

(2e) A-*me*-ruka chini a-*ku*-kimbia ku-cheza mpira
He-Pres.perf.-jump down he-Cons.-ran off INF.-play football

“He has jumped down, he (then) ran off to play football”

Other types of verbs are the copulas and auxiliaries. Copulas in Swahili, as in English, are known to have little independent meaning, and mainly function to relate sentential elements of clause structure especially subject and complement (3a). Just like in English, Swahili modal verbs accompany lexical verbs (3b), but, unlike in English, Swahili modal verbs are inflected for Agreement. Auxiliaries such as ‘to have’ and ‘to be’ that are used in combination with a participle, do not exist in Swahili.

3a) Kenya ni nchi kubwa
Kenya is country big

“Kenya is a big country”

3b) mgonjwa a-na-weza kunywa maziwa
patient he-Pres.-can drink milk

“The patient can drink milk”

1.5. The research questions and expectations

The current study contributes to aphasiology as a field of research in two ways: Firstly, it provides further evidence of features of agrammatism from a previously undescribed language; secondly, it gives an insight into the patterns of manifestation of agrammatism in bilingual individuals speaking two structurally different languages. This has been achieved by addressing three main research questions:

1. Are there similarities or differences in the English speech production of monolingual and bilingual aphasic speakers?
2. What are the features of Swahili agrammatism? Are they comparable with those of English agrammatism?
3. What are the agrammatic speakers’ patterns of production of verb morphology for tense, and time reference in Swahili and in English? Are verb forms referring to the past impaired?

First, we compared the English samples of narrative speech of Kenyan bilingual agrammatic speakers with those of monolingual American agrammatic speakers from Thompson, Choy, Holland, and Cole (2010). This was done to determine whether the analysis of spontaneous speech in languages for which aphasia tests are not available is sufficient to identify agrammatism. We expected similar manifestation of agrammatism in English language between the two groups irrespective of number of languages mastered pre-morbidly.

To answer the second question on features of Swahili agrammatism, the Swahili and English samples of the bilingual Kenyan agrammatic speakers were analyzed on a number of variables that are relevant to quantify agrammatic aphasia: the mean length of utterances (MLU), speech rate (words per minute), number and diversity of nouns and verbs, the use of copulas and auxiliaries, and the
percentages of ungrammatical and embedded sentences. We first made comparisons between samples of agrammatic speech and those of non-brain-damaged speakers in Swahili and English. We expected differences between the two groups on each of these variables. We then compared the agrammatic performance on these variables between Swahili and English. If the underlying disorder is the same in both languages, which is likely because we compared within individuals (Fabbro, 2001; Faroqi-Shah & Waked, 2010), it was expected that the reduction in utterance length and the delay in speech rate, as well as the degree in which nouns and verbs are produced would be similar in both languages. Also, we expected the agrammatic speakers to produce more ungrammatical sentences and fewer embedded sentences than non-brain-damaged control speakers in both languages.

The final question is how the bilingual agrammatic speakers perform on a variable that is fundamentally different in the two languages. Comparisons were made between the use of verb inflections and time reference morphology. Abuom et al. (2011) showed that, on a production experiment with two bilingual English–Swahili agrammatic speakers, verb inflection was better preserved for Swahili than for English. It was argued that this was caused by the fact that verb inflection is more anchored into the system in Swahili, with its very rich verb inflection paradigm for tense and agreement. In English, the tense and agreement paradigm is poor (restricted to -s, -ed), sometimes irregular and less anchored in the system and, therefore, more vulnerable. Hence, we predict that production of finite verbs (those verb forms that are inflected for tense and agreement) will be relatively spared in Swahili (cf. Goral, 2011). It has also been reported that agrammatic speakers produce fewer verb forms referring to the past than non-brain-damaged speakers, in spontaneous speech data (Simonsen & Lind, 2002; Stavrakaki & Kouvava, 2003), conversation data (Beeke et al., 2003) and experimental data (Bastiaanse, 2008; Bastiaanse et al., 2011; Faroqi-Shah & Dickey, 2009). We, therefore, predict that production of verb forms referring to the past will be reduced, whereas production of present verb forms will be relatively spared. However, as mentioned, in Abuom et al.’s (2011) experiment, the two bilingual English Swahili agrammatic individuals showed intact production of past tense in Swahili, but not in English. This relatively better preservation of verb forms referring to the past in Swahili may be reflected in spontaneous speech. Substitutions of verb inflections are expected to occur in Swahili, whereas omissions are expected in English (Grodzinsky, 1991, 1999; Paradis, 1995).

2. Methods and procedures

2.1. Participants

The participants recruited for this study include 6 non-fluent aphasic/agrammatic speakers and 12 non-brain-damaged speakers (NBDs). Each participant spoke either Bantu or Nilotic language as native language, but all spoke English and Swahili as second languages. They were matched on age, native language, and education (a minimum of O-Level qualification, equivalent to high school diploma). In the Kenyan school system, these are graduates who have gone through kindergarten, elementary (primary school) and high school tiers of the education system, which means 12 years of uninterrupted exposure to English and Swahili. The agrammatic speakers were, therefore, pre-morbidly highly proficient in the two second languages. All participants were right-handed and without a history of psychiatric or developmental speech or language disorders or any other neurological conditions.

The aphasic speech produced was judged as ‘telegraphic’ by a speech therapist: it was perceived as being slow and effortful with short phrases consisting of mainly content words. Unfortunately, in Kenya there are no tests available to establish the aphasia syndrome. However, all agrammatic speakers had good comprehension in both languages on an adapted version of the subtask for auditory comprehension of single words (nouns, verbs, colors, shapes, letters, numbers) from the Boston Diagnostic Aphasia Examination word comprehension test (Goodglass & Kaplan, 1972). A few pictures of this task were substituted, because some items were unknown in Kenya and, hence, no Swahili word was available (for example, a hammock was changed to a swing). It is however important to note that the BDAE cannot be used to classify the aphasia type in Kenya because of its cultural bias. The demographic details of the participants and their scores on the BDAE subtest for auditory word comprehension are shown in Table 1.
2.2. Materials

For elicitation of narrative speech, the methods of Olness (2006) were used. Two pictures have been used, the Pulitzer Prize winning photograph by Annie Wells of a girl being rescued from the water by a fireman and the cookie theft picture from the BDAE (Goodglass & Kaplan, 1972). The participant was first asked to describe the picture and then to make a story around it with a beginning, a middle and an end. Olness (2006) showed that when aphasic speakers are asked to tell a story rather than to describe a picture, more variation in verb forms occurs. Since our main interest was in the use of verbs and verb inflection for time reference, this seemed to be an appropriate method. Additionally, a spontaneous speech interview was held with one question asking for information from the past and one for information in daily life. The questions were:

The flood rescue and the cookie theft
(a) Can you tell me what is happening in this picture?
(b) Can you create a story with the beginning, the middle and the end about what happened in the picture?

Spontaneous speech
Reference to the past:
(a) Can you tell me about how your speech problems started (agrammatic speakers)/about your last illness (for NBDs)?
Reference to the present:
(b) Can you tell me about your current work/hobbies?

2.3. Procedures

Recording sessions were held in a quiet setting for each of the participants using a digital audio recorder. For the agrammatic speakers, the interviews in English and Swahili were done on different
days, for the NBDs at different times on the same day. To avoid code switching during recording sessions, the participants were explicitly asked to speak only Swahili or only English. The experimenter was very cautious to use only one language without intrusions from the other. Half of the participants were first tested in English, half first in Swahili.

The order of the elicitation was similar for each participant: first the ‘flood rescue’ picture, followed by the ‘cookie theft’. The interview was done last. The questions were always in the same order, that is, the order given above. From each participant all the data were recorded and orthographically transcribed in English and Swahili.

For each question, the participants were encouraged to say as much as possible. All the audio-recorded samples were orthographically transcribed verbatim. The sparse number of intrusions from the other language was ignored. After transcription the samples were segmented into utterances. Each utterance was considered a ‘sentence’ based on Hartmann and Stork’s (1972) definition of a clause as a grammatical unit that includes, at the minimum, a predicate and an explicit or implied subject and expresses a proposition.

2.4. Analysis

300 Words is a reliable sample size for spontaneous speech analysis for languages like English, Italian and Dutch (see Brookshire & Nicholas, 1994). However, Swahili, unlike English, is a highly agglutinative language and much information that is expressed in single words in English is expressed by suffixes in Swahili. Therefore, a comparison of samples of the same size would be inappropriate. A first analysis of both the agrammatic and NBD samples showed that for speech rate and MLU the ratio of English and Swahili is around 3:2, meaning that the information conveyed in 300 words in English is given in around 200 words of Swahili. Therefore, 200 words of the Swahili samples were analyzed.

To determine whether speech which was characterized as ‘agrammatic’ for English in bilingual participants by the SLTs was similar to agrammatic speech of monolingual speakers of English, a comparison was made between the American English agrammatic data of eleven monolingual speakers from Thompson et al. (2010) and the Kenyan–English samples. The following variables were analyzed:

- speech rate (number of words produced per minute)
- mean length of utterances (total number of words divided by the number of utterances).
- noun-to-verb ratio
- percentage grammatical sentences

Subsequently, the English and Swahili samples were then compared on the following variables:

- mean length of utterances and speech rate
- number and diversity of nouns and verbs and number of copulas and (modal) auxiliaries
- percentage grammatical sentences and proportion of embedded/complex sentences

Finally, for the analysis of verb inflection and time reference through verb forms, we analyzed:

- number of verb inflections for tense and agreement on the lexical verbs
- time reference through verb inflection (number of verb forms referring to the present and the past, including copulas, auxiliaries and modals, taking both tense and aspect into account1)

We ensured a balanced representation of all the questions by extracting an equal number of words from every section (flood rescue, cookie theft, interview). For statistical analysis, we used non-

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1 For both languages, present tense-imperfective aspect (for English, for example, ‘writes’ and ‘is writing’) was taken as referring to the present and past tense-imperfective aspect, present tense-perfect aspect or past tense-perfect aspect (for English: ‘wrote’, ‘has written’, ‘has been writing’, ‘was writing’, respectively) was considered to be reference to the past.
parametric tests (Mann–Whitney U test was used for between-group comparisons) because of the small group sizes.

2.4.1. Transcription procedure and the inter-transcriber reliability

All collected spontaneous speech samples were orthographically transcribed verbatim and then segmented into utterances using prosodic features as well as syntactic structure to determine utterance boundaries, and analyzed for lexical, morphological, and structural measures. Minor utterances (e.g., ‘yes it is’, ‘no it isn’t’ for English, ‘sawa sawa’, ‘ndio’ in Swahili), voiced and unvoiced starters, repetitions of words or sentence chunks, non-meaningful words, and fillers or interjections were excluded. For analysis (300 words for English and 200 words for Swahili), the focus was on clauses that contained a verb: utterances containing verb, copula, modal, or auxiliary were analyzed. Initial transcription and segmentation was done by a student of clinical linguistics, a bilingual speaker of Swahili and English, who was trained on this method of analysis. The transcriptions and segmentations were checked for reliability by a second transcriber, the first author (TA), also a bilingual speaker of Swahili and English, and verified by the second author (RB) for English. The same procedure was used for the analysis. The results of the two raters were compared and the disagreements were resolved.

3. Results

3.1. Comparison of the Kenyan–English samples with those of American English agrammatism

Since we had no test data that characterized Broca’s aphasia, agrammatism in Kenyan English, we compared the English agrammatic data with the pre-treatment data of eleven American agrammatic speakers from Thompson et al. (2010). As can be seen from Table 2, the mean scores are very similar and so are the ranges. The Kenyan–English aphasic speakers talk slowly, in short and simplified sentences which are often incomplete and/or ungrammatical. We, therefore, consider these samples as typically agrammatic. This, in combination with the well-preserved comprehension of single words, justifies the assumption these agrammatic speakers suffer from Broca’s aphasia, at least in English. In the next sections, we will compare their data for both English and Swahili.

<table>
<thead>
<tr>
<th></th>
<th>Kenyan–English agrammatic</th>
<th>American English agrammatic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>MLU</td>
<td>6.02</td>
<td>2.9–7.7</td>
</tr>
<tr>
<td>Words/minute</td>
<td>51.5</td>
<td>14–70</td>
</tr>
<tr>
<td>Noun–verb ratio</td>
<td>1.52</td>
<td>0.82–1.63</td>
</tr>
<tr>
<td>% Grammatical sentences</td>
<td>49.5</td>
<td>13–65</td>
</tr>
</tbody>
</table>

3.2. Comparison of the English and Swahili samples of the agrammatic and non-brain-damaged speakers

3.2.1. Mean length of utterances and speech rate

The results reveal a serious fluency reduction in the agrammatic speakers. Their speech rate is low and the utterance length is considerably reduced (see Table 3). The differences between the NBD and agrammatic group were significant for both MLU (for English: \( z = -3.37, p < .001 \), for Swahili: \( z = -3.37, p < .001 \)) and speech rate (for English: \( z = -3.37, p < .001 \), for Swahili: \( z = -3.37, p < .001 \)). In fact, for both variables and in both languages, each of the agrammatic speakers scores outside the normal range. The data reveal that the agrammatic speakers performed very similar in both languages: their MLU was 60.4% of that of NBDs in both English and Swahili and their speech rate was reduced with 61.1% in English and 58.5% in Swahili. The corresponding patterns evident in the two languages...
confirm that the brain-damaged participants had a quantitatively and qualitatively similar aphasia in both languages.

3.2.2. Nouns, verbs, copulas and auxiliaries

The analysis of the noun and verb production showed that the agrammatic speakers fell within the normal range in both English and Swahili with only a few exceptions. There were no significant differences between the groups: noun tokens (for English: $z = -0.33$, $p > 0.05$, for Swahili: $z = -0.56$, $p > 0.05$); noun diversity (for English: $z = -0.7$, $p > 0.05$, for Swahili: $z = -0.37$, $p > 0.05$); verb tokens (for English: $z = -0.28$, $p > 0.05$, for Swahili: $z = -0.56$, $p > 0.05$); verb diversity (for English: $z = -0.23$, $p > 0.05$, for Swahili: $z = -0.14$, $p > 0.05$); copulas (for English: $z = -0.52$, $p > 0.05$, for Swahili: $z = -0.66$, $p > 0.05$); and auxiliaries (for English: $z = -0.09$, $p > 0.05$, for Swahili: $z = -0.9$, $p > 0.05$). Some individual agrammatic speakers showed behavior outside the normal range: EA overused nouns in the English sample and produced a reduced number of copulas and auxiliaries in both English and Swahili. MM’s use of auxiliaries was outside the normal range in Swahili. Overall, the production of nouns, verbs, copulas and auxiliaries was quite normal, however.

It can also be seen from Table 4 that the number of nouns and verbs is very similar in English and Swahili and comparable between the two groups (except that the mean number of nouns in the agrammatic group is a bit higher for the agrammatic speakers when speaking English, due to the large number of nouns produced by EA). This is interesting, because the English sample size was 300 words and the Swahili sample size 200 words. It shows that, as expected, in English many more function words are used than in Swahili, the latter being a far more agglutinative language. This not only holds for the NBDs, but also for the agrammatic speakers, who are supposed to be poor in the production of function words.

### Table 3
The comparison of the mean length of utterances (MLU) and speech rate (words per minute).

<table>
<thead>
<tr>
<th>Languages</th>
<th>MLU</th>
<th>Speech rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA</td>
<td>7.692</td>
<td>70</td>
</tr>
<tr>
<td>MM</td>
<td>6.818</td>
<td>63</td>
</tr>
<tr>
<td>EA</td>
<td>2.941</td>
<td>14</td>
</tr>
<tr>
<td>HJ</td>
<td>5.172</td>
<td>46</td>
</tr>
<tr>
<td>JK</td>
<td>6.977</td>
<td>61</td>
</tr>
<tr>
<td>SW</td>
<td>6.522</td>
<td>55</td>
</tr>
<tr>
<td>NBDs’ range</td>
<td>8.11–10.71</td>
<td>119–140</td>
</tr>
<tr>
<td>Swahili</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA</td>
<td>4.255</td>
<td>65</td>
</tr>
<tr>
<td>MM</td>
<td>4.082</td>
<td>40</td>
</tr>
<tr>
<td>EA</td>
<td>2.778</td>
<td>9</td>
</tr>
<tr>
<td>HJ</td>
<td>3.636</td>
<td>50</td>
</tr>
<tr>
<td>JK</td>
<td>4.348</td>
<td>56</td>
</tr>
<tr>
<td>SW</td>
<td>3.846</td>
<td>60</td>
</tr>
<tr>
<td>NBDs’ range</td>
<td>5.41–7.14</td>
<td>75–100</td>
</tr>
</tbody>
</table>

### Table 4
The comparison of noun and verb production between the agrammatic and non-brain-damaged speakers in English and Swahili.

<table>
<thead>
<tr>
<th>Languages</th>
<th>Noun-tokens</th>
<th>Noun-types</th>
<th>Verb-tokens</th>
<th>Copulas</th>
<th>Auxiliaries</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>LA</td>
<td>MM</td>
<td>EA</td>
<td>HJ</td>
<td>JK</td>
<td>SW</td>
</tr>
<tr>
<td>Noun-tokens</td>
<td>37</td>
<td>54</td>
<td>43</td>
<td>47</td>
<td>56.2</td>
<td></td>
</tr>
<tr>
<td>Noun-types</td>
<td>26</td>
<td>45</td>
<td>27</td>
<td>26</td>
<td>30.2</td>
<td>16–45</td>
</tr>
<tr>
<td>Verb-tokens</td>
<td>45</td>
<td>56</td>
<td>47</td>
<td>43</td>
<td>43</td>
<td>31–51</td>
</tr>
<tr>
<td>Copulas</td>
<td>10</td>
<td>11</td>
<td>9</td>
<td>12</td>
<td>10.5</td>
<td>5–18</td>
</tr>
<tr>
<td>Auxiliaries</td>
<td>16</td>
<td>19</td>
<td>3</td>
<td>11</td>
<td>15.2</td>
<td>8–32</td>
</tr>
<tr>
<td>Swahili</td>
<td>Noun-tokens</td>
<td>35</td>
<td>58</td>
<td>48</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Noun-tokens</td>
<td>23</td>
<td>20</td>
<td>26</td>
<td>23</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Verb-tokens</td>
<td>44</td>
<td>33</td>
<td>26</td>
<td>57</td>
<td>53</td>
<td>41.2</td>
</tr>
<tr>
<td>Copulas</td>
<td>7</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Auxiliaries</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>10</td>
<td>8</td>
<td>6.8</td>
</tr>
</tbody>
</table>

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3.2.3. Grammaticality and syntactic complexity

Analysis of the grammaticality and complexity of the produced sentences revealed that all the agrammatic speakers produced a significantly larger proportion of ungrammatical sentences (for English: $z = -3.37, p < .001$, for Swahili: $z = -3.37, p < .001$) and a significantly smaller proportion of embedded sentences (for English: $z = -3.37, p < .001$, for Swahili: $z = -3.37, p < .001$) than the NBDs in both languages (see Table 5). Again, the data in English and Swahili are very similar: the agrammatic speakers produce 10 times as many ungrammatical sentences in English and 8.6 times as many ungrammatical sentences in Swahili than the NBDs. The NBDs produce 4.5 times as many embeddings in English and 4.8 times as many in Swahili than the agrammatic speakers.

The ungrammatical sentences produced by the agrammatic speakers in both English and Swahili were mainly incomplete structures (missing internal arguments; frequent omissions of free morphemes such as articles, prepositions, determiners; substitutions of grammatical morphemes, such as inflections, leading to tense and agreement errors). Such frequent omission of elements within a sentence, coupled with limited use of embeddings largely account for the reduced length of utterances as mentioned above.

<table>
<thead>
<tr>
<th>Participants</th>
<th>English</th>
<th>Swahili</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ungrammatical sentences</td>
<td>Embeddings</td>
</tr>
<tr>
<td>LA</td>
<td>18 (46%)</td>
<td>7 (18%)</td>
</tr>
<tr>
<td>MM</td>
<td>17 (39%)</td>
<td>6 (14%)</td>
</tr>
<tr>
<td>EA</td>
<td>89 (87%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>HJ</td>
<td>32 (55%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>JK</td>
<td>15 (35%)</td>
<td>4 (9%)</td>
</tr>
<tr>
<td>SW</td>
<td>19 (41%)</td>
<td>4 (9%)</td>
</tr>
<tr>
<td>Mean</td>
<td>31.7 (51%)</td>
<td>3.8 (8%)</td>
</tr>
<tr>
<td>NBD mean</td>
<td>1.58 (5.1%)</td>
<td>10.83 (36%)</td>
</tr>
<tr>
<td>Range</td>
<td>0–13%</td>
<td>27–46%</td>
</tr>
</tbody>
</table>

Table 5
Proportions of ungrammatical and embedded sentences of the agrammatic and non-brain-damaged speakers in English and Swahili.

3.3. Verb inflection and time reference through verb forms

3.3.1. Verb inflections on lexical verbs

As shown above, the number of lexical verbs produced by the agrammatic speakers was similar to that of the NBDs in both languages. However, in English the agrammatic speakers produce a larger proportion of these verbs as an infinitive and gerund than the NBDs (see Table 6). 89% of the lexical verbs produced by the agrammatic speakers were in the infinitive or gerund (-ing) form, compared to 74% in the NBD population ($z = 3.32, p < .0001$). For Swahili, a similar comparison cannot be made. Unlike in English, uninflected verb forms in Swahili do not exist. Non-finite verb forms, that is, verb forms that are not marked for tense and agreement, also bear inflection. These are the infinitives and the consecutive forms, marked with *ku-* and *ka-* respectively. The agrammatic speakers use as many of these non-finite inflected lexical verbs as the NBDs ($z = 1.55; p > .05$).

In English lexical verbs, only the third person singular, present tense is inflected for agreement (-s) and only the past tense is marked on the verb (-ed). In the NBD samples, 4.5% of the lexical verbs are inflected for the 3rd person singular, comparable to the percentage in the agrammatic speakers ($z = -1.36, p > .05$). However, the agrammatic speakers used significantly fewer tense markers in English than the NBDs (7.4% vs 20.95%; $z = -3.32, p < .001$). In Swahili, all finite verbs are bearing markers for agreement and tense. Therefore, in Swahili the agrammatic speakers (and the NBDs) produce many more verbs inflected for tense and agreement, but the pattern is the same: the agrammatic speakers use a normal percentage of agreement markers ($z = -0.98, p > .05$), but the use of tense markers is significantly reduced ($z = -2.39, p < .02$).

In summary, when agrammatic speakers produce lexical verbs in the English condition, they overuse forms that are not inflected for tense and agreement (infinitives and gerunds). The number of
finite verbs inflected for third person singular, present tense is normal, meaning that agreement inflection, as far as measurable in English, is intact, although there were only a few instances of agreement inflection in the data set. However, the overt tense marker in English, -ed, in combination with the irregular past-tense forms, is used with a lower frequency than normal. In Swahili, uninflected forms of verbs do not exist and are not produced when the agrammatic speakers produce Swahili. The number of infinitives and consecutive forms is not statistically different from normal. Just like when they are speaking English, agreement inflection is intact, but tense inflection is produced less frequently than normal.

3.3.2. Time reference through verb inflection

Tense and aspect inflections are used to refer to a time frame, that is, past, present or future. Since the majority of tense inflections in both languages and in both populations were to present and past, reference to the future was ignored in the current analysis. Not only the tense and aspect inflections of lexical verbs were tallied, but also copulas and auxiliaries.

As shown in Table 7, both in English and in Swahili, the individual agrammatic speakers’ use of verb forms referring to the past was outside the normal range and significantly lower than in the NBDs (for English: \( z = -3.37, p < .001 \), for Swahili: \( z = -3.37, p < .001 \)). This was not the case for verb forms referring to the present. In fact there was a substantial overuse of present verb forms by the agrammatic speakers in English (\( z = -3.37, p < .001 \)), but not in Swahili (\( z = -.84, p > .05 \)) compared to the NBDs. A further comparison of the use of verb forms referring to the past and those referring to the present within the agrammatic speakers group reveals a preference for verb forms referring to the

| Table 6 |
| The proportions of verb inflections on lexical verbs in English and Swahili produced by agrammatic and non-brain-damaged speakers. |

<table>
<thead>
<tr>
<th>English verb inflections</th>
<th>Swahili verb inflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tense inflections: -ed (irr)</td>
<td>Tense inflections: -li, -me-</td>
</tr>
<tr>
<td>Agreement inflections: -s</td>
<td>Agreement inflections: -ni, -a, -wa</td>
</tr>
<tr>
<td>Infinitives &amp; v + ing verb forms</td>
<td>Infinitives and consecutive markers: ku-, -ka-</td>
</tr>
<tr>
<td><strong>LA</strong></td>
<td>4 (4)</td>
</tr>
<tr>
<td><strong>MM</strong></td>
<td>1 (2)</td>
</tr>
<tr>
<td><strong>EA</strong></td>
<td>1 (2)</td>
</tr>
<tr>
<td><strong>HJ</strong></td>
<td>3 (4)</td>
</tr>
<tr>
<td><strong>JK</strong></td>
<td>5 (2)</td>
</tr>
<tr>
<td><strong>SW</strong></td>
<td>4 (1)</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>3 (2.5)</td>
</tr>
<tr>
<td><strong>NBD mean</strong></td>
<td>8.8 (6.1)</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>6–14 (&gt;5)</td>
</tr>
</tbody>
</table>

Irr = irregular verbs.

| Table 7 |
| Production of time reference through tense and aspect in English and Swahili by agrammatic and non-brain-damaged speakers. |

<table>
<thead>
<tr>
<th>English time reference</th>
<th>Swahili time reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past (tense &amp; aspect)</td>
<td>Present (tense &amp; aspect)</td>
</tr>
<tr>
<td>Past (tense &amp; aspect)</td>
<td>Present (tense &amp; aspect)</td>
</tr>
<tr>
<td><strong>LA</strong></td>
<td>19</td>
</tr>
<tr>
<td><strong>MM</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>EA</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>HJ</strong></td>
<td>18</td>
</tr>
<tr>
<td><strong>JK</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>SW</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>12.5</td>
</tr>
<tr>
<td><strong>NBD mean</strong></td>
<td>24.5</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>20–25</td>
</tr>
</tbody>
</table>

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present over those referring to the past, a difference that is significant for English \((z = -2.88, p < .01)\), but not for Swahili \((z = -1.12, p > .05)\).

4. Discussion

This section discusses three research questions outlined in Section 1.5, namely (1) Are there similarities or differences in English speech production in monolingual and bilingual aphasic speakers? (2) What are the features of Swahili agrammatism? How comparable are they with the features of English agrammatism? (3) What are the agrammatic speakers’ patterns of production of verb inflection for tense and time reference in Swahili and in English? Are verb forms referring to the past impaired? The section will end with a discussion on linguistic complexity and frequency.

4.1. Comparisons with American English data

The results of the analysis of the Kenyan–English samples were compared to those provided by Thompson et al. (2010) to determine whether analysis of spontaneous speech in languages for which aphasia tests are not available is sufficient to identify agrammatism. The similarities were remarkable: the Kenyan–English samples had the same speech rate, mean length of utterances, noun-to-verb ratios and percentages of grammatical sentences as the American English agrammatic samples of Thompson et al. (2010). This, in combination with the good performance on the BDAE subtest for auditory word comprehension, shows that the spontaneous speech could be characterized as ‘agrammatic’ and that the agrammatic speakers could be classified as suffering from Broca’s aphasia, at least in English, although no formal Kenyan tests are available. Knowing that these aphasic individuals were agrammatic in English allowed us to do additional analyses and to make comparisons with the Swahili samples, to see whether the spontaneous speech in this language can also be qualified as agrammatic.

4.2. Comparison of the English and Swahili samples

The analysis of Swahili agrammatic samples compared to those of NBDs shows features that generally quantify agrammatism: reduced spontaneous speech output; low speech rate; shorter utterances; limited use of embeddings in sentences; and production of large proportions of ungrammatical sentences. For cross-linguistic comparisons, we first compared the mean length of utterances (MLU) and speech rate (words per minute). The results showed similar pattern in Swahili and English: a considerable reduction in utterance length and the delay in speech rate is similar in both languages. Second, the use of nouns and verbs (including copulas and auxiliaries) is very much alike in both languages. Somewhat surprisingly, the scores on these variables are not different from normal. On the basis of the literature (e.g., Bastiaanse & Jonkers, 1998; Thompson et al., 1997) it was expected that the agrammatic speakers would produce fewer lexical verbs and/or lexical verb types, as well as fewer copulas and auxiliaries. However, this pattern was not observed in our agrammatic speakers in either language. There are at least two other studies that report the same results. Lorch (1990) studied verb production in three highly inflectional languages (Hindi, Icelandic and Finnish) and showed that agrammatic speakers’ production of verbs and verb types was not impaired in all speakers. More recently, a study by Crepaldi et al. (2011) did not report a noun–verb dissociation in Italian agrammatic speech. However, looking at the individual data of the current study, we see that EA, who was the most severely aphasic, had difficulties producing both copulas and auxiliaries in the two languages. MM had difficulties with auxiliaries only in Swahili. Our interpretation of the current data is that the agrammatic speakers in this study may not have specific retrieval problems for lexical verbs, at least not in their spontaneous speech. Their ability to retrieve nouns, lexical verbs and other categories of verbs appears to be intact. Interesting is the finding that even though lexical verbs and other verb categories are retrieved normally by these agrammatic speakers, the proper use of the retrieved verbs in sentences is generally impaired leading to higher proportions of ungrammatical sentences. The agrammatic speakers often omitted complements (obligatory and implicit arguments).

Finally, as per our expectation, the agrammatic speakers produce more ungrammatical sentences and fewer embedded sentences than NBDs in both languages. Again, there is a similar pattern in
Swahili and in English. The agrammatic speakers' ability to produce grammatically correct sentences that are typically longer and/or complex (with embeddings) is clearly disrupted, confirming the results of previous studies on agrammatism (see Section 1.3).

In sum, the agrammatic symptoms in both languages are very similar on variables that were not expected to yield different results in the two different languages: reduced speech rate, short utterances, high proportion of ungrammatical sentences, and fewer embedded sentences. Unexpectedly, the production of verbs is well-preserved in both languages, which is not common in agrammatic spontaneous speech. Still, the noun–verb ratio of our English samples is comparable to those of Thompson et al. (2010) for American English agrammatic speech.

4.3 Verb inflection and time reference

The final question addressed the production of verb inflection. Two sub-questions were raised. First, whether there would be differences in the use of verb inflections in these typologically different languages and second whether there was a selective disorder for verb forms referring to the past. With regard to the first sub-question, several theories were addressed in the Introduction. In spontaneous speech it is hard to point to obvious errors, but it was clear that those verb forms that were produced were usually correct, in both languages. Thus, it is not the case that more errors are made in Swahili than in English. In English, the agrammatic speakers overused the infinitive and gerund forms of lexical verbs. In Swahili, the infinitive and narrative markers (ku- and ka-) were produced slightly more often than normal, although the difference is not significant. When the finite verbs are compared, we see that in both languages agreement inflection is normal, but the production of tense inflection is compromised, although less in Swahili than in English (English 35% of the normal number of Tense inflections, in Swahili 57%). This is in line with the findings of Knoph (2011) and Alexiadou and Stavvakaki (2006) who also reported that inflection of the morphologically most complex language is best preserved. It also supports the findings of our earlier study in which the English–Swahili agrammatic speakers' production of past-tense forms were impaired in English but not in Swahili (Abuom et al., 2011). These authors explained this by the assumption that inflection for Tense is much more anchored in the Swahili language system, with its very rich and informative paradigm, than in English, in which the lexical verb is not even marked for two time frames (present and future). In the final section we will return to the issue why there is a slightly better performance on Tense in Swahili than in English, regardless of the morphological complexity of the two languages.

Grodzinsky's (1991, 1999) and Paradis' (1995) claim that omission of grammatical inflections occurs in languages that allow bare forms. They also claim that substitutions will be produced in languages where omissions result in non-words. Both claims are supported by our data. Speaking in English results in an overuse of infinitives, whereas speaking in Swahili results in a more than normal number of verbs with ku- and ka- markers. However, in English gerunds are also overused and these forms are inflected (-ing). Thus, the results may also be explained in a different way: in both languages the agrammatic speakers show a preference for non-finite verbs, whether or not they are inflected. This is more in line with the idea of Fabbro (2001), who expects the same errors in both languages. This seems, indeed, to be the case: in both languages, the agrammatic speakers refrain to non-finite verbs, that is, verbs that are not inflected for tense and agreement.

Why would agrammatic speakers use these forms? Obviously, it is not because they have problems with agreement markers, as their use of this affix is normal. However, inflecting a verb for Tense is difficult for them. They produced fewer tense inflections in both languages compared to the non-brain damaged speakers. The data suggest that this is not because they have problems with tense in general. The use of verbs in the present tense is normal in both languages. However, if we take both tense and aspect into account, and make a division between verb forms that refer to the present and verb forms that refer to the past, the real underlying deficit appears, a deficit that manifests itself in both languages. It is reference to the past through verb inflection that is impaired: in both languages the agrammatic speakers produce significantly fewer verb forms that refer to the past; and in English this is compensated by an overproduction of verb forms referring to the present. This selective deficit for verb forms referring to the past has been reported before for monolingual agrammatic speakers in studies: spontaneous speech (Simonsen & Lind, 2002; Stavrakaki & Kouvava, 2003); conversation analysis.

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by Abuom et al. (2011), that verb in reference to the past are similar as in English (though less severe). Goral (2011), however, suggests that even if the verb in the right track, but it does not give an explanation in terms of processing load. Another problem is that Swahili verb in Abuom et al. (2011), more problems arise with the simple paradigm. It is hard to see how or why the speakers have more problems in Swahili, which, however, is not the case. Just like in the study of paradigm, both intuitively and from a linguistic point of view. Therefore, one expects the agrammatic processing model. It is obvious that the Swahili verb inflection paradigm is more complex than the English paradigm, both intuitively and from a linguistic point of view. Therefore, one expects the agrammatic speakers to have more problems in Swahili, which, however, is not the case. Just like in the study of Abuom et al. (2011), more problems arise with the simple paradigm. It is hard to see how or why the Swahili verb inflection paradigm requires less processing load than the English one. The theory raised by Abuom et al. (2011), that verb inflection is more anchored in the Swahili language system, may be on the right track, but it does not give an explanation in terms of processing load. Another problem is that even if the verb inflections are more anchored in the Swahili system, the selective problems with reference to the past are similar as in English (though less severe). Goral (2011), however, suggests that it is not a matter of morphological complexity but rather of regularity. She argues that the morphology of a language with complex but regular morphology is likely to be better preserved than the morphology of a language with simple but not completely regular morphology. This argument has been substantiated by Bybee (2007) who associates regular morphology with affixation and irregular morphology with internal stem change. Bybee (2007) argues that affixation (regularity) is rather more ‘natural’ and highly frequent in most languages, hence easier to process in general; whereas internal stem change (irregularity) is rather less ‘natural’, lexically arbitrary and of low type frequency, hence more difficult to master. Centeno and Anderson (2011) demonstrate that individuals with linguistic limitations (such as agrammatic speakers, children with SLI), in their oral expression, have a preference for high-frequency linguistic items over low frequency items in a language. This theory partly explains high preference for present verb forms in both languages, as well as the slightly better preserved Tense system in Swahili than in English regardless of the morphological complexity of the two languages. Swahili past Tense has only one regular form marked as an inflexion on the verb paradigm, whereas English past Tense has both regular and irregular forms. Furthermore, Swahili verb morphology has high frequency of affixation compared to English, which combines a few instances of affixations and internal stem changes.

In sum, the current data and the discussion thereof do not offer an answer to the question on the underlying deficit. It rather challenges the theories that pose that it is a matter of processing load. We do not dispute that agrammatism is a processing rather than a representational deficit. However, we do

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think that more data and more refined experiments are needed to generate a theory that can explain the problems of agrammatic speakers in terms of complexity in relation to the effects of diminished processing abilities due to brain damage. The present study demonstrates that studies in bilingual populations can be very helpful, if not in solving the problem, then at least in revealing the weak points.

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