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A characterization of verb use in Turkish agrammatic narrative speech

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ABSTRACT
This study investigates the characteristics of narrative-speech production and the use of verbs in Turkish agrammatic speakers (n = 10) compared to non-brain-damaged controls (n = 10). To elicit narrative-speech samples, personal interviews and storytelling tasks were conducted. Turkish has a large and regular verb inflection paradigm where verbs are inflected for evidentiality (i.e. direct versus indirect evidence available to the speaker). Particularly, we explored the general characteristics of the speech samples (e.g. utterance length) and the uses of lexical, finite and non-finite verbs and direct and indirect evidentials. The results show that speech rate is slow, verbs per utterance are lower than normal and the verb diversity is reduced in the agrammatic speakers. Verb inflection is relatively intact; however, a trade-off pattern between inflection for direct evidentials and verb diversity is found. The implications of the data are discussed in connection with narrative-speech production studies on other languages.

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Agrammatism; discourse-linking; finiteness; evidentiality; narrative speech; Turkish; verbs

Introduction
Narrative speech of individuals with agrammatic aphasia is well-studied across languages. There is the cross-linguistic source book from Menn and Obler (1990), but there are also many studies on individual languages (Anjarningsih, Haryadi-Soebadi, Gofir and Bastiaanse (2012) for Indonesian; Bastiaanse and Jonkers (1998) for Dutch; Miceli, Silveri, Romani and Caramazza (1989) for Italian; Saffran, Berndt and Schwartz (1989) for English) and a study on a group of bilingual (Swahili-English) agrammatic speakers (Abuom and Bastiaanse, 2012). All these studies show that the speech of agrammatic speakers is slow and non-fluent, and that their utterances are short and lack grammatical complexity when compared to non-brain-damaged individuals (NBDs). Verbs and verb morphology, furthermore, seem to be particularly vulnerable.

Research has shown that agrammatic speakers have difficulties producing lexical verbs in narrative speech. For instance, Thompson, Choy, Holland and Cole (2010) studied the narrative speech of English-speaking agrammatic individuals using retellings of a fairy-tale and analysed the whole produced samples. On the other hand, Anjarningsih et al. (2012)
and Abuom and Bastiaanse (2012) administered interview tasks to Indonesian and Swahili-English agrammatic speakers, respectively, and analysed extracted samples containing a fixed number of words. Moreover, Olness (2006) elicited different discourse types (such as a picture description and storytelling) from a group of English-speaking agrammatic speakers and analysed these discourse types comparatively. Conclusions from these studies show that the production of lexical verbs in agrammatic narrative speech is impaired, no matter whether the production is measured by verb-to-noun ratios or by type-token ratios.

**Verb inflection in agrammatic narrative speech**

The speech of agrammatic speakers is often characterized by an overuse of non-finite verbs (e.g. infinitives and gerunds; Bastiaanse, Hugen, Kos & Van Zonneveld, 2002; Kolk & Heeschen, 1992; Thompson et al., 2010) or by incorrect verb inflections (Miceli, Mazzucchi, Menn, & Goodglass, 1983). This characterization seems to be language dependent; for instance, Grodzinsky (1991, 1999) suggests that in languages that allow bare stems, verb inflection is predominantly omitted, whereas in languages where no bare stems are allowed, inflections are substituted. Moreover, Abuom and Bastiaanse (2012) found the latter pattern in their group of Swahili-English agrammatic speakers: in Swahili, an agglutinative language that does not allow bare verb stems, verb inflections were substituted, whereas the same agrammatic speakers omitted the verb inflections when they spoke English. The data in Abuom and Bastiaanse (2012) study are also comparable to Menn and Obler (1990) who propose that the problems of agrammatic speakers with producing correct verb inflections are associated with the extent of the inflectional paradigm of the language. According to this account, agrammatic speakers of languages that have a diverse inflectional paradigm are assumed to encounter more difficulties in producing inflected verbs than those speaking languages with a relatively smaller inflectional paradigm. To exemplify, Swahili has one morpheme for past tense, whereas English employs numerous ways to form the past tense: three allomorphs – V+t (‘he fixed’); V+d: (‘he begged’); V+ed (‘he created’); and it also has irregular forms (‘he stood’). Thus, Abuom and his colleagues report that Swahili-English bilingual agrammatic speakers’ greater difficulties with English verb inflection are consistent with Menn and Obler (Abuom & Bastiaanse, 2012, 2013; Abuom, Obler, & Bastiaanse, 2011). Alternatively, Goral (2011) attributes problems with verb inflections in agrammatic aphasia to the regularity of the inflectional paradigm. She suggests that verb inflections in agrammatic speakers of languages with highly regular inflectional paradigms should relatively be spared.

A number of studies indicate that inflected lexical verbs are not globally impaired in agrammatic aphasia. For instance, Bastiaanse, Hugen, Kos and van Zonneveld (2002) show that production of finite verbs is harder for Dutch-speaking agrammatic speakers than non-finite forms. Furthermore, in English, the progressive form V+ing does not seem to be difficult for agrammatic speakers, even though it is considered to be an inflected lexical verb (Abuom & Bastiaanse, 2012; Faroqi-Shah & Thompson, 2004). Nevertheless, difficulties with finite verbs seem to vary among agrammatic speakers. For instance, Miceli et al. (1989) show that some of their participants are better in finite verb production than others.

Bastiaanse and Jonkers (1998) studied a group of Dutch agrammatic speakers. Their data indicated a trade-off pattern: Some agrammatic speakers were relatively good in producing finite verbs, but had little variation in their use of lexical verbs (i.e. a low type-token ratio),
whereas others had more variety in their lexical verbs but produced relatively few finite verbs. In addition, Anjarningsih and Bastiaanse’s (2011) examination of Indonesian agrammatic speakers revealed that the trade-off between lexical diversity and finite verbs observed for Dutch was also observed in Indonesian between lexical diversity and the use of aspectual adverbs.¹ That is, Indonesian agrammatic speakers who produced lexical verbs with a relatively normal variety produced relatively few aspectual adverbs and vice versa.

**Expression of past time reference in agrammatic narrative speech**

Narrative speech studies that analyse past time reference in agrammatic aphasia are relatively scarce. One case study on Norwegian agrammatic speaker reported that this speaker did not use any past tense forms in his spontaneous speech (Simonsen & Lind, 2002). Furthermore, Stavrakaki and Kouvia’s (2003) examination on a group of Greek agrammatic speakers revealed that perfect aspect, which signals terminated events, was harder to realize than imperfect aspect, which is used to indicate ongoing events. Abuom and Bastiaanse (2012) showed that Swahili-English agrammatic speakers failed in producing correct verb forms that refer to the past in both English and Swahili, whereas verb forms referring to present and future were virtually unaffected. The data from those studies are consistent with the past discourse linking hypothesis (PADILIH; Bastiaanse, 2013; Bastiaanse, Bamyaci, Hsu, Lee, Yarbay-Duman, & Thompson, 2011). The PADILIH assumes that reference to the past through verb inflection and reference to any time frame by aspectual adverbs require ‘discourse linking’, and thus, are impaired in agrammatic aphasia. This is based on Zagona’s (2003) claims that tense requires licensing conditions where event-time and speech-time function as internal/external arguments. Hence, past tense is assumed to be discourse linked and requires an external argument (i.e. a ‘specific set’ at the level of discourse) while a non-past tense does not require such a linking relationship. Consistently, Avrutin (2000, 2006) showed that discourse-linked structures, such as which-NP questions, are more impaired in agrammatic aphasia than non-discourse-linked ones. Integrating Zagona’s and Avrutin’s perspectives, Bastiaanse et al. (2011) showed that reference to the past, not only through tense, but also through grammatical morphology (including aspectual adverbs), is difficult for agrammatic speakers.

So far, the features of agrammatic narrative speech in Turkish have only been scarcely studied. This is a caveat here. Turkish expresses distinct morphology for finite and non-finite verbs, and these verb inflections differ from previously studied languages in a way that finite verbs referring to the past must be inflected for direct or indirect information source perspective based on how the event is known to the speaker. These kinds of verb inflection have not yet been investigated in agrammatic narrative speech. In the next section, the relevant features of Turkish for the current study will be presented.

**Linguistic background**

Turkish is an agglutinative language with a rich and regular inflectional paradigm. Turkish verb tenses express inflectional morphemes on finite verbs and verbal predicates, uses of which are

¹Indonesian verbs are not marked for tense, unlike English or Dutch, aspectual adverbs are used instead.
linked to whether the event being referred to commenced in the past, is ongoing in the present or yet to begin in the future. Within the past time reference, two distinct forms are available: direct and indirect evidentiality signalling whether the event was either (1) witnessed personally or (2) either heard from another source or inferred (Aksu-Koç & Slobin, 1986; Slobin & Aksu, 1982). Evidentiality marking is obligatory within the past time reference (see 1–2).

(1) Direct evidential (witnessed past)

Kedi sütü içti
Cat\textsubscript{nom} milk\textsubscript{acc} drink\textsubscript{direct evidential.past 3rd sing.}
'The cat drank the milk'

(2) Indirect evidential (reported or inferred past)

Kedi sütü içmiş
Cat\textsubscript{nom} milk\textsubscript{acc} drink\textsubscript{indirect evidential.past 3rd sing.}
'The cat drank the milk'

The direct evidential –DI, in (1), asserts that the speaker has directly witnessed or personally participated in the past event s/he is talking about. The indirect evidential –mIş in (2) reflects that the speaker knows about a past event through indirect or second-hand information sources: either inference or report of another speaker (see Aksu-Koç, 1988; Aksu-Koç & Slobin, 1986; Slobin & Aksu-Koç, 1982).

Based on the theoretical framework on tense, aspect and evidentiality (e.g. Aikhenvald, 2004; Enç, 2004), Arslan, Aksu-Koç, Maviş and Bastiaanse (2014) adopted the view that evidential forms take ‘evaluation time’\textsuperscript{2} to specify their time reference. As a result, Arslan et al. (2014) argued that direct evidentials are discourse linked, as for a witnessed past event, evaluation time is in the past. Indirect evidentials, by contrast, specify non-witnessed events where the actual event time is irrelevant to evaluation time, and thus, indirect evidentials are not discourse linked.

The present progressive –Iyor in (3) marks the imperfect aspect and refers to present events and states.

(3) Present progressive

Kedi sütü içiyor
Cat\textsubscript{nom} milk\textsubscript{acc} drink\textsubscript{present progressive 3rd sing.}
'The cat is drinking the milk'

Vowel harmony applies to all verb affixes in Turkish, resulting in a large number of allomorphs. For example, the direct evidential form in (1) can be realized in the (orthographical) forms –dI, -tI, -di, -ti, -du, -tu, -dū, and –tū, depending on the vocalic properties of the verb stems.

Selection of one evidential over the other is determined by genre and discourse types: while direct evidentials usually occur in stories about personal experiences and in first person narration, indirect evidentials are used for conventional accounts of storytelling

\textsuperscript{2}Evaluation time here is referred to as the time when the speaker receives information about an event.
(Aikhenvald, 2004; Aksu-Koç, 1988; De Villiers & Garfield, 2009). Aikhenvald (2004) argues that when a speaker is asked about his personal experience, direct evidentials will be used. Some storytelling genres, such as fairy tales or folk tales, however, require the use of indirect evidentials in Turkish (Aksu-Koç, 1988).

There is another feature of Turkish verbs that is interesting for narrative speech analyses; both finite and non-finite verbs are used in embedded clauses, as shown in (4–5), but non-finite verbs are more frequently used (Hankamer & Knecht, 1976; Erguvanlı-Taylan, 1994).

(4) Embedding with a finite verb
Adam müzik dinledim dedi
Mannom music listendirect evid.past.3rd sing. saydirect evid.past 3rd sing.
‘The man said (that) he listened to music’

(5) Embedding with a non-finite verb
Adamın dinlediği müzik gürültüydü
[Man_gen listenobj.participle.3rd sing. music] noisydirect evid.past 3rd sing
‘The music that the man listened to was noisy’

Turkish has an extensive inflectional paradigm for non-finite verbs. These non-finite verb forms have three main categories: infinitives, participles and gerunds. Infinitives in Turkish can be used in embedded clauses (the so-called ‘action nominals’) as shown in (6) and are marked by the suffixes –mE and –mEK (Kural, 1994). Furthermore, no bare verb stems are allowed.

(6) Infinitive in an embedded clause
Adam müzik dinlemeyi seviyor
‘The man loves to listen to music’

Participles (or verbal adjectives) are used in different types of relative clauses. The subject participle –An is used in subject relatives (see 7), whereas the object participle –DIK is used in object relatives3 (see 8) and refers to non-future events. The other participle forms, inflected with –EcEk and –mIş, can be used in object and subject relatives and express future and past events, respectively (see Kornfilt, 1997 for an overview).

(7) Subject participle
Müzik dinleyen adam
[Music listensubj.participle man]
‘The man that listens to music’

(i) sabah olduğunda
[morning become–participle.loc] ‘when the morning comes’

3The object participle –DIK can also be used in adverbial clauses, see (i) below. The other uses of –DIK are however outside the scope of the current study.
(8) Object participle

\[
\text{ adamantin } \text{ dinlediği } \text{ müzik} \\
[\text{Man}_{\text{gen}} \text{ listen}_{\text{obj.participle.3rd sing.}} \text{ music}] \\
\text{‘The music that the man listened to’}
\]

Finally, gerunds are often used to construct adverbial clauses. Depending on the function of the adverbial clause, different markers can be used: the suffix –Iken expresses temporal simultaneity, as demonstrated in (9), while the suffixes –Ip and –IncE can be used to express sequential events.  

(9) Yürüyüş yaparken müzik dinliyorum

\[
[\text{Walk} \text{ do}_{\text{adverbial gerund}} \text{ music listen}_{\text{present prog.1st sing}}] \\
\text{‘(I am) listening to music while taking a walk’}
\]

Agrammatic aphasia in Turkish individuals

Studies on narrative speech production in Turkish agrammatic aphasia are scarce. Maviş, Tunçer, Üre and Öztürk (2014) investigated Turkish individuals with agrammatic aphasia using picture description, storytelling and spontaneous speech interview tasks to elicit narratives. The authors reported that although the total number of verbs and different types of verbs were reduced in those agrammatic speakers, type-token ratio of verbs in agrammatic speakers was not different from NBDs. Proportion of finite verbs to all verbs was reduced only in storytelling task, compared to the other tasks. Moreover, the data indicated that grammatical complexity in Turkish agrammatic aphasia, as measured by mean length of verbs, is considerably reduced.

Consistent with the above spontaneous speech study, experimental sentence production studies have shown that sentence-level processing in grammatically complex structures is challenging for agrammatic Turkish speakers (Yarbay-Duman, Aygen, Özgirgin, & Bastiaanse, 2007). In particular, producing and comprehending subject and object relatives, where non-finite verbs are used, pose difficulties to Turkish agrammatic speakers (Aydın, 2007; Yarbay-Duman, Aygen, & Bastiaanse, 2008).

Several experimental studies indicated that Turkish agrammatic speakers find finite verbs that refer to the past hard to produce and comprehend (Bastiaanse et al., 2011; Yarbay-Duman & Bastiaanse, 2009). Recall that expressing past events requires the use of one of the direct or indirect evidential forms. Arslan et al. (2014) conducted a production task with sentences requiring either direct or indirect evidentials on a group of Turkish agrammatic speakers. Visual and verbal materials were used to elicit evidential forms

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4Notice that in the object relative (8), the object participle must agree with the subject of the embedded clause, whereas in the subject relative (7) there is no such agreement. Furthermore, the subject of the object relatives is assigned genitive case. It should be noted that in Turkish SOV is the base word order. In the subject relative, the subject is moved to the end of the clause, resulting in OVS order (7), whereas in the object relatives, the object is in clause final position, resulting in SVO (8).

5We only include –Iken, –Ip, –IncE gerundial suffixes for this study. However, gerunds in adverbial clauses are not only limited to these, see Erguvanlı (1984) for further examples.
appropriate for directly witnessed, inferred or reported past events. The authors showed that the direct evidentials are more difficult to produce for Turkish agrammatic speakers than the indirect evidentials.

To summarize, studies on Turkish agrammatic aphasia have shown that (i) speech output is delayed and grammatically less complex; (ii) direct evidentials are more difficult to produce than indirect evidentials (Arslan et al., 2014). In Turkish, non-finite verbs (i.e. infinitives, participles or gerunds) are preferred over finite verbs in Turkish relative clauses. The participles, in particular, require scrambled word order, see (7)–(8), which is known to be hard for agrammatic speakers to produce and comprehend (Aydın, 2007; Bastiaanse & van Zonneveld, 2005, 2006; Yarbay-Duman et al., 2008).

The current study

In the current study, we administered an oral narrative speech production experiment to a group of Turkish-speaking individuals with agrammatic aphasia and to a group of non-brain-damaged Turkish speakers (NBDs), which served as a control group. As summarized above, experimental studies indicated that the production of inflectional morphology of Turkish agrammatic speakers is adversely affected. A compelling way for us to investigate the problems of agrammatic speakers with verb inflection was to explore naturalistic speech production elicited through narrative tasks. This methodology enabled us to examine a wider range of inflectional phenomena within a meaningful discourse, which would not have been possible in a sentence-level processing experiment. In particular, we analysed the narratives of Turkish agrammatic speakers and NBDs with an emphasis on verb production together with the finite and non-finite verb inflections. The following four main research questions were addressed:

(Q1) Are general characteristics of oral narrative speech production regarding speech rate, utterance length, number of grammatical sentences and embedded clauses affected in Turkish agrammatic speakers as compared to NBDs? Does agrammatism in Turkish as shown by narrative speech production resemble agrammatism in other languages?

(Q2) Is production of lexical verbs in Turkish agrammatic speech impaired?

(Q3) Is production of finite and non-finite verb inflections impaired in Turkish agrammatic speech?

(Q4) Is production of verb tenses and evidentiality affected in Turkish agrammatic speech?

Considering the previous results from narrative studies on agrammatic aphasia, we predict that Turkish agrammatic speakers under investigation here will produce short utterances and less grammatically complex and correct sentences as compared to the NBDs. This prediction seems reconcilable with Maviş et al.’s (2014) findings. Narrative speech analyses are informative to define characteristics of agrammatism in a language. One of the clinical markers of agrammatism across languages is difficulty expressing verbs and verb inflections. Given the previous findings from studies on both the Indo-European languages (e.g. English and Dutch) and the agglutinative languages (e.g. Swahili), production of lexical verbs and verb diversity are adversely affected. Turkish agrammatic speakers...
are therefore expected to encounter difficulties producing lexical verbs. Goral (2011) predicts verb inflections in Turkish agrammatic speakers to be spared. According to this account, the problems of agrammatic speakers with verb inflection are associated with regularity of the paradigm; the more regular an inflection paradigm is the fewer difficulties emerge. On the other hand, Menn and Obler (1990) expect Turkish agrammatic speakers to have troubles with inflected verbs. This is based on the assumption that the availability of a large number of allomorphs for a given inflectional morpheme renders the production harder for agrammatic speakers.

Recall that Turkish inflectional morphemes demonstrate different characteristics when appended on the finite verb to signal verb tense and evidentiality or on the non-finite verb to mark infinitive, participles or gerunds. The non-finite verbs require embedded clauses to be formed, among which the object and subject participles trigger scrambling conditions. These structures have been consistently shown to be difficult in agrammatism, as summarized above; we thus expect the use of non-finite verbs to be limited in our agrammatic speakers. With regard to inflected finite verbs, given Arslan et al.’s (2014) data, problems with the production of the direct evidentials are expected.

**Methods**

**Participants**

Ten agrammatic speakers participated in this study. They were recruited from the Hacettepe University Department of Audiology; Ankara University, Department of Speech Therapy; Ankara University, Department of Neurology; and Ankara Hospital for Physical Medicine. They were diagnosed by their speech and language therapists as having Broca’s aphasia using Gülhane Aphasia Test (Tanrıdağ, 1993). There were six men and four women and their age ranged from 43 to 74 years (mean 58.6 years). All agrammatic speakers were right-handed and suffered from a stroke in the left hemisphere. The time post-onset varied from 1 to 22 months (mean 7.9 months). They all had a right-sided hemiparesis. All agrammatic speakers completed at least primary education and were literate individuals who had regular reading habits prior to their aphasia, as reported by their proxies. Individual data are given in Table 1.

A control group was composed of non-brain-damaged speakers (NBDs) in the age range of 37–67 years (mean 51.7 years), who came from the same regions as the agrammatic speakers. Prior to their participation, the NBDs were asked to confirm that they had not been diagnosed with any neurological or psychiatric disorders that would affect their speech. All participants signed an informed consent and allowed us to use their data for research.

**Narrative speech elicitation**

The methods to elicit narrative speech were similar to that of Abuom and Bastiaanse (2012). First, an interview was conducted by means of open-ended questions, as shown in (A) below. Afterwards, the participants were asked to tell a story on the basis of two pictures. To elicit those stories, the questions in (B) were asked sequentially for each picture, based on Olness (2006). The pictorial materials used were the ‘cookie theft’ picture (Goodglass & Kaplan, 1972) and the ‘flood rescue’ picture, a Pulitzer Prize winning
photo of Annie Wells. These pictures were used as they allow possible meaningful scenarios to arise while leading the participant to be rather creative. Moreover, these pictures are well established among aphasiology studies. Since different genres have been shown to elicit different verb forms (Armstrong, 2000; Olness, 2006), different elicitation tasks were preferred in order to maximize the variation in verbs.

(A) Interview questions
- *Konuşma güçlüğü nasil başladı?* (How did your speech problems start?)
- *Daha önce ya da şu an yaptığınız işten bahseder misiniz?* (Could you tell me about your present or previous job?)
- *Ailenizden bahseder misiniz?* (Could you tell me about your family?)
- *Hobileriniden bahseder misiniz?* (Could you tell me about your hobbies?)

(B) Picture description
- *Bana bu resimde neler olduğunu anlatabilir misiniz?* (Could you tell me what you see in this picture?)
- *Bu resimle ilgili başı, ortası ve sonu olan bir hikaye anlatabilir misiniz?* (Could you make a story with a beginning, a middle and an end about this picture?)

### Procedure

Sessions were conducted for each participant individually in a quiet room. The order of questions was as mentioned above (in A and B) for each participant. The participants were encouraged to recount as much as possible, when needed the experimenters provided words of encouragement, such as ‘please go ahead’, ‘tell me more about that’. The sessions were audio recorded with a voice recorder.
Analysis

All samples were transcribed in orthographic speech. Two hundred words from each sample were extracted, following the methods of Vermeulen, Bastiaanse and Van Wageningen (1989) that were used in all our previous analyses. This is comparable to 300 words in a non-agglutinative language and supposed to be a reliable sample size for agglutinative languages (Abuom & Bastiaanse, 2012). For each speech sample, an equal proportion of words was extracted from open-end questions and picture descriptions.

Ungrammatical sentences were defined as utterances that did not contain a finite verb or in which other morphological, syntactic or lexical-semantic errors are made. Minor phonological and articulation errors were ignored. In order to determine the agrammatic nature of the aphasic samples, the following variables were included:

1. Speech rate: words per minute
2. Mean length of the utterances (MLU)
3. Percentage correct sentences
4. Number of embedded clauses with finite and non-finite verbs

For the analysis of verb production, the following variables were calculated:

5. Number and diversity of lexical verbs (including non-finite verbs and the copular verb ol: ‘to become’, but excluding nominal predicates). The number of lexical verbs was counted, as well as the number of lexical verbs per utterance. Diversity of the lexical verbs was measured by type-token ratios (number of different verbs divided by the total number of verbs). When sample sizes are comparable (i.e. equal number of words), and verb tokens are similar in number across participants, type-token ratio is a reliable measure of diversity of verbs (see Richards & Malvern, 1997).

6. Number and proportion of finite verbs (that include a finite form of the copula var: ‘there is’ or yok: ‘there is not’ and nominal predicates) and number of non-finite verbs. The non-finite verbs include the infinitives, participles and gerunds.

7. Tense inflection. Three types of finite verbs were distinguished: (i) direct evidential (witnessed past); (ii) indirect evidential (inferred/reported past); (iii) and present progressive. For each of these inflection types, the frequency as well as the diversity was calculated.

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6The verb ol ‘to become’ was counted as a lexical verb, although it may sometimes be used as a copula. However, it behaves similarly to all other lexical verbs. The existential copulas var ‘there is’, yok ‘there is not’ were counted as nominal predicates. Note that the evidential morphemes can be inflected on nominal predicates and existential copulas, while present tense and future tense cannot.

7Future and habitual tense were tallied as well, but they were hardly used in either group and they will further be ignored.
**Statistical analysis**

Two-tailed t-tests were used to test the reliability of the differences between the agrammatic and NBD group. The t-tests were carried out on each variable individually so as to minimize statistical interference effects of simultaneous multiple comparisons.

**Results**

**General agrammatic features**

In Table 2, the scores on MLU, speech rate, number of utterances, percentage correct sentences and number of embeddings are given for both groups. Results from two-tailed t-tests showed that the speech rate of the agrammatic speakers was significantly lower than that of the NBDs\(^8\) \((t(18) = 8.539; p < 0.0001)\) and their utterances were significantly shorter \((t(18) = 7.166; p < 0.001)\). The percentages of correct sentences were significantly reduced \((t(18) = -6.055; p < 0.0001)\), when compared to the NBDs. The agrammatic speakers produced fewer embeddings with non-finite verbs than the

<table>
<thead>
<tr>
<th>Participant</th>
<th>MLU</th>
<th>Speech rate</th>
<th>Number of utterances</th>
<th>Correct sentences</th>
<th>Number of embeddings</th>
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<td>Number</td>
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<td>9.21</td>
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</table>

\(^8\)Maviş, Tunçer, Selvi, Sarıyer, and Balo (2015) showed that a large group of healthy Turkish speakers between 20 and 55+ years of age typically produce a mean of 91.8 words per minute ranging between 39 and 152 words. Thus, the NBDs reported in the current study represent the speech fluency of healthy Turkish speakers as their individual speech rates are within the described norms.
NBDs did ($t(18) = -2.330; p = 0.032$), whereas no group difference was found in the number of embeddings with a finite verb ($t(18) = -1.019; p = 0.322$).

**Production of lexical verbs**

Table 3 demonstrates the data for the production of lexical verbs. The agrammatic speakers’ use of lexical verbs when it comes to verb tokens was found to be similar to the NBDs ($t(18) = -0.1373. p = 0.8923$). Lemma frequencies of the produced tokens from the agrammatic group, as verified from a web-based Turkish corpus, were similar to those of the NBDs; a group comparison yielded no significant difference ($t(199) = .123; p = 0.902$). However, the diversity of the produced verbs was significantly reduced compared to the NBDs ($t(18) = 2.604; p = 0.018$). The number of verbs per utterance of the agrammatic speakers was reduced ($t(18) = 5.02; p = 0.0001$).

**Production of finite and non-finite verbs**

Table 4 shows the data for the finite and non-finite verbs. The Turkish agrammatic speakers under investigation here had fewer problems with finite verbs than expected, as attested by similar number of produced finite verbs to the NBDs ($t(10) = -0.4708; p = 0.6438$). The proportion of finite verbs (number of finite verbs divided by the

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9The lemma frequencies were taken from the TS corpus (Sezer and Sezer, 2013). The comparison was done on LOG-transformed frequency scores. Mean verb lemma frequencies: agrammatic speakers=5.64, and NBDs=5.60.
number of finite+non-finite verbs) was also similar in both groups ($t(18) = 1.579; p = 0.132$).

In Turkish, there are three categories of non-finite verbs: infinitives, participles used in object and subject relatives and gerunds used in adverbial clauses. The agrammatic speakers’ use of infinitives and gerunds was found to be similar to that of the NBDs (infinitives: $t(18) = −0.211; p = 0.835$; gerunds $t(18) = −0.274; p = 0.787$). Nevertheless, the agrammatic speakers produced fewer participles than the NBDs did ($t(18) = −2.717; p = 0.014$). Furthermore, our data indicated that the difficulties that agrammatic speakers have with the participles lie upon fewer number of object participles than the NBDs (1.00 vs. 3.30; $t(18) = −2.203; p = 0.040$). No group differences were found for the production of subject participles (1.00 vs. 0.40; $t(18) = −1.567; p = 0.135$), or any of the other participle forms (–mls and –EcEk: both $p > 0.11$).

**Verb tense and evidentiality**

In Table 5, the use of inflectional morphology for tense/aspect and evidentiality for both groups is given. Results from two-tailed $t$-tests showed that there was no difference

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10The infinitives produced by all participants were in embedded clauses. However, agrammatic participant A10 (see Table 4) produced most of the infinitives in isolation and only few in embeddings.

11Not to be confused with the indirect evidential –mls. The participle –mls is used in relative clauses and is not a finite verb nor does it make reference to indirect information. The indirect evidential and the participle –mls were analysed separately.
between the use of each type of inflection between the groups, although there was a trend for agrammatic speakers to produce more direct evidentials than the NBDs (direct evidentials: $t(18) = -1.822; p = 0.085$; indirect evidentials: $t(18) = -0.394; p = 0.699$; present progressive: $t(18) = -1.085; p = 0.292$).

Since the number of direct evidentials of the agrammatic speakers was surprisingly high, we inspected the raw data and looked at the diversity of the verbs that were used within each inflectional category. The agrammatic speakers produced a reduced diversity of verbs inflected for the direct evidentials than the NBDs did (TTR: $t(18) = -2.333; p = 0.031$); the diversity of verbs inflected either for the indirect evidentials or for present progressive was similar in the two groups (both $ps > 0.11$).

The individual performances of the agrammatic speakers on the direct evidentials revealed a trade-off pattern between the number of direct evidentials and the diversity of verbs used with them. In particular, the Turkish agrammatic speakers who produced relatively many direct evidentials showed little diversity of the lexical verbs used in direct evidential forms and vice versa: agrammatic speakers who produced direct evidentials with a relatively high diversity produced relatively few of them. This is graphically represented in Figure 1. For the other tenses and for the healthy speakers, this pattern is not found.

**Summary of the results**

The Turkish agrammatic speakers had a slow speech rate and used short utterances, which were simple and often incorrect. They produced a normal number of lexical verbs in 200

### Table 5. The individual scores, means and standard deviations (SD) of the numbers and type token ratios (TTR) for the three most frequently used finite verb forms.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Direct evidential</th>
<th>Indirect evidential</th>
<th>Present progressive</th>
</tr>
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<td>TTR</td>
<td>Number</td>
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words of narrative speech, but they used fewer verbs per utterance. The diversity of the verbs was reduced. However, verb inflection was maintained as they produced as many finite verbs as the NBDs. The produced finite verbs were equally distributed over the main verb tenses – direct evidentials, indirect evidentials and present progressive – although the agrammatic speakers produced marginally more direct evidentials than the NBDs. Within these direct evidentials, there was a trade-off pattern between verb inflection and verb diversity in the agrammatic group. A similar pattern was not observed for the NBDs or for the other tenses. The agrammatic speakers produced fewer embeddings with non-finite verbs than the NBDs did, yet, not all non-finite verbs were equally affected. The agrammatic speakers performed as well as the control group in producing infinitives and gerunds, whereas they produced fewer participles than the NBDs did. However, this was due to a reduced number of object participles; the number of other participles was normal.

Discussion

Findings from the current study have contributed to our understanding of whether and how different types of verbs are affected in narrative speech of Turkish-speaking individuals with agrammatic aphasia. We had four main research questions that needed to be answered. Below, we will discuss each of those research questions.

General characteristics of agrammatic aphasia

Our first research question was whether general characteristics of narrative speech production regarding speech rate, utterance length, number of grammatical sentences and embedded clauses are affected in Turkish agrammatism. The Turkish agrammatic speakers
had slow and non-fluent speech, with reduced sentence complexity. The speech of the Turkish agrammatic speakers was indeed slow: the speech rate was reduced compared to that of NBDs. Grammatical abilities were also compromised: the utterances of the agrammatic speakers were shorter and more often incorrect, and the number of embeddings with non-finite verbs was lower than normal. One idea behind analysing the general characteristics was to explore whether agrammatism in Turkish resembles agrammatism in other languages and this is indeed the case: speech is severely delayed and the sentences produced are shorter and less complex; see for English: Safran et al. (1989), Italian: Miceli et al. (1989), Dutch: Bastiaanse and Jonkers (1998), Swahili-English: Abuom and Bastiaanse (2012), and Indonesian: Anjarningsih et al. (2012).

Production of lexical verbs

The second question was whether the production of lexical verbs in Turkish agrammatic speech is impaired. The number of lexical verbs in the 200-word-sample was similar for both groups, like it was in other languages in which the analysis was done over a fixed number of words (Abuom & Bastiaanse, 2012; Anjarningsih & Bastiaanse, 2011; Anjarningsih et al., 2012; Bastiaanse & Jonkers, 1998). However, since the agrammatic speakers had a reduced utterance length, they produced more utterances than the NBDs. When this was taken into account and the numbers of verbs per utterance were compared between agrammatic and NBDs, the differences between the groups emerged: the agrammatic speakers produced fewer verbs per utterance. The findings reported here broadly fit in with the results from both the studies where speech samples were extracted and analysed based on a certain duration of time (Safran et al., 1989); and those where analyses were done on whole samples (e.g. Thompson et al., 2010).

With regard to production of lexical verbs, our findings are at odds with those in Maviş et al (2014). Following Maviş et al (2014), we may have expected the total number of verbs to be reduced, but type-token ratio of these verbs to be similar in both groups under investigation. However, the current data showed the exact reverse pattern: the agrammatic speakers produced similar number of verbs compared to the NBDs, but the diversity of these verbs was reduced. Arguably, this could be due to the different methodologies used. Unlike Maviş et al. (2014), in the current study, we used a fixed number of words to analyse the diversity of verbs. Therefore, we argue that the underlying problem in Turkish agrammatic narrative production is not a reduced number of lexical verbs, but in fact, it is a reduced diversity of verbs. Although our agrammatic speakers produced similar number of verbs as the NBDs (but fewer number of lexical verbs per utterance), the information they provide with these verbs was limited. The diversity, as measured with a type-token ratio, was lower than normal. This lack of variation in verb use is in fact not uncommon in agrammatic aphasia and has been reported before for Dutch (Bastiaanse & Jonkers, 1998), Indonesian (Anjarningsih et al., 2012) and Italian (Crepaldi et al., 2011).

Verb finiteness

The third question was whether the use of finite verbs and non-finite verbs (i.e. infinitives, participles and gerunds) was affected in Turkish agrammatic speech. With regard to finite verbs, our data from the Turkish agrammatic speakers showed that the use of finite verbs
were unaffected in the narratives. Agrammatic speakers of non-agglutinative languages, such as Dutch and English, tend to lack inflectional morphology on finite verbs (e.g. Bastiaanse & Jonkers, 1998; Safran et al., 1989). However, this was not the case for Turkish. Recall that Turkish is an agglutinative language in which bare verb stems are not allowed. Therefore, omission of inflectional morphemes is a rather unlikely scenario in our case. This was what Abuom and Bastiaanse (2012) showed for Swahili – another agglutinative language, where the bilingual agrammatic speakers had both omission and substitution errors with finite verbs in English, but not in Swahili. Abuom and Bastiaanse (2012) argued that finite verbs are rather spared in Swahili, as the inflectional morphemes (i.e. tense and agreement) cannot be omitted. The same holds for the Turkish agrammatic speakers in the current study: the Turkish agrammatic speakers produced a normal proportion of finite verbs and these were predominantly used correctly. Miceli et al. (1989) reported fewer problems with finite verbs for some Italian agrammatic speakers in their study (but see Grodzinsky, 1991,1999). The data reported here are in line with the predictions of Goral (2011) who suggests that the use of finite verbs in the agrammatic speakers of languages with regular verb inflection paradigms is relatively spared. However, we are unable to confirm the claims made by Menn and Obler (1990), who argued that the number of allomorphs is the critical factor.

In respect to non-finite verbs, the agrammatic speakers produced fewer object participles, but not subject participles, infinitives or gerunds than the NBDs. The spared use of infinitives and gerunds is in line with the findings of Kolk and Heeschen (1992), Bastiaanse et al. (2002) and Thompson et al. (2010) for Dutch and English. However, the difficulties of agrammatic speakers with object participles are compatible with the findings of Aydin (2007) and Yarbay-Duman et al. (2008) for Turkish, despite the very scarce use of the subject participles in both groups. Recall that the object participles are marked for agreement and time reference. We may account for the lack of object participles in the narratives of Turkish agrammatic speakers by assuming that the presence of distinct inflectional morphology on Turkish non-finite verbs results in greater problems with the participle forms. Nevertheless, not all non-finite verbs were equally affected: the object participles were most susceptible to agrammatic deficits.

Alternatively, fewer object participles in the agrammatic speakers may be caused by the structures these participles appear in. Recall that while the object participles are used in object relative clauses, the subject participles are used in subject relative clauses and that both clause types require derived word order. It is conceivable that word order derivation has increased the problems of agrammatic speakers with the participles. However, a problem with derived word order cannot explain the lack of object participles but not of subject participles. The current study concentrated on the verb use, and on the basis of the current narrative speech data it is not possible to conduct clause-level analyses with theme-agent pairs of these verbs. It is worthwhile to develop an experiment to find out what underlies the scarce use of the participles in Turkish agrammatic narrative speech.

**Verb tense and evidentiality**

The final research question was whether the use of verb tense and evidentiality was affected in Turkish agrammatic speech. Evidentiality is obligatorily marked on finite verbs that refer to the past. In earlier experimental studies, it was shown that Turkish agrammatic speakers have problems using verbs referring to the past (Bastiaanse et al.,
2011; Yarbay-Duman & Bastiaanse, 2009) and that, within this category, direct evidentials are most impaired (Arslan et al., 2014). At first sight, this was not reflected in the narrative speech data. The agrammatic speakers did not seem to have more problems in referring to the past than to the present in their narrative speech. Furthermore, the frequency of evidentiality marking was not different from that of the NBDs. Moreover, our results are comparable to the findings of Anjarningsih and Bastiaanse (2011): Indonesian-speaking agrammatic speakers used relatively fewer aspectual adverbs, but the distribution of reference to past, present and future was the same for the agrammatic and NBD speakers.

Although the frequency of morphemes referring to the past is normal for both direct and indirect evidentials, a post-hoc analysis revealed that there is a trade-off pattern. Such a trade-off pattern was observed earlier between time reference markers in Dutch and Indonesian and diversity of the produced verbs (Anjarningsih & Bastiaanse, 2011; Bastiaanse & Jonkers, 1998). This is also visible in Turkish, but only for direct evidentials. Direct evidentials refer to an event in the past that is witnessed by the speaker. It was shown that direct evidentials are more difficult for agrammatic speakers to produce than indirect evidentials (Arslan et al., 2014), and that verbs with present and future tense do not pose more difficulties than direct evidentials do (Bastiaanse et al., 2011; Yarbay-Duman & Bastiaanse, 2009). The greater difficulties of agrammatic speakers with direct evidential, as shown by a low diversity of verbs inflected with direct evidential morphology, are reconcilable with the PADILIH, which postulates that reference to the past is difficult because it requires discourse-level operations (i.e. discourse linking). Obviously, the agrammatic speakers under investigation had difficulties producing a larger variation of verbs inflected for direct evidentiality since this particular inflection type requires discourse linking, unlike indirect evidentiality (Arslan et al., 2014). This broadly fits in with claims in Bastiaanse (2013) who suggests that what makes finite verbs in narrative speech difficult for agrammatic speakers is the fact that the name of the event should be retrieved and inflected for the time frame in which the event takes place. This requires a high processing load. The current data suggest that this is most difficult for verb forms that need to be linked to events that one witnessed.

Although the number of evidential verb forms was similar in the agrammatic speakers and NBDs, the agrammatic group was able to provide less information with these verbs. However, there seems to be important individual differences here: those agrammatic speakers, who produced relatively many direct evidential markers, did not provide much information with them (as shown by the relatively low diversity); whereas those agrammatic speakers who provided relatively much information with direct evidentials (high diversity) used them relatively less frequently. Similar problems with inflectional morphology for time reference have been observed before in Dutch (Bastiaanse & Jonkers, 1998) and with aspectual adverbs in Indonesian (Anjarningsih & Bastiaanse, 2011). In Indonesian, such a pattern was observed for all time frames (for Dutch no analysis per time frame was done). This seems to hold for direct evidentials only in the current Turkish agrammatic data. We believe that the common denominator here is that the verb forms for which discourse linking is required are difficult. This is because referring to past needs to be parsed by discourse syntax, which is hard for agrammatic speakers (Avrutin, 2000, 2006; Bastiaanse et al., 2011; Bos & Bastiaanse, 2014).
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Declaration of interest

The authors report no declaration of interest.

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