The production of Turkish relative clauses in agrammatism: Verb inflection and constituent order

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Accepted 5 November 2007
Available online 20 February 2008

Abstract

This study presents results from a sentence completion test that examines the production of finite main clauses and non-finite relative clauses in Turkish agrammatic speech. In main clauses, the verb is finite and all its constituents are in their base positions. In relative clauses, the verb is a participle and the NP undergoes overt movement to an A-bar position. The results show that non-finite relative clauses with overt movement as such are more difficult to produce than finite main clauses with a base order. The findings are discussed with respect to several hypotheses on finite verbs and syntactic complexity. The conclusion is that Turkish agrammatic speakers have more problems in producing structurally derived clauses and the production of verbs is influenced by linguistic factors such as the overt movement of the NP.

Keywords: Agrammatic aphasia; Verb inflection; Syntactic movement; Constituent order

1. Introduction

Agrammatic speakers with Broca’s aphasia are known to have problems with both complex sentence structures and free and bound grammatical morphemes. This has been explained by various theories at different levels. Some researchers assume that the deficit in Broca’s aphasia is restricted to certain nodes in the syntactic tree (Friedmann, 2000; Hagiwara, 1995), that is, the syntactic tree is partially damaged from a specific node up and therefore errors are made in production. Others seek to determine which elements (Thompson’s Argument Structure Complexity Hypothesis, see Lee & Thompson, 2004), structures (Bastiaanse & van Zonneveld’s Derived Order Problem Hypothesis, 2005) or positions in the syntactic tree (Wenzlaff & Clahsen’s Tense Underspecification Hypothesis, 2004, 2005; Burchert and colleagues’ Tense and Agreement Underspecification Hypothesis, 2004, 2005; Burchert and colleagues’ Tense and Agreement Underspecification Hypothesis, 2005) are most vulnerable. There is quite some overlap between the different hypotheses.

1.1. Linguistic accounts

The focus of the present study will be on the different predictions made by the hypotheses concerning finite verbs—Friedmann’s Tree Pruning Hypothesis (TPH), Burchert and colleagues’ Tense and Agreement Underspecification Hypothesis (TAUH) and Wenzlaff & Clahsen’s Tense Underspecification Hypothesis (TUH)—on the one hand and the hypothesis on sentence complexity (Bastiaanse & van Zonneveld’s Derived Order Problem Hypothesis (DOP-H)) on the other.

What the TPH, TAU and TUH have in common is that they describe the problems that agrammatic speakers have with the production of finite verbs. According to the TPH and the TUH, the production of Agreement morphology is intact while the production of Tense is impaired. According to the TAUH, both Tense and Agreement can be independently affected in agrammatic production. The difference between the TPH on the one hand and the TAUH and TUH on the other, is that the TPH assumes that all nodes above Agreement are inaccessible (these are Tense and...
Complementizer nodes, following Pollock, 1989) while the lower nodes are intact, whereas the TAUH and the TUH predict that the production of Tense and/or Agreement is impaired, but that this does not necessarily imply that nothing else is impaired in agrammatic production. In other words, the TPH predicts exactly which structures are impaired and which are not, whereas TUH and TAUH, according to which Tense is underspecified, suggest that poor production of Tensed finite verbs is due to the nature of Tense, that is, due to its interpretable features that are underspecified and they do not make further assumptions on other structures.

The basic assumption of the DOP-H is that all languages have a base word order and that other word orders are derived. The DOP-H predicts more problems in sentences in which the constituents are in derived order than in sentences in which the constituents are in their base position. For example, the base order in Dutch is subject–object–(finite) verb (SOV), which is visible in the embedded clause. The order of the main clause is derived (subject–finite verb–object). One of the findings that the DOP-H is based on is that Dutch agrammatic speakers have more problems to produce finite verbs in main than in embedded clauses (Bastiaanse, Hugen, Kos, & van Zonneveld, 2002). The DOP-H is not restricted to finite verbs. It also predicts that object scrambling, an operation low in the syntactic tree, is also impaired. This was confirmed for Dutch (Bastiaanse, Koekkoek, & van Zonneveld, 2003) and German (Burchert, 2006). Hence, the DOP-H is not focused on one position in the tree, but simply poses that complex sentences (defined as sentences with overt movement of a constituent) are difficult to produce for agrammatic speakers. In other words, in terms of language production models (Levvelt, 1989), ‘grammatical encoding’ is assumed to be impaired (Bastiaanse & van Zonneveld, 2004).

The present study is focused on the production of finite and non-finite clauses in Turkish. First, the linguistic background of the relevant Turkish grammar will be sketched out, followed by a section on the predictions for agrammatic production. Then the experiment itself and the results will be presented, followed by a discussion of the results in the light of the different theories.

2. Linguistic background

2.1. Main clauses

Turkish is an SOV (subject–object–verb) language\(^1\) (Erguvanli, 1984). This is illustrated in (1: nom = nominative; acc = accusative, progr = progressive, 3sg = 3rd person singular agreement).

\[(1) \text{ adam ceketi-dik-iyor} \]
\[\text{the man-nom the jacket-acc sew-progr/3sg} \]
\[\text{‘the man sews/ is sewing the jacket’}\]

\(^1\) Permutations of basic SOV order are possible (OSV, SVO, OVS and VSO) in Turkish. The permutations represent derived orders that are consequences of syntactic operations such as topicalization, backgrounding and focusing in Turkish (Erguvanli, 1984).

The hierarchy of functional categories in Turkish is Complementizer Phrase (CP)–Tense Phrase/Inflection (TP/INFL)–Aspect Phrase (AspP)–Verb Phrase (VP) (Aygen, 2004). In main clauses, the finite verb moves to T (tense) to check its inflectional features (Chomsky, 1995). This can be seen in Fig. 1. The finite verb moves to T through V+v+T movement in a Turkish main clause (see dashed arrow). This operation is invisible at the surface level, i.e. the finite verb is in its base position even though tense features, such as the present, must be checked (Chomsky, 1995).\(^2\)

In Turkish, both C and T/INFL are responsible for finiteness (Aygen, 2004). Non-finite verbs do not move as high as the T node in the syntactic tree. In the next few paragraphs, some background will be provided about relative clauses in Turkish which are non-finite, but which do have overt syntactic movements.

2.2. Relative clauses

Turkish relative clauses (RC) are participle constructions where the verb of the relative clause appears in a non-finite form (Hankamer & Knecht, 1976; Underhill, 1974). The verb of the relative clause is either marked with a specific subject participle (Spar)—\(\gamma\)An, used to relativize the subject, or with a specific object participle (Opar)—\(\text{DIK}\), used to relativize the object and the non-subject. Uppercase letters in the subject and object participle morphemes represent underspecified phonemes subject to vowel harmony and other morpho-phonemic rules in Turkish.

Example 2 is a subject relative clause and Example 3 is an object relative clause. Overt movement of the subject from its clause-initial position to the end of the clause in a subject relative (see (2) below), and of the object from its pre-verbal position to the end of the clause in an object relative (see (3) below) is shown by a trace (\(t\)) which is co-indexed with the moved argument (Aygen, 2003, 2005). In an object relative, the subject is in its genitive (gen) case and the verb agrees in person/number with the subject of the relative clause. Neither the subject in a subject relative nor the object in an object relative is overtly marked for case (nominative) in the examples below.\(^3\)

\(^2\) The present tense is expressed by the -iyor Aspect marker in Turkish in the absence of any other Tense/Aspect marker following it (Taylan, 2001). According to Aygen-Tosun (1998), the verb moves to T/INFL to check both its Tense and Aspect features in the finite main clauses, even when Tense is not marked overtly.

\(^3\) The case on the extracted subject in subject relative clauses is dependent on its external syntax of the relative clause. Specifically, if the subject relative clause is the subject of a main clause, then it is in the nominative (i.e. ceketi diken adam burada ‘the man that has sewn/ sew is here’. If it is the object of a main clause, then it is in the accusative (i.e. ceketi diken adamı gördüm ‘I saw the man that has sewn/ sew the jacket’). The case on the extracted object in object relative clauses is also dependent on the external syntax of the relative clause—the object is in the nominative when it is the subject of a main clause (i.e. adamın diktigi ceketi burada ‘the jacket that the man has sewn/ sew is here’. If it is the object of a main clause, then it is in the accusative (i.e. adamın diktigi ceketi gördüm ‘I saw the jacket that the man has sewn/ sew’).
Turkish relative clauses are reduced relatives and as such they consist of structures smaller than an IP/TP or CP. They consist only of Asp(ect) P(hrases)\(^4\) with overt A-bar movements of the noun phrase (NP) (Aygen, 2004; Krause, 2001). Fig. 2 illustrates the graphical representation of relative clauses, based on Aygen (2005).

Fig. 2 shows that overt movement of the subject in a subject relative and the object in an object relative from VP target the head of the Determiner Phrase (DP), where they become heads of the relative clause—the subject in a subject relative and the object in an object relative. The verb of the subject and object relative clause moves to D’ to check its features. This is shown by the [Verb+Asp+N] complex. The movement of the verb to D nominalizes the verb in relative clauses (see Aygen, 2005 for further details). Table 1 summarizes those aspects of non-finite relative clauses syntactically relevant to our study. Notice that, in the relative clauses, the verb is at D, meaning that the verb is non-finite, although there is agreement in an object relative.\(^5\)

In the next section the predictions of different theories of agrammatism are discussed.

### 3. Theories of agrammatism and their predictions

Different theories of agrammatic sentence production generate different predictions for the production of non-finite relative clauses and finite main clauses with a base order in Turkish. The TPH predicts that the production of non-finite relative clauses will be easier than production of finite clauses in base order. This is because neither of the morphosyntactic operations in Turkish relative clauses involve Tense or a higher node. Therefore, no impairment to non-finite relative clauses is predicted, neither an inflectional one in the production of non-finite verbs (i.e. the verb being at D) nor a deficit in performing the movement operation below T (e.g. the landing site of the overt movement of the NP being AspP). However, an inflectional def-

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\(^4\) Kural (1993) claims that the ‘object nominalizer’—DIK morpheme consists of Tense—DI and a complementizer—k. Studies on the extraction possibilities and consequences of T-to-C in Turkish (e.g. Aygen-Tosun, 1999) indicate that there is neither an overt Complementizer in such structures nor a Tense.

\(^5\) In an object relative, the predicate complex [V+Asp+N] is adjoined to D and its phi features are checked/deleted at D in a Spec–Head relation. Thus, the predicate gets the agreement morphology. In a subject relative, the predicate lacks subject–verb agreement morphology: the predicate has to be in a Spec–Head relation with the subject DP that carries interpretable phi features so that the predicate can get the agreement morphology. The predicate is at D (i.e. the verb moves to Asp, N and D, respectively), but the subject is not at Spec DP. It is adjoined to superordinate DP due to relativization; accordingly there is no agreement on the predicate (see Aygen, 2005).
ict is anticipated for finite main clauses where the verb is finite, such as where the verb moves to T node, which is assumed to be problematic for agrammatic speakers. Again, the DOP-H and TAUH do not make predictions for the performance on non-finite relative clauses. The DOP-H, assuming that overt syntactic movement is impaired regardless of the position that the elements take in the syntactic tree, makes the opposite prediction to the TPH—the production of non-finite relative clauses will be more difficult than the production of finite clauses in base order. This is because there is overt movement in non-finite relative clauses, assumed to make the production of these clauses difficult for the patients. However, finite main clauses where all constituents are in their base position will cause fewer problems compared the relative clauses, since neither verb inflection, implying that the verb does not overtly move, nor constituent order, where the NPs are in base position, will cause major difficulties. This theory, which proposes that overt movement causes patients to have more problems with verb inflection due to the syntactic complexity of the sentence structure, does not make any predictions about which aspect of finiteness features—or verb inflection—will be affected by the movement of the NP in Turkish non-finite relative clauses. In a previous study on Turkish (Yarbay Duman, Aygen, Ozgirgin, & Bastiaanse, 2007), it was shown that finite main clauses with object scrambling are more difficult to produce for agrammatic speakers than main clauses with base order.

For the present study on the production of Turkish main clauses and subject and object relatives, the TPH predicts more problems in the main clause condition. However, it is the DOP-H, which does predict more problems with the subject and object relatives, that will be tested here. In other words, we hypothesize that non-finite clauses with the overt movement of the NP will be more difficult for Turkish agrammatic speakers than finite main clauses with a base order.

4. Methods

4.1. Subjects

The study was conducted with seven Turkish-speaking individuals with agrammatic Broca’s aphasia (mean age: 52.4 years). All patients were right-handed and had normal auditory and visual acuity. They had a single lesion in the left hemisphere and were at least 5 months post-onset. All the patients but one (B6) suffered from right hemiplegia at the time of the study. None of the patients had major articulatory problems. The patients were obtained from the Ankara Physical Medicine and Rehabilitation Center (Turkey).

The aphasis type was established with the Gulihe Aphasia Test (Taandrag, 1993) and confirmed by a speech therapist. Based on spontaneous speech production, the speech therapist confirmed that all the patients had non-fluent speech, producing only simple and short utterances. Their speech production was characterized as telegraphic. Relevant patient data are given in Table 2. Eight Turkish native speakers with no language or speech impairment history served as the control group. All were right-handed. This group was matched on age and education with the Broca’s aphasia group.

4.2. Materials and procedure

A sentence completion test with three conditions was developed. These conditions were (1) main clause condition, (2) subject relative clause condition and (3) object relative clause condition. Each condition consisted of 20 items. Each subject was thus tested on a total of 60 items manipulating two variables—the presence/absence of the overt movement of the NP and verb inflection.

The patients were presented with two pictures in which the same action was performed by a different person and with a different object. There were two picture sets. Each picture set and the object in that set was reversed and used randomly in one of the three conditions (see Fig. 3 set (a) ‘sew’ the woman/the pajama + ‘sew’ the man/the jacket’ and set (b) ‘sew’ the man/the pajama + ‘sew’ the woman/the jacket’). First, the patients were familiarized with the subject and the object of the sentence. The familiarization sentence was a conjoined sentence with an existential verb (e.g. for set (a) of Fig. 3: burada kadın ve pijama var ama burada adam ve ceket var ‘here is the woman-nom and the pajama-nom but here is the man-nom and the jacket-nom’). The same familiarization structure was used for all sentence types. The patients were then prompted with the target sentence once before being asked to complete the final sentence in a similar way. For all conditions, the prompting sentence included the oral presentation of the first constituent of the target clause so that the patients were required to complete the final sentence with a verb and an argument. The patients were explicitly told that they would hear different types of sentences and that they needed to focus on both the structure of the sentences and inflection of the verb.

The three conditions are presented below, with the given first constituents represented in italics. The target argument had to precede the verb in the main clauses while the target argument had to follow the verb in the relative clauses.

<table>
<thead>
<tr>
<th>Table 2: Patient data</th>
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<tbody>
<tr>
<td>Gender</td>
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<td>B1</td>
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<td>B3</td>
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<td>B4</td>
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<td>B5</td>
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<td>B6</td>
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<td>B7</td>
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</table>
As the test design shows, the patients were required to complete the final sentence with a non-finite verb and a ‘moved subject’ in subject relative clauses (see (2) above) and with a non-finite verb and a ‘moved object’ in object relative clauses (see (3) above). This contrasted to main clauses, where the patients were required to produce a finite verb and an object, both in their base positions (see (1) above).

All sentence types were elicited with appropriate and equivalent discourse conditions—a main clause was always prompted with a main clause, a subject relative was always prompted with a subject relative clause and an object relative was always prompted with an object relative clause. Moreover, throughout the test, the experimenter pointed to the figures of the arguments that ‘bu’ (this) would stand for (the figure of the subject argument for a main and subject relative clause; the object argument for an object relative clause). An example follows.

**Condition 1:** main clause condition (− overt movement, + finite) [subject–object–finite verb (+present progressive + null 3sg agreement)]

**Tester:** Bu kadın pijamayı dikiyor ama bu adam ...

**Patient:** ceketi dikiyor

‘The woman sews/is sewing the pajama but this is the man who sews/has sewn the jacket’

**Condition 2:** subject relative clause condition (+ overt movement, − finite) NP [object–non-finite verb (− tense, − agreement)] subject]

**Tester:** Bu pijamayı diken adam ama bu ceketi ...

**Patient:** diken kadın

‘This is the man who sews/has sewn the pajama but this is the woman who sews/has sewn the jacket’

**Condition 3:** object relative clause condition (+ overt movement, − finite) NP [subject–non-finite verb (− tense, + overt 3sg agreement)] object]

**Tester:** Bu kadının diktği pijama ama bu adamın ...

**Patient:** diktigİ ceket

‘This is the pajama that the woman sews/has sewn but this is the jacket that the man sews/has sewn’

The sentences were randomly distributed over the test and were read with normal intonation. The test started with a practice trial consisting of 6 sentences (2 for each condition) and the practice trial was repeated until it was clear that the patient understood the distinction between the types of sentences and the types of inflections. When the patient requested, the experimenter repeated the prompting sentence. Self-corrections were allowed, no time limit was imposed and only the final answer was analyzed. All responses were audio-recorded and transcribed into normal script.

**4.3. Scoring**

Both quantitative and qualitative analysis were performed. For the quantitative analysis, a correct–incorrect
For the qualitative analysis, the following error categories were distinguished. This was done post hoc, based on the error frequencies.

1. **Constituent order**—a clause produced without the target constituent order. The production of ‘*bu adam (patient: dik-iyor ceket-i)*’Lit. ‘this the man-nom (patient: sew-progr/3sg the jacket-acc) is an example in the main clause condition. In relative clauses, this error type results in an ungrammatical sentence (marked with an *). An example for the subject relative clause condition is ‘*bu ceket-i (patient: kadın diken)*’ Lit. ‘*this the jacket-acc (patient: the woman-nom sew-Spar)*’.

2. **Verb inflection**—a clause produced without the target verb inflection. These are substitution errors within a finite paradigm. An example of a main clause condition is ‘*bu adam (patient: ceket dikiyor)*’ Lit. ‘this the man-nom (patient: the jacket-fut sew)’. The production of ‘*bu ceketi (patient: dikiyor kadın)*’ Lit. ‘*this the jacket-acc (patient: the woman-nom sew-progr)*’.

3. **Base order + V-finite**—a constituent order error necessarily resulting in base SOV order plus a verb inflection substitution co-occur in relative clause conditions. All patients made the same type of error by producing base

### 5. Results

The control group showed a ceiling effect for all conditions. That is, no errors were produced by this group of Turkish-speaking participants. Hence, their data were not further analyzed.

The agrammatic speakers performed worse than the control group in all conditions. The patient data are presented below. The total number and mean proportions of correctly completed sentences in three conditions are given in Table 3. Since the number of subjects was relatively small, statistical testing was done non-parametrically. The total number of correct responses in finite main clauses in base order was significantly higher than the total number of correct responses in both the subject relative clauses (wilcoxon, $z = -2.201, p = 0.028$) and the object relative clauses (wilcoxon, $z = -2.375, p = 0.018$). When non-finite subject and object relative clauses were compared, no statistical difference was found (wilcoxon, $z = -0.254, p = 0.799$). Individual scores (presented in Appendix A) show that the subject relative is significantly more difficult than the main clause for four out of seven patients. The object relative clause is more difficult than the main clause for all but one patient (B7).

### Table 3

Mean score (and percentages) of correctly completed sentences in the main clause, subject relative clause and object relative clause conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean Score</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Main clause</td>
<td>16.57</td>
<td>6.57</td>
</tr>
<tr>
<td>Subject relative</td>
<td>82.8%</td>
<td>32.8%</td>
</tr>
<tr>
<td>Object relative</td>
<td></td>
<td>35%</td>
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</tbody>
</table>

The raw scores are given in Appendix A.
Table 4 presents the error data (raw scores) of the patients for the three conditions. The error analysis showed that ‘base order + V-finite’ errors were the most common error type in relative clauses. These were responses with a clause in base order (SOV) where the verb was finite and where all arguments were left in their base positions, even though the patients were prompted with non-finite relative clauses with the overt movement of the NP. However, the opposite—using a non-finite verb/clause when a finite verb/clause was required—was not observed for finite main clauses with a base order.

When ‘base-order + V-finite’ errors were made in subject relative clause condition, almost always a nominative subject (62 times out of 63 errors) was produced and the nominative subject was produced clause-initially ever time but one. The objects were left in their pre-verbal base positions and they were mostly inflected with the accusative case (50 times out of 62—the other 12 were in the nominative case). In other words, the patients produced grammatical strings that constitute grammatical clauses. However, a different error pattern was observed for the object relative clause condition. In this condition, the subject of the clause (the given first constituent) was already its clause-initial base position, but in the genitive case. The patients either produced a clause-initial-nominative subject (23 times out of 49 errors)—as they did for the subject relative clause condition—or they used the given clause-initial-genitive-subject to complete the clause (making up the other 26 errors). In both cases, the objects were left in their pre-verbal base position and were mostly produced in the nominative case (14 times out of the 23 that the patients produced a nominative subject; 20 times out of the 26 that the patients used the genitive subject—the remaining 15 were in the accusative case). It should be noted that the strings the patients produced are grammatical in both cases, being an object in its base position and a finite verb. However, the clause having the clause-initial-genitive-subject is ungrammatical (i.e. tester: adam-an; the man-gen... patient: ceket/ceketi dikti; the jacket-nom/the jacket-acc sew-finite).

There were few constituent order and (single) verb inflection errors throughout the test. The number of omissions of argument or verb was not high either. However, the patients made more omissions in relative clauses compared to finite main clauses in base order. Individual patient error data can be found in Appendix B.

6. Discussion

The study has two major findings. One is that finite verbs inflected for the present progressive in linguistically simple sentences are relatively well-preserved in Turkish agrammatic production. Second is that overt movement of the NP, regardless of the position that the elements take in a functional hierarchy, is a factor hampering speech production in Turkish agrammatic aphasia. These findings show that the production of non-finite relative clauses is more difficult for Turkish agrammatic speakers than finite main clauses where all constituents are in their base position.

The TPH predicts the finite verb to be selectively impaired (because T node is ‘pruned’) and no problems with non-finite relative clauses in Turkish. However, relatively well-preserved production of the finite verb at the morphosyntactic level, with verb movement to T/INFL on the one hand and impaired production of non-finite clauses with the overt movement of the NP (generated below the ‘pruning’ site: in AspPs) on the other, shows that the position in the tree—the presence of a finite verb with present progressive Aspect and Tense does not predict performance patterns in agrammatic aphasia. The Turkish data demonstrate that the production of non-finite relative clauses with overt movements involving neither Tense (T) nor an overt complementizer (CP) is more difficult than the production of finite main clauses (T/C) with a base order. This was not predicted by the TPH. From these results it is concluded that overt movement of the NP is a difficult operation for the patients.

The DOP-H suggests that finite verbs are relatively intact when there is no overt verb movement. The relatively well-preserved production of finite verbs inflected for the present progressive in Turkish is line with this theory. However, the fact that some patients have problems with Tense might well be related to the interpretability of Tense features (TUH and TAUH), which is the topic of the future study. The DOP-H predicts relative clauses with overt movements to be more difficult than finite main clauses.

<table>
<thead>
<tr>
<th>Table 4</th>
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<tbody>
<tr>
<td>Error data (raw scores) in the main clause, subject relative clause and object relative clause conditions</td>
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<tr>
<td>Constituent order</td>
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</tr>
<tr>
<td>Main clause</td>
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<tr>
<td>Subject relative clause</td>
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<td>Object relative clause</td>
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*Two verbs were omitted from the main clauses; seven arguments were omitted from the subject relative clauses; 12 verbs and four arguments were omitted from the object relative clauses. When four arguments were omitted from the object relative clauses, one of the verbs was non-finite and the other three was finite. Therefore, please note that the finite instances also accompany inflectional problems.

All the verbs (except one) are finite.
in base order due to syntactic complexity that overt movement operation causes. This is what we found. Interestingly, Burchert and colleagues also found in another study that object scrambling is difficult for German agrammatic speakers (Burchert, 2006).

Nevertheless, objections could be raised to the conclusion that it is the overt movement of the NP that makes non-finite relative clauses more complex structures for Turkish agrammatic speakers. The most common error type in relative clauses was ‘base order + V-finite’ errors, where the patients neither performed the overt movement operation nor produced the non-finite verb morphology, making it laborious to determine whether the problem with these clauses is related to the overt movement of the NP or non-finite verb morphology. However, the data show several empirical bases from which to assume that the problem was overt movement as such and not verb inflection. Before we proceed with the discussion, it should be noted that the present study (as well as Bastiaanse et al., 2002; Friedmann, 2000) puts forth results from pure production tests, whereas Wenzlaff & Clahsen’s (2004, 2005) & Burchert et al.’s (2005) theories are based on forced choice sentence completion tests.

First, when Turkish agrammatic speakers moved the NP (the head-noun) in relative clauses, they always produced the non-finite verb with the correct inflection. In other words, the patients hardly made errors to non-finite verb morphology once they moved the NP. This suggests that there was a relationship between the realization of the overt movement of the NP and production of the target inflection. However, an interesting pattern emerged when the patients could not move the NP—‘the NP (head-noun) + non-finite verb’ is not an order possible in Turkish grammar (an order error). That is, a clause head (in italics) in a relative clause has to follow the non-finite verb and can never precede the non-finite verb (such as, for an object relative clause: *adamın ekmek kestiği = *[NP subject genitive–object–verb non-finite] and for a subject relative clause: *ekmek adam kesen = *[NP object–subject–verb non-finite]). Turkish agrammatic speakers seem to be sensitive to this rule, they did not produce strings that were not in keeping with their grammar but rather, their error types were mirrored as ‘base order + V-finite’ errors (see Bastiaanse & Thompson, 2003 for a similar assumption for the error data of English and Dutch speaking patients in examining the relationship between verb position and verb inflection). Accordingly, when the patients could not move the head-noun, they left it in its base position and produced a finite verb following the head-noun (the NP + finite verb string) since only a finite verb is permitted in that position in Turkish. Non-finite verbs as such cannot be clause-final for German (Rausch, Burchert, & De Bleser, 2005 ).

This implies that the frequency of a sentence structure does not play a decisive role in agrammatic production. Teylan and Koç (1998) show that native speakers of

Second, there are hardly any single inflectional errors in relative clauses. If the problem was non-finite verb morphology and not the overt movement of the NP, we would then expect to see ‘inflection’ errors, at least in subject relative clauses, without even ignoring the given first constituent (e.g. ekmeği kesiyor adam), where an ‘inflection’ error, unlike an order error, results in a grammatical string and a grammatical clause in a subject relative clause condition. Nevertheless, the patients did not make inflectional errors as such, neither in the subject relative nor in the object relative clauses. This is consistent with the error pattern in the data, in that a single inflectional error in a subject relative clause results in the production of a finite main clause with a derived order in Turkish. Again, the patients left all the constituents in their base positions, including the subject in a subject relative clause, and did not produce a derived variant—the given-subject was already in its base position in an object relative clause.

Finally, if the main problem is not the overt movement of the NP and if the patients had a random choice of constituent order mostly by ignoring the given first constituents, even though they correctly produced and used the new elements in the second picture, they would indeed have five other alternatives to produce a main clause in Turkish, since Turkish permits OSV, SVO, OVS, VOS and VSO orders in main clauses. However, only one alternative (SOV) among the five did not include (NP) movement—or scrambling—and it was this order that was produced. Accordingly, the systematic tendency to leave all the arguments, including the head nouns, in their base positions, both in subject and object relative clause conditions is unlikely to be explained by a deficit in non-finite verb morphology. Moreover, the error types were not random at all. There are neither ‘order’ nor ‘base order + V-non-finite’ errors in finite main clauses.

Relative clauses are less frequent than finite main clauses in Turkish. However, Bastiaanse and colleagues (Bastiaanse et al., 2002; Bastiaanse & Thompson, 2003) showed that completing an embedded clause is significantly easier for Dutch agrammatic speakers than completing a main clause. The Dutch embedded clause is in base order (SOV) whereas the order of the Dutch main clause is derived (SVO). Although the Dutch main clause is twice as frequent as the embedded clause (Corpus Gesproken, Netherlands), it is significantly more difficult to produce. Similar findings have been reported for German (Rausch, Burchert, & De Bleser, 2005). This implies that the frequency of a sentence structure does not play a decisive role in agrammatic production. Teylan and Koç (1998) show that native speakers of

8 Notice that an actual inflectional error in a subject relative clause results in a derived finite OSV sentence. However, production of these errors was rare.
Turkish produce more object relative clauses in their narratives than subject relative clauses, but in the present study, no difference was found for the agrammatic speakers.

The findings above indicate that when Turkish agrammatic speakers avoid a certain clause structure, they produce strings in keeping with their grammar, as was previously suggested by Kolk and Heeschen (1992) and Bastiaanse and Thompson (2003) for structurally different languages such as Dutch and English. The tendency of Turkish agrammatic speakers to prefer correct strings is probably because of the patients’ knowledge of relative clauses, including (1) knowing the function of a head-noun in that they know which NP they should move to construct a relative clause; (2) knowing the correct relativizing participle to use before the head noun since they use the subject relative participle—An or object relative participle—DIK correctly; and (3) knowing in which position to use the head-noun, namely before or after the relativized verb is relatively intact. Furthermore, the patients do not simply leave the NPs in their base positions but adapt the verb inflection as well, to avoid overt syntactic movement as grammatically economically as possible. Accordingly, it is suggested that the strategies the patients use to avoid overt movement are shaped by the rules of the specific grammar of the patients’ language.

The adaptation of verb inflection for a specific position is only related to the grammar of the clause structure in Turkish in that the patients produced a finite verb when they left the object or subject in their respective base position, in the pre-verbal area, in the object or the subject relative clause conditions (object + finite verb; subject + finite verb), since a participle verb that has to precede the moved/relativized argument (participle + object or participle + subject) is not possible for that position (*object + participle; *subject + participle) in Turkish. In other words, Turkish agrammatic speakers do not necessarily adapt or change verb inflection if it is sufficient to leave an NP in its base position (avoidance of overt movement) to construct a relatively grammatical string. Yarbay Duman et al. (2007) show that Turkish agrammatic speakers have problems with NP movement in object scrambled sentences (e.g. the skirt, the man tı ironed). However, they predominantly make single ‘base order’ errors rather than ‘base order + inflection’ errors, since it is sufficient to leave the NP in its base position to produce a grammatical sentence without overt movement (e.g. the main ironed the skirt) in finite main clauses as such. Notice also that both movement to an argument (A) position as in clauses with NP movement (clause internal object scrambling in Turkish) and movement to a non-argument (A-bar) position as in Turkish relative clauses (the present study) are difficult for the patients, meaning that the crucial factor is overt movement of the NP.

At the individual level, object relative clauses are problematic for more patients than the subject relative clauses are. Moreover, the whole clause was only ungrammatical in the object relative clause condition (53% of cases). The ungrammaticality of the clause was caused by the fact that a given-genitive-subject was followed by no relativization/nominalization, as a result of the ‘base order + V-finite’ errors the patients made. We suggest that the patients’ knowledge of the genitive case is relatively intact—the patients knew that the genitive-marked-NP, the subject of the clause, was already in its clause-initial base position. Therefore, they attempted to produce a relativized string (non-finite verb + overtly moved object) following the given-genitive-subject. However, the proper use of the genitive case in Turkish is dependent on the syntax of the clause structure, i.e. the realization of overt object movement in object relative clauses. In cases where patients could not overtly move the object they left the object in its base position and produced a finite verb (a grammatical string). As a result, a given-genitive-subject followed by no relativization/nominalization yielded ungrammaticality. The patients were probably aware of their inability to form the required relativized string and the ungrammaticality of the clause as such. They monitored their errors by producing clauses with nominative subjects in their clause-initial positions (i.e. grammatical clauses, 47% of cases) when they could not move the objects and left them in their base positions (‘base order + V-finite’ errors). Notice that when the patients overtly moved the object, no problem with the genitive case or clause structure was observed. The data indicate that the proper use of genitive case by Turkish agrammatic speakers is dependent on the clause structure i.e. whether overt movement of the NP is required or not.

It could be argued that there are other potential factors that might have affected the performance of agrammatic speakers in the present study, such as (1) the relative distance between verb and its arguments and (2) subordination. However, we would argue that closer consideration eliminates these possibilities. Firstly, the distance between the verb and its arguments was the same in all three conditions, i.e. all three lexical items across all conditions. A simple distance explanation thus fails. Secondly, relative clauses are subordinate clauses that are noun phrases (NPs) in Turkish. If the overt movement operation in Turkish relative clauses is not a complex operation for the patients, there is no theoretical reason to suggest that an NP with three constituents (non-finite relative clauses) is a more complex structure than a full finite clause with three constituents.

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9 The patients often produced the prompted object case when ‘base order + V-finite’ errors were made. The objects were mostly produced in the nominative case for an object relative (76.9% with the genitive subject and 61% with the nominative subject) and in the accusative case for a subject relative (81%).
Note also that Yarbay Duman et al. (2007) show that NP movement is difficult even when two minimal pair finite main clauses (base SOV and derived OSV) are compared.

It is hard to disentangle difficulties with the overt movement of the NP and nominalization in Turkish since most nominalized clauses involve overt movement as such. Therefore, what ‘nominalization’ might mean from a morphosyntactic point view could be relevant here—nominalization, or non-finite verb morphology, is the movement of the verb to D in Turkish (Aygen, 2005). Accordingly, it is not plausible to assume that the production of finite verbs, at least those inflected for the present progressive (T/INFL), is relatively well-preserved at the morphosyntactic level, since verb movement to T is not problematic for the patients, whereas the production of all non-finite verbs is, due to a selective impairment in verb movement to D. If nominalization as such, i.e. invisible verb movement to D, was impaired, then errors in ‘inflection’ but not in ‘order’ would be expected. Notice that any nominalization explanation would necessarily predict that non-finite verbs or nominalization would also be difficult for agrammatic speakers in other languages. However, no nominalization explanation as such is available for any language, neither in terms of the syntactic tree nor otherwise. Turkish Broca’s patients hardly produce relative clauses in picture descriptions (Slobin, 1991). According to the present study, agrammatic speakers of Turkish might use fewer nominalized clauses compared to agrammatic speakers in other languages because nominalization and the overt movement of the NP are mostly simultaneously manifested in the same clause in Turkish. We suggest that it is the overt movement of the NP that is the source of the problem and not nominalization itself. This assumption might be further tested in Turkish subordinate clauses that have nominalization but no overt movement as such, i.e. Ahmetin geldi˘gni biliyorum ‘Ahmet-gen come-nominalization-agr know-tense-agr’ (I know that Ahmet has come/came).

All clause types in the test were elicited with appropriate and equivalent pragmatic conditions—the patients were prompted with a main clause in base order for the elicitation of this clause, and with a subject and an object relative clause for the elicitation of subject and object relative clauses respectively. Therefore, the context of presentation of the stimuli required either a subject or an object relative clause, depending on the condition, as the pragmatically most appropriate target clause. However, the patients produced a main clause, which is grammatically correct but pragmatically less appropriate when the whole conjoined clause (the experimenter’s prompting sentence + how the patient completed the sentence) is considered. The pragmatically less appropriate combinations might be consequences of difficulties with the complex clause structure, since these pragmatically less appropriate combinations were observed only for clauses with overt movement—relative clauses and not main clauses. Overall, these data are compatible with a deficit at the grammatical encoding level (Levelt, 1989). The patients do make more errors in syntactically more complex clauses.

In summary, sentence production is in general difficult for Turkish agrammatic speakers. However, sentences with the overt movement of the NP, regardless of the position of the elements in the syntactic tree, are more difficult to produce for the patients studied, even when these clauses are non-finite. Accordingly, we suggest that agrammatic aphasia is not a general problem with the finite verb at the morphosyntactic level, nor do non-finite verbs always constitute the correctly produced verb forms in agrammatic speech. The production of verbs in structurally derived clauses is influenced by linguistic factors such as the overt movement of the NP. There may be several other factors that diminish the patients’ speech production abilities as well, such as the ability to refer to past time through finite verbs and/or participles, due to selective problems with the semantics of Tense/Aspect. Future research will reveal what other factors play decisive roles in agrammatic speech.

Acknowledgments

This work was supported by the Mosaic Program of the Netherlands Organization for Scientific Research (NWO) under Grant No. 017.001.164 to Tuba Yarbay Duman. The authors wish to thank members of the Ankara Physical Medicine and Rehabilitation Center (Turkey); particularly to Nermin Altınok for her collaboration. We thank Dirk Bart den Ouden for his useful comments on the earlier versions of this paper.

Appendix A

Individual scores of the correctly completed sentences in the main clause, subject relative clause and object relative clause conditions (maximum score in each condition is 20)

<table>
<thead>
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<th>Main clause</th>
<th>Subject relative clause</th>
<th>Object relative clause</th>
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<td>6***</td>
<td>2***</td>
</tr>
<tr>
<td>B2</td>
<td>18</td>
<td>14</td>
<td>10**</td>
</tr>
<tr>
<td>B3</td>
<td>18</td>
<td>4***</td>
<td>11*</td>
</tr>
<tr>
<td>B4</td>
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<td>B5</td>
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<td>0***</td>
</tr>
<tr>
<td>B7</td>
<td>18</td>
<td>0***</td>
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<tr>
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<td>46</td>
<td>49</td>
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</table>

\*p < 0.05; **p < 0.01; ***p < 0.001 when compared to the score on the main clause (chi square).
## Appendix B

Individual error analysis scores in the main clause, subject relative clause and object relative clause conditions

### Main clause Errors

<table>
<thead>
<tr>
<th>Correct</th>
<th>Errors</th>
<th>Inflection</th>
<th>Movement + V-non-finite</th>
<th>Omission</th>
<th>Others</th>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>1</td>
</tr>
<tr>
<td>B3</td>
<td>18</td>
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<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>B4</td>
<td>15</td>
<td>0</td>
<td>0</td>
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</tr>
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<td>0</td>
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<tr>
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<td>0</td>
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<td>2</td>
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### Subject relative Errors

<table>
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<tr>
<th>Correct</th>
<th>Errors</th>
<th>Inflection</th>
<th>Base order + V-finite</th>
<th>Omission</th>
<th>Others</th>
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<tbody>
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<td>63</td>
<td>7</td>
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</table>

### Object relative Errors

<table>
<thead>
<tr>
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<th>Errors</th>
<th>Inflection</th>
<th>Base order + V-finite</th>
<th>Omission</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>B2</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>B3</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>B4</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>3</td>
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<td>Total</td>
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<td>1</td>
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<td>16</td>
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The number of correctly completed sentences in each condition is found under ‘correct’.

### References


