CHAPTER 2

2. Finite verb inflections for evidential categories and source identification in Turkish agrammatic Broca’s aphasia

Abstract: This study presents the pioneering data on the neurological representation of grammatically marked evidentials with regard to their dissolution in agrammatic Broca’s aphasia. Across two tasks, we investigated the production of finite verb inflections for evidential categories and identification of the information sources these evidential categories are mapped on in Turkish individuals with agrammatic aphasia. In Turkish, information source is grammatically marked for three different past contexts: direct perception, reportative, and inferential. The following research questions were explored: (1) is inflection for different evidential categories equally affected in Turkish agrammatic aphasia? (2) Is identifying the categories of information source impaired? Turkish agrammatic speakers and non-brain-damaged speakers (NBDs) were tested with a production and a source identification tasks. Our findings demonstrate that in Turkish agrammatic speakers the direct perception evidential was more affected in production than the inferential and reportative evidentials. However, the agrammatic speakers retained the ability to identify the source for the direct perception. We argue that information source values conveyed by evidential forms are impaired in agrammatic aphasia. These findings are discussed on the basis of earlier studies to time reference and tense in agrammatism.

2.1. Introduction

Agrammatism is one of the characteristic symptoms of Broca’s aphasia. It has been shown that function words and grammatical morphemes are omitted or substituted in agrammatism (Badecker & Caramazza, 1986). Verb inflections for tense seem to be particularly vulnerable. Roughly, there are three different explanations for this. The first set of explanations is syntactic in nature. Friedmann and Grodzinsky (1997) compared the production of tense and agreement in an agrammatic speaker of Hebrew. They found that tense errors are produced more frequently than agreement errors. This was interpreted in terms of the representation of the syntactic tree: projections from the tense node up were unavailable or ‘pruned’ for
agrammatic speakers. Therefore, the hypothesis was called the ‘Tree Pruning Hypothesis’ (TPH). A number of studies compared agreement and/or mood to tense inflections in agrammatism (Burchert et al., 2005; Clahsen & Ali, 2009; Gavarró & Martínez-Ferreiro, 2007; Wenzlaff & Clahsen, 2004, 2005). Wenzlaff and Clahsen (2004, 2005) for German, and Clahsen and Ali (2009) for English reported that tense was more impaired than agreement and mood (irrealis) for agrammatic speakers. They hypothesize that [+interpretable] features of tense [+/past] are underspecified while [-interpretable] features (i.e., agreement or mood) are relatively spared in agrammatism. The hypothesis is referred to as the ‘Tense Underspecification Hypothesis’ (TUH). Second, Faroqi-Shah and Dickey (2009), and Faroqi-Shah and Thompson (2007) argued that the nature of the deficit in agrammatism is morphosemantically based: diacritical encoding and retrieval processes of tense morphology are disrupted. What syntactically and morphosemantically based accounts have in common is that they propose that tense in general is vulnerable in agrammatic aphasia. We, therefore, will refer to those studies as ‘tense-relevant accounts’.

Crosslinguistic studies have shown that what gives rise to verb inflection problems in agrammatism may not be tense itself but rather reference to the past. Stavrakaki and Kouvava (2003) found that perfective aspect was more impaired than imperfective aspect in agrammatic speakers of Greek. Bastiaanse (2008) showed that for Dutch agrammatic speakers both past tense inflections and non-finite past participles were difficult to produce while present forms were spared. Yarbay-Duman and Bastiaanse (2009) tested time reference through verb inflection in Turkish. Their data showed that past tense/perfect aspect is more impaired than future tense/imperfect aspect. Jonkers and de Bruin (2009) demonstrated that the selective deficit for past tense is not restricted to production but also holds for comprehension in Dutch Broca’s and Wernicke’s aphasia alike. These studies led to the idea that it is not tense but reference to the past through verb inflection that is selectively impaired in agrammatic aphasia.

15 Yarbay-Duman and Bastiaanse (2009) tested past tense/perfect aspect marker and that is the direct perception evidential (–DI).
A large scale crosslinguistic study investigated whether past time reference is impaired in agrammatic speakers regardless of the language and of the grammatical form used for past time reference (i.e., tense, aspect or aspectual adverbs). Agrammatic speakers of Chinese, English, Turkish (Bastiaanse et al., 2011), Dutch (Bos & Bastiaanse, 2014), Russian (Bos et al., 2014; Dragoy & Bastiaanse, 2013), Spanish-Catalan (Martínez-Ferreiro & Bastiaanse, 2013; Rofes, Bastiaanse, & Martínez-Ferreiro, 2014), and Swahili-English (Abuom & Bastiaanse, 2013) have been tested with the ‘Test for Assessing Reference of Time’ (TART: Bastiaanse, Jonkers, & Thompson, 2008). The data were straightforward: in all languages, there was a selective deficit for past time reference in both production and comprehension. While in Chinese all time frames were affected in production, only reference to past was selectively impaired in comprehension. These findings led to the formulation of the ‘PAst DIscourse LIinking Hypothesis’ (PADILIH: Bastiaanse et al., 2011). The basic assumption is that verb forms referring to the past are discourse-linked. This is based on the theory of Zagona (2003), who proposes that past tense needs to be discourse-linked whereas present verb forms are interpreted by a bound reading where speech time and event time overlap in the here-and-now. Furthermore, Avrutin (2006) treats tense as a discourse-linked element, similar to pronouns or referential which-questions; and he suggests that these forms constitute a particular problem for agrammatic speakers. According to Avrutin (2006), the discourse-linked elements referring to discourse outside the sentence must be processed by the ‘discourse syntax’, which requires extra computational cost. By contrast, the elements that are bound within a sentence are processed by ‘narrow syntax’. The PADILIH combines theories of Zagona (2003) and Avrutin (2006) and predicts that all verb forms referring to the past are discourse-linked, and thus, are impaired in agrammatic aphasia. This was tested not only in aphasia but also in sentence processing studies with non-brain-damaged individuals. It was reported that violations in past temporal contexts by present verb forms in Dutch evoke shorter and more accurate behavioral response than the violations in present temporal contexts by past verb forms (Dragoy, Stowe, Bos, & Bastiaanse, 2012). The authors reported that the former violation type evokes positive-going brain waves peaking around 600 ms (the so-called P600 component) time locked to the critical verb,
which was not observed in the latter violation type. Dragoy et al. (2012), therefore, concluded that referring to the past is processed at a higher computational cost in the brain, in line with the PADILIH.

Turkish differs from the so far tested languages regarding past time reference. In this language, marking the information source is grammatically obligatory. In other words, for reference to a past event there are verb inflections available that mark the type of source from which the information is gained: direct perception, inference or verbal report. In the current study we tested whether Turkish agrammatic speakers maintain the awareness of information sources that evidential categories are mapped onto. Thus, for the purposes of the current study, we concentrated on the semantic components of evidentials in Turkish.

2.1.1. Turkish evidentials and past time reference

Evidentiality is defined as the grammatical category referring to the information source (Aikhenvald, 2004). Evidentials are considered to be deictic tools that index the information source for a given statement (Aikhenvald, 2003, 2004; Boas, 1938; Jakobson, 1957; Mushin, 2000; Willett, 1988). Traditionally, evidential forms are classified under two general classes on the basis of whether the speaker has ‘direct’ or ‘indirect’ evidence\(^\text{16}\) (Aikhenvald, 2003; Givón, 1982; Lazard, 2001; Slobin & Aksu, 1982; Willett, 1988), however see also Cornillie (2009) and Tantucci (2013).

\(^{16}\) The direct versus indirect categorization of the evidentials has been discussed in Cornillie (2009) and Tantucci (2013). The latter account, for example, distinguishes the evidentials as domain marking for ‘acquired information’ rather than specific categories for ‘information source’. Tantucci (2013) establishes an evidential category of interpersonal evidentiality on the basis of interpersonal knowledge regardless of the information source. He discusses, however, that evidential constructions encoding particular information sources may be seen as a sub-class of the semantic scope of the ‘acquired knowledge’. The current paper does not deal with theoretical issues on broader scope of evidentiality. Since Turkish marks evidentials morphologically, and the experiment we designed corresponds to particular information sources, we adopt the view ‘evidentials as indicators of information source’.
for alternative accounts on direct-indirect dichotomy. See Figure 2.1 for an illustration of direct and indirect evidence perspectives in Turkish. Evidential distinctions are expressed through the tense/aspect (and mood) inflections in Turkish (Aksu-Koç & Slobin, 1986; Sezer, 2001; Slobin & Aksu, 1982). Thus, Turkish evidentials have binary referential components: attribution to the category of information source and reference to time.

![Diagram](https://via.placeholder.com/150)

**Figure 2.1.** Evidential categories of evidential verb forms used in expressing past events in Turkish

First, the information source component is explained (see Table 2.1 for examples). Turkish has been attested to “differentiate direct versus indirect experience functionally for all past expressions” (Aksu-Koç & Slobin, 1986, p. 159; Slobin & Aksu, 1982, p. 186), both of which are “formally marked” (Aksu-Koç, 2000, pp. 16-17). The direct evidence perspective is represented by the *direct perception* evidential –DI, which expresses that the knowledge asserted has been directly accessed through perception or participation in the event,\(^\text{17}\) and has been described as the

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\(^\text{17}\) According to some analyses Turkish only formally marks the indirect evidentials (e.g., Lazard, 1999; Lazard, 2001), the opposing category being neutral, that is, the direct evidential is not marked. These analyses exemplify their theoretical basis for Turkish from Slobin and Aksu (1982) which, however, is one of the earliest studies articulating that Turkish marks both direct and indirect evidentials through separate inflection morphemes on the verb.
‘witnessed past’ (Erguvanlı-Taylan, 1997; Sezer, 2001). The information source for this perspective is often visual perception implying that the speaker has seen the event. The second perspective is the indirect evidence that consists of the inferential and reportative evidentials. The inferential evidential –mIş denotes that the speaker has access to the information through inference. Substantially, it is used when an event that occurred in the past is apprehended through a resultant state at the evaluation time. Finally, the reportative evidential –(I)mIş conveys that the speaker has access to the information about the situation through hearsay, that is, the linguistic report of another speaker.\(^{18}\)

**Table 2.1. Examples of Turkish Evidentials and their relation to the category of information source**

<table>
<thead>
<tr>
<th>Evidential Form</th>
<th>Category of information source</th>
<th>Event Time</th>
<th>Evaluation Time</th>
<th>Evidential Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>–DI (Direct Perception)</td>
<td>Direct perception (visual/non-visual sensory)</td>
<td>Past</td>
<td>Past</td>
<td>Direct perception</td>
</tr>
<tr>
<td>Adam portakal-ı soy-du peel-direct perception</td>
<td>The man peeled the orange (I witnessed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>–mIş (Inferential)</td>
<td>Inference (on the basis of a physical evidence)</td>
<td>Past</td>
<td>Non-past</td>
<td>Inferential</td>
</tr>
<tr>
<td>Adam elma-yı ye-miş eat-inferential</td>
<td>The man has eaten the apple (presumably, I infer)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– (I)mIş (Reportative)</td>
<td>Verbal report from someone else</td>
<td>Past</td>
<td>Non-past</td>
<td>Reportative</td>
</tr>
<tr>
<td>Adam dün gel-miş, come-reportative</td>
<td>Yesterday the man came (I was told)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{18}\) Reportative evidential also marks ‘mirative’ meanings, that is, the marking of a proposition representing information that is new (and often surprising) to the speaker. This strategy is observed in many languages that express the reportative evidential (DeLancey, 2001; Lazard, 2001; Slobin & Aksu, 1982).
Further linguistic distinctions between the evidential markers have to be made at this stage. The direct perception –DI and the inferential –mIş are considered to have temporal/aspectual and evidential (as well as modal) functions. However, a number of studies have shown that the reportative –(I)mIş behaves differently from the inferential –mIş, and does not mark tense/aspect but only evidential category of reportative (Aksu-Koç, 1988, 2000; Aksu-Koç & Slobin, 1986; Aksu-Koç, Ögel-Balaban, & Alp, 2009; Csató, 2000; Gül, 2009; Johanson, 2006; Johanson & Utas, 2000). ¹¹ Turkish evidentials have been classified under modality, as a category of epistemic implications for the speaker’s degree of certainty about the proposition asserted (e.g., Aksu-Koç, 1988; Slobin & Aksu, 1982) in close relationship to the epistemic modality (see also Chafe & Nichols, 1986; Givón, 1982; Palmer, 1986). However, recent theories on evidentiality have shown that evidentials are grammatical categories in their own right (Aikhenvald, 2003, 2004, 2007). No matter which linguistic point of view is adopted, modal meanings, such as the degree of certainty, are unavoidable interpretations that can be drawn from evidential discourses, albeit they do not constitute the core meaning of evidentiality (Aikhenvald, 2004; Cornillie, 2009; De

¹¹ Whether –(I)mIş and –mIş are the same or different structures is a controversy in Turkish linguistics. While a great deal of recent accounts advocate that they are different structures (Aksu-Koç & Slobin, 1986; Aksu-Koç, 1988; Aksu-Koç, 2000; Aksu-Koç, Ögel-Balaban, & Alp, 2009; Csató, 2000; Gül, 2009; Johanson, 2000; 20069, some others treat them as the same. It cannot be avoided that they differ in terms of evidential meanings. Observe (1-2) below:

(1) Adam gelmiş
   Man    come INDIRECT EVID
   “the man came, inferably”

(2) Adam gelecekmiş’
   Man come FUTURE + INDIRECT EVID
   “the man will come, reportedly”

In the former sentence the tense is past and indirect evidential is specified; however, in the latter indirect evidential only marks the reportative evidential, not inference, or perfect aspect, and not past tense. Therefore, the clause refers to the future but the information was heard from another person. See Aksu-Koç (2000) for a comprehensive discussion on these distinctions.
Haan, 1999; Tantucci, 2013 to cite a few). In summary, we assume that while the direct perception –DI and the inferential –mIŞ are tense/aspect inflections, the reportative –(I)mIŞ is not; however, the latter still contributes to modal interpretations like all evidential forms.

The second component in Turkish evidentials is reference to a time frame. The interaction between the source perspective and the time reference is explained with the notions of event time, speech time, and evaluation time (See Figure 2.2 for an illustration). In this analysis, the evaluation time represents the moment when the speaker receives the information regarding an event. Previous theoretical work has argued that the time reference of evidential forms is relevant by fixing the reference to the evaluation time, that is, when the speaker receives the information (Aikhenvald, 2004, pp. 99-103; Slobin & Aksu, 1982). For the direct perception evidential, evaluation time co-occurs with the event time in the past: the speaker’s information on the event is the same as the event time (see Figure 2.2 A). For the inferential and reportative evidentials, however, event time precedes the evaluation time. Simply put, the speaker receives the information about the event after it has occurred. We adopt that time reference in the inferential and reportative evidentials is fixed to the evaluation time and the actual event time is irrelevant, although they refer to past events by the implication (Aikhenvald, 2004; Slobin & Aksu, 1982). The reference point in evidential verb forms is established by fixing the evaluation time as speech time (Enç, 2004, p. 208). Furthermore, this characterization is in line with Johanson’s (2000, 2006) analysis of aspectual-temporal features of Turkish inferential and reportative forms (the ‘indirective’ in his terms). He argues that these forms derive their relevance solely from the speakers’ viewpoint, possibly through the observation of results, traces, or report about them (Johanson, 2006, p. 78).

It was suggested that the inferential and reportative evidential forms are

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20 Note that in inferential or reportative forms speech time and evaluation time may overlap, that is, evaluation of a past event may be at the moment of speech. However, this is not always the case. It is also possible that inferred and reported past events are evaluated before the speech time. However, what seems to be important is that ‘evaluation time is taken as speech time’ in this analysis. Enç’s (2004) analysis implies that the temporal distance between speech time and event time in the classical tense approaches (i.e., Reichenbach, 1947) may not necessarily hold in evidential forms.
encoded through an observable result or report, and thus, they may bear a ‘present relevance’ (Comrie, 1976; Erguvanlı-Taylan, 2001; Palmer, 1986). Therefore, we claim that the inferential and reportative evidentials make non-past reference through their evaluation time in relation to the actual event time, although they shift back to the past by the implication that the actual event was in the past (see Figure 2.2 B).

![Diagram](image)

**Figure 2.2.** Graphical representation of time reference in Turkish (A) direct perception evidential; and (B) the inferential and reportative evidential forms (photos are taken from the TART: Bastiaanse, Jonkers, & Thompson, 2008)

### 2.1.2. Information source and the brain

Evidentiality encoded in language and monitoring the sources mapped on those evidential forms have been studied, and the cognitive connection
between them is controversial (Aksu-Koç et al., 2009; Papafragou, Li, Choi, & Han, 2007; Tosun, Vaid, & Geraci, 2013). The latter phenomena, that is, *source monitoring* refers to encoding, retrieving and identifying contextual details within which a specific memory has been acquired (Johnson, Hashtroudi, & Lindsay, 1993). In this view, different types of memories are encoded and retrieved by different characteristics. For instance, visually encoded memories comprise of more vivid representations. By contrast, non-visually encoded memories subsume more conceptual knowledge (Johnson et al., 1993). Source monitoring has been extensively investigated in populations of non-evidential language speakers. A large number of neurological patient and neuroimaging studies led to identification of neural correlates involved in source monitoring. Regions of the medial temporal lobes (MTL) including the hippocampus have been identified to be involved in episodic and source memories. Furthermore, bilateral prefrontal cortices (PFC) and the parietal cortex are involved in monitoring the sources of memories (see for review: Mitchell & Johnson, 2009). Frontal lobe damage has been reported to result in impairments in making source judgments. Several studies have shown that the bilateral PFC is vital to source memory. This has been demonstrated by a number of different tasks: source discrimination in frontal brain damaged patients (Janowsky, Shimamura, & Squire, 1989; Swick & Knight, 1999; Swick, Senkfor, & Van Petten, 2006); recognition of old/new items and source recognition for the speaker (i.e., *who said the sentence?*) with elderly non-brain-damaged speakers (Glisky, Polster, & Routhieaux, 1995; Shimamura, Janowsky, & Squire, 1991; Wilding & Rugg, 1996); recalling the gender of the speaker of reported information (Dodson, Holland, & Shimamura, 1998). Distinct PFC activity in fMRI studies has been found during source memory retrieval (Lundstrom, Ingvar, & Petersson, 2005), during source memory encoding (Blumenfeld & Ranganath, 2007), and during recalling source versus recalling temporal order of items (Cabeza et al., 1997; Mangels, 1997). Left dorso- and ventro-lateral PFC activity is particularly associated with the systematic evaluation of information source. By contrast, the right lateral PFC is involved in more heuristic judgments, that is, automatic judgments based on less specific information (Dobbins & Han, 2006; Mitchell, Johnson, Raye, & Greene, 2004). The fMRI studies have shown that the left lateral PFC including Broca’s area attains larger activation during source
retrieval than during remembering the actual memory (Mitchell et al., 2004). Through the interactivity of these studies, it is concluded that areas underlying retrieval of specific information source and areas for language processing may overlap.

Source monitoring studies with adult speakers in evidential languages are rare. Tosun et al. (2013) studied neurologically intact Turkish speakers with a source memory test. The authors used sentences predicated with the direct perception and inferential or reportative (both being indirect) evidential verb forms in two conditions. The participants read these sentences without knowing it was a memory test. Subsequently, they were asked to judge whether they had seen the sentences before and in which evidential form they had seen them. Tosun et al. (2013) showed that the sentences with the direct perception evidential were better recognized than those with the inference or reportative verb forms in Turkish monolingual adults. The authors concluded that obligatory linguistic marking of the information source affects the ability to monitor the information source. However, for contrasting results/accounts, see Papafragou et al. (2007).

2.1.3. The current study

In the current study, we administered two experiments with agrammatic and NBD speakers. First, in a sentence production task, evidential categories had to be produced through finite verb inflection. This task tested how production of past time reference is affected in Turkish agrammatic aphasia when more than one distinctive evidential form referring to past events is available to the speaker. Second, we tested identification of the information source (on the basis of the direct perception, inferential or reportative evidential forms).

For the production task, the tense-relevant accounts predict tense to be more impaired than mood (Burchert et al., 2005; Clahsen & Ali, 2009; Faroqi-Shah & Thompson, 2007; Friedmann & Grodzinsky, 1997; Wenzlaff & Clahsen, 2004; 2005). We have described that the direct perception and
the inferential evidentials are tense/aspect (as well as mood) inflections whereas the reportative evidential is only an evidential with no temporal/aspectual value comparable to a tense marker. All evidential forms in Turkish, however, contribute to modal meanings pertaining to epistemic interpretations, and they make reference to how the information has been evaluated: directly or indirectly. Therefore, the tense-relevant accounts predict the reportative evidential to be spared and other evidentials to be impaired. However, the PADILIH predicts that verb forms referring to the past are impaired in agrammatism (Bastiaanse et al., 2011; Bastiaanse, 2013). The assumption of this hypothesis is that all verb forms referring to the past are discourse-linked, and thus, are expected to be impaired in agrammatic aphasics. By contrast, non-past verb forms do not require discourse linking. Above, we provided a temporal reference analysis of Turkish evidentials (see Figure 2.2). This analysis shows that evidentials are distinguished by their reference point as evaluation time, that is, the moment of receipt of information. The inferential and reportative evidentials make non-past reference when their evaluation time is considered in relation to the actual event time, whereas in the direct perception evidential, event time and evaluation time are both in the past. Thus, for production, the PADILIH predicts that the inferential and reportative evidentials are relatively spared compared to the direct perception evidentials.

Previous source monitoring studies on individuals with frontal lobe damage (Janowsky et al., 1989; Swick & Knight, 1999; Swick et al., 2006) demonstrated the importance of the left PFC (especially Broca’s area and the basal forebrain) in source monitoring. It is assumed that in agrammatic aphasia there is a lesion in Broca’s area or in areas that are crucial for proper functioning of Broca’s area. Therefore, it is hypothesized that lesions resulting in agrammatic Broca’s aphasia cause impairments in identifying the information source. However, the direction of source identification impairment cannot be predicted on the basis of the current literature.
2.1.4. Participants

Seven agrammatic speakers (4 females, mean age: 43 years old) participated in the current study. All of them were diagnosed with Broca’s aphasia, based on the Turkish Aphasia Assessment Test (ADD: Maviş & Toğram, 2009). They were right-handed and had right-sided hemiplegia at the time of testing. In addition, clinical judgments by a speech therapist determined that the agrammatic speakers were non-fluent but they had relatively retained auditory comprehension (see Table 2.2 for demographic data, and Appendix A1 for individual scores on the aphasia assessment subtests). A control group of seven non-brain-damaged Turkish speakers were tested as well. They were monolingual speakers and had no history of neurological disorders. They were individually matched to the agrammatic speakers by age, education, and handedness.

2.2. Methods

2.2.1. Materials and procedures

In the current study, we used two tasks; (1) a sentence completion task was administered to assess the production of evidential categories through finite verb inflections. The production task was adapted from the Test for Assessing Reference of Time (Bastiaanse et al., 2008). (2) A source identification task was developed based on Aksu-Koç et al. (2009). The purpose of the source identification task was to test the explicit linguistic awareness of the information source expressed by the evidential verb forms.
Table 2.2. Demographic characteristics and etiological information of the participants

<table>
<thead>
<tr>
<th>Agrammatic</th>
<th>Gender</th>
<th>Age</th>
<th>Handedness</th>
<th>Education</th>
<th>Etiology</th>
<th>Post-onset (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Male</td>
<td>65</td>
<td>Right</td>
<td>Secondary</td>
<td>Left CVA</td>
<td>5</td>
</tr>
<tr>
<td>A2</td>
<td>Female</td>
<td>36</td>
<td>Right</td>
<td>Primary</td>
<td>Left CVA</td>
<td>38</td>
</tr>
<tr>
<td>A3</td>
<td>Female</td>
<td>33</td>
<td>Right</td>
<td>Primary</td>
<td>Left CVA</td>
<td>1.5</td>
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<tr>
<td>A4</td>
<td>Female</td>
<td>46</td>
<td>Right</td>
<td>Primary</td>
<td>Left CVA</td>
<td>5</td>
</tr>
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<td>A5</td>
<td>Male</td>
<td>60</td>
<td>Right</td>
<td>Secondary</td>
<td>Left CVA</td>
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<tr>
<td>A6</td>
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<td>Right</td>
<td>Secondary</td>
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</tr>
<tr>
<td>A7</td>
<td>Male</td>
<td>37</td>
<td>Right</td>
<td>College</td>
<td>Left CVA</td>
<td>14</td>
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</tbody>
</table>

Control

<table>
<thead>
<tr>
<th>Control</th>
<th>Gender</th>
<th>Age</th>
<th>Handedness</th>
<th>Education</th>
<th>Etiology</th>
</tr>
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<tbody>
<tr>
<td>C1</td>
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<td>Right</td>
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<td>Female</td>
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<td>Primary</td>
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<td>Primary</td>
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<td>Right</td>
<td>Primary</td>
<td></td>
</tr>
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<tr>
<td>C6</td>
<td>Female</td>
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<td>Secondary</td>
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</tr>
<tr>
<td>C7</td>
<td>Male</td>
<td>37</td>
<td>Right</td>
<td>College</td>
<td></td>
</tr>
</tbody>
</table>

2.2.1.1. Sentence completion

For the sentence completion task 30 transitive verbs were used. Each of the thirty transitive verbs was matched with an inanimate object to construct verb clauses (i.e., ‘to eat an orange’). The verb clauses depicted simple events, which were used to elicit the direct perception \( n = 10 \), the inferential \( n = 10 \), and the reportative \( n = 10 \) evidential forms. The verb
clauses were matched with a subject (i.e., kadın “the woman”) and a temporal adverb referring to past (az önce “previously”). Ten events were displayed with short motion clips (duration range: 15 – 20 seconds) where the whole action was shown from beginning to the end. The description of these events require the use of a verb inflected with –DI, the direct perception evidential. A photo with an initial state and a resultant state depicted ten events as an inferable evidence for what has happened (e.g., a man with an orange and a man with orange peels). The description of such a resultant state requires the use of a verb inflected with –mIş, the inferential evidential. Ten declarative sentences (each five words in length) inflected with the direct perception evidential (i.e., az önce adam çorap giydi “just before the man wore the socks”) were auditorily presented to the participants. They were asked to retell the sentences to another person. The retelling requires switching from the direct perception into –(I)mIş, the reportative evidential. Thus, the test items (n = 30) formed three conditions of information source, each appropriate for the use of an evidential form (see Figure 2.3 for examples of stimuli for each condition, and Appendix A2 for the list of verb clauses).

**Procedure for sentence completion**

The test items were presented to the participants through a laptop computer in randomized order in a single block. The test items started with a fixation of 2000 ms. The fixation was depicted with a plus centered on a white background. Two hundred ms offset to the presentation of each stimulus, a target sentence appeared in which the verb (in final position in Turkish) was left out. The target sentences were formatted in 36 point font in white color on a black background. The target verbs were given in bare form (i.e., ye “eat”) above the target sentences. The following instruction was given: “You will see different movie clips and photo pairs, and hear sentences in a random order. You should tell me what happened because I do not know. I have never seen or heard these items before. Ok? For this, after each item a sentence will appear. I will read aloud this sentence but the final part is left out. That is a verb. This verb is given above the sentence. But be careful. It
The sentence completion task was administered individually. Three extra items, one for each condition, were used in a practice session and these items were repeated until the task was fully understood. Once the experiment had started, presentation of the items was not repeated, but the experimenter repeated the target sentences, which the participants had to complete, when necessary. Each test item took one minute maximally.

The answers were scored as correct when the participant produced the verb with the intended inflection. Both a quantitative (accuracy of produced target verb forms) and qualitative (error types coding) analyses were performed. If the participant did not produce the verb or produced the verb in its bare form, this was counted as an omission error. If the participants produced an inappropriate verb form this was counted as a substitution error.

### 2.2.1.2. Source identification

The same thirty sentences that had to be completed in the production task were used. The sentences were all five words in length. The task was to identify one of the three categories of information source mapped onto the evidential forms. The source-relevant cues presented during the sentence completion task were different for each of the information source condition. (1) The video clips in the *direct perception* condition comprised of similar scenic details, that is, a simple kitchen setting. A female agent acted by the same actress performed all of the actions. The video clips did not include spoken material but the action relevant sounds were kept in (i.e., sound of cutting the bread, or watering the flowers). (2) In the *inferential* condition, the agents (half male and half female) were different from the directly perceived events to avoid the perceptual source confusions. (3) In the *reportative* condition, a female speaker told the events to the participants. Therefore, the three source types were cued by different characteristics.
Figure 2.3. Sample items from tasks used for elicited production of the evidential forms. In parentheses: expected correct responses.

**Procedure of source identification:** After the administration of the production tasks finished, a 10-minute break was given. The participants were not involved in any linguistic activity. The participants were not informed about the purpose of the second task. The sentences with correctly inflected verb forms were read aloud to the participants. The participants were asked to tell or show the correct type of information source for each sentence. This task required comprehension of the evidential forms to
identify the information source. Since this was not a production task, three choices were printed in descending order of (a) to (c) in the center of a landscape A4 sheet in 48 point font. The participants were instructed as follows: “I will read you some sentences from the previous task, please listen carefully and tell me where you know this information from? Did you hear it? Did you infer it? Or did you watch it? You can tell me or show it on this sheet.” The choice sheet included the following: a) Duydum “I heard it”, b) Tahmin ettim “I guessed it/inferred it”, and c) İzledim “I watched it”. Three versions of choice sheets were used with different ordering of options. An item was administered in the following order, for example:

**Examiner:** How do you know the following information?

- Az önce kadın çiçek suladı
- Previously woman flower water

**Participant:** İzledim! “I watched it” (or points to the appropriate choice)

Notice that the participants were provided with two clues: they could answer on the basis of their memory on the previous task and they could use the information provided by the verb inflection. The practice items from the production task, one for each condition, were used as practice items for the second task as well. These items were repeated until it was clear that the participants understood the task. The scores were analyzed quantitatively (accuracy for source identification) and qualitatively (error type analysis). A response was counted as correct when the participant mentioned the correct source. When the participants did not remember the source, it was counted as no-recognition. When they misattributed a source type to another, it was counted as a source misattribution. There were three types of source misattributions: (a) ‘thought to have heard’ is when the participant substituted a source by the reportative condition, (b) ‘thought to have inferred’ is when a participant substituted a source by the inferential
condition, (c) ‘thought to have seen’ is when a participant substituted a source by the direct perception condition.  

2.3. Results

2.3.1. Sentence completion

The NBDs performed at ceiling in all conditions for production. Therefore, their data were not further analyzed. Since the sample size was rather small and not normally distributed, non-parametric tests (Wilcoxon) were used for statistical analysis. The mean numbers and ranges of correctly completed sentences of agrammatic speakers in the three conditions are given in Table 2.3 (see Appendix A3 for individual scores).

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct perception evidential</td>
<td>2.14</td>
<td>(0-8)</td>
</tr>
<tr>
<td>Inferential evidential –ml$ş$</td>
<td>8.29</td>
<td>(4-10)</td>
</tr>
<tr>
<td>Reportative evidential –(I)ml$ş$</td>
<td>8.29</td>
<td>(5-10)</td>
</tr>
</tbody>
</table>

Agrammatic speakers had specific problems producing the direct perception evidential in comparison to the inferential evidential (Wilcoxon, $z = -2.043$, $p = .041$), and the reportative evidential (Wilcoxon, $z = -2.388$, $p = .017$). There was no difference in performance between the inferential

21 In the source condition ‘direct perception’ the relevant cues are not only visual; one may also perceive the events through their sounds (i.e., sound of watering the flowers). However, these other sensory cues co-occur with vision. We, therefore, refer this source category as ‘direct perception’.
and the reportative evidentials \((\text{Wilcoxon}, z = -.106, p = .916)\). The data, thus, support the first hypothesis.

One evidential form being selectively impaired is an interesting case of dissociation considering that all these perspectives refer to past events. This was further analyzed quantitatively by looking at individual error types. We observed that the agrammatic individuals made more substitution errors (94\% of all erroneous responses) than omissions (6\%). All of the substitution errors were related to verb inflection for evidentiality. Most errors were made in the direct perception condition. In most cases, the direct perception evidential was substituted by the inferential or the reportative evidential. Only a very small portion of substitution errors (3\%) concerned a modal construction \((-ebilir: \text{‘to be able to’})\). No other substitutions were observed.

2.3.2. Source identification

Agrammatic participants’ source identification was worse than that of NBDs, who also made errors on this task. However, for the NBDs, the errors were equally distributed over the conditions (all comparisons \(p > .05\)). The mean numbers and ranges of correctly answered source identification questions are given in Table 2.4.

<table>
<thead>
<tr>
<th>Source for</th>
<th>Direct perception</th>
<th>Inferential</th>
<th>Reportative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrammatic</td>
<td>7.71 (5 - 10)</td>
<td>2.29 (0 - 5)</td>
<td>2.71 (0 - 6)</td>
</tr>
<tr>
<td>Control</td>
<td>8.43 (6 - 10)</td>
<td>7.57 (6 - 10)</td>
<td>8.00 (4 - 10)</td>
</tr>
</tbody>
</table>
The agrammatic speakers were significantly worse in judging the correct information source than NBDs for the inferential condition (Wilcoxon, z = -3.14, p = .001), and for the reportative condition (Wilcoxon, z = -2.96, p = .001). However, they did not differ from the NBDs in recognition of the source for the directly perceived events (Wilcoxon, z = - .716, p = .535). Comparisons of agrammatic speakers’ performance across the three conditions confirmed that the direct perception as information source is easier to identify than the inferential (Wilcoxon, z = -2.37, p = .018), and the reportative (Wilcoxon, z = -2.37, p = .018). Inferred and reported events as information source conditions were both difficult to identify, and there was no significant difference between them (Wilcoxon, z = -.542, p = .588).

Table 2.5 demonstrates the total number of source errors and substitutions. The agrammatic participants made two types of source identification errors: (1) no-recognition (i.e., no answer or ‘I do not know’ responses), and (2) source misattributions. We observed three types of source misattributions types: (a) thought to have heard, (b) thought to have inferred, and (c) thought to have seen.

<table>
<thead>
<tr>
<th>Source Error Types:</th>
<th>Direct perception</th>
<th>Inferential</th>
<th>Reportative</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) No-recognition</td>
<td>7 (44%)</td>
<td>10 (19%)</td>
<td>13 (25%)</td>
</tr>
<tr>
<td>(2) Source misattribution</td>
<td>9 (56%)</td>
<td>44 (81%)</td>
<td>38 (75%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source misattributions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought to have seen</td>
</tr>
<tr>
<td>Thought to have inferred</td>
</tr>
<tr>
<td>Thought to have heard</td>
</tr>
</tbody>
</table>
In direct perception condition, agrammatic speakers made fewer source errors than they did in the inferential (Wilcoxon, $z = -2.201; p = .028$), and the reportative (Wilcoxon, $z = -2.207; p = .027$). There was no difference between source errors made in the inferential and reportative conditions (Wilcoxon, $z = -0.681; p = .496$). The ‘thought to have seen’ type of source errors outnumbered other source error types (76% vs. ‘thought to have heard’ 17%, and ‘thought to have inferred’ 7%, see Table 2.5.

### 2.3.3. Production and source identification compared

When individual production errors are inspected, six out of seven participants produced more errors with the direct perception evidential than they did with the inferential evidential. All seven participants made more errors with the direct perception evidential than the reportative evidential. It is clear that the direct perception is the most difficult evidential to produce for the aphasic speakers. Three participants made more errors in the inferential evidential than the reportative evidential, and three participants showed the reverse pattern. One participant made an equal number of errors in both conditions. The agrammatic speakers made more errors on the production task than they did in source identification. The lower performance in the production task is not surprising, as this task allows a wider variety of errors than in the multiple choice source identification task (chance = 33.3%).

### 2.3.4. Summary of results

The results showed that: (1) Agrammatic speakers performed worse when referring to past events than NBDs; (2) Agrammatic speakers found the direct perception evidential more difficult to produce than the inferential and reportative evidentials. (3) Responses in the source identification condition showed a contrasting pattern to the production condition: for directly perceived events it was easier to identify source albeit the
production difficulties in the linguistic expression of the direct perception evidential. However, the reverse was true for inferred and reported events.

2.4. Discussion

The data presented above showed that in Turkish, the verb forms that refer to directly perceived events are selectively impaired in agrammatic production. This selective pattern suggests that the problem with verb forms referring to the past is not a general tense problem. We have demonstrated that the selective nature of the deficit varies per information source conveyed by the evidential markers. Also, identifying the information source is affected. In the following we will discuss how these results relate to previous findings of verb inflection studies in agrammatic aphasia and of source monitoring studies.

2.4.1. Production of evidential forms

Our first research question was whether the different inflections for evidential categories are equally affected in Turkish agrammatic aphasia. We provided two sets of accounts that aim to capture the difficulty with verb inflection in agrammatism. First, the ‘tense relevant-accounts’ that associate the deficit to tense (Burchert et al., 2005; Clahsen & Ali, 2009; Faroqi-Shah & Thompson, 2007; Faroqi-Shah & Dickey, 2009; Friedmann & Grodzinsky, 1997; Gavarró & Martínez-Ferreiro, 2007; Wenzlaff & Clahsen, 2004; 2005). The idea of tense being impaired overall is challenged by our findings. We have argued that in Turkish evidentials, the reportative does not mark tense/aspect but contributes to evidential and modal interpretations only, unlike the inferential and direct perception forms both of which are tense/aspect and evidential (as well as mood) markers. In this respect, the data support Clahsen and Ali (2009) that the reportative evidential was less affected than the verb forms that mark
tense/aspect besides the mood. However, tense-relevant accounts predict the *direct perception* and *inferential* evidentials to be impaired. We did not find any difference between production of the *inferential* and *reportative* evidentials (both 83% correct). This might be due to the fact that the *inferential* and *reportative* evidentials share a common semantic origin (Aksu-Koç, 1988), although they demonstrate formal differences. Moreover, the production scores for the *direct perception* and *inferential* evidentials were significantly different in agrammatic production (21% vs. 83%, respectively) and these forms both mark tense/aspect and evidentiality. Hence, the deficits that underlie the selective deficits in evidential forms cannot be explained by a theory of a pure tense deficit.

By its nature, tense refers to a specific temporal frame. In Turkish past time reference, there is no tense marker that simply refers to a time frame without specifying the information source. The production deficits can be best explained by the direct versus indirect information source contrast. That is, among the evidentials the *direct perception* verb forms were more difficult to produce for agrammatic aphasia than the *inferential* and *reportative* verb forms. Bastiaanse et al. (2011) has proposed a specific hypothesis that captures time reference in aphasia. They argue that in order to refer to the past, the evaluation time needs to be linked to discourse (i.e., to be connected to some point or period in the past). Bastiaanse et al. (2011) combines the theories of Zagona (2003) who claims that past tense is discourse-linked and Avrutin (2006) who argues that discourse linking is impaired in agrammatic aphasia. Bastiaanse et al. (2011) propose that all verb forms referring to the past are discourse-linked, and hence, difficult for agrammatic individuals. The current data support the PADILIH. In our temporal analysis of evidentials, we stated that the *inferential* and *reportative* evidentials denote that the speaker has access to a past event through an evaluation time later than the actual event time. In the *inferential* evidential, time reference bears a present reference through its extension to resultative, but it shifts to past because the actual event was not witnessed but inferred from its results. Similarly, in the *reportative* evidential, the event time is irrelevant; the only relevant reference point is the evaluation time, which is, the moment of receipt of information. We argued that in temporal interpretation of evidentials, it is evaluation time that sets the reference. It can be argued that the *inferential* and *reportative* evidentials
make non-past reference through their evaluation time, following Enç (2004), who proposes that when there is no local binder, time reference of the inferential and reportative evidentials is established by taking evaluation time as speech time (Enç, 2004, p. 208). Based on this, and in line with Bastiaanse et al. (2011) who argues that not only tense, but any verb form referring to the past requires discourse-linking, we assume that the inferential and reportative evidentials do not require discourse linking as there is no relevant event witnessed by the speaker. Therefore, they are easier to produce for the agrammatic speakers. Equally important, production of the direct perception evidential was found to be severely impaired in aphasic individuals. This finding aligns with the results of Yarbay-Duman and Bastiaanse (2009) and Bastiaanse and her colleagues (2011) who also tested this particular verb form in Turkish.

2.4.2. Information source identification

Our second research question focused on a probable impairment in identification of information source in aphasic individuals. The task we presented to the participants was a source identification task. That is, it reflects whether aphasic individuals maintain the capacity to identify differential sources that were expressed by evidentials. Our findings demonstrate that aphasic individuals have specific problems in doing so. In particular, they showed a better recognition for directly perceived events than for reported or inferred events. Notice that the task required not only the source monitoring but also the processing of the evidential verb forms. The PADILIH predicts that source identification of these evidential verb forms should be selectively impaired for directly perceived events. This was, however, not the case. Thus, we need to interpret the data on the basis of the literature on source monitoring. An issue is how to interpret poorer performance in identifying inferred or reported events. The inferred and reported events are expressed by the inferential and reportative evidentials and are marked by phonologically overlapping forms (–mIš or –(I)mIš, respectively). This can lead to source confusions between inferred and reported events. However, this was not the case. The agrammatic speakers
substituted both inferred and reported events by directly perceived events (76% of all source misattributions, see Table 2.5). That is, they ‘thought to have seen’ the reported and inferred events. The phonological similarity does not seem to play a role. Alternatively, the inferential and reportative evidentials may sometimes express overlapping meanings as suggested by some theoretical accounts (Aksu-Koç, 1988; Lazard, 1999; 2001; Slobin & Aksu, 1982; Tantucci, 2013). Although the inferential and reportative evidentials were presented through different modes of sources in the experiment (the inferential through pictures, and the reportative through verbal report of another person) both categories may be represented as ‘indirect information’.

Previous studies on frontal brain damage patients22 (i.e., Janowsky et al., 1989; Shimamura et al., 1991; Swick & Knight, 1999; Swick et al., 2006) demonstrated that they have a high number of source misattributions in their source judgments. Similarly, we have shown that the agrammatic individuals have a high rate of misattributions shown by pointing to directly perceived events although they did not witness the events. This may be due to fact that in both conditions participants ‘saw’ either an event in clips or a final stage of an event in photos leading them to reply they actually ‘saw’ the event. In other words, the perceptual cues in the stimuli may have given rise to such source confusions. However, our findings do not reflect such an interpretation. NBDS did not confuse the directly perceived events with inferred events. Moreover, the aphasic individuals incorrectly attributed reported events to be seen events (36.2% of all source misattributions) in cases where they never saw the event. This implies that the agrammatic speakers ignore the information provided through these evidential verb forms. Thus, it seems as though the linguistic evidence is overridden by the (misattributed) memories.

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22 The source monitoring studies on frontal lobe pathology frequently reported groups of patients with lesions in the left PFC, but they do not necessarily report whether the patients had agrammatic problems comparable to Broca’s Aphasial. It is likely, though, that a number of participants had agrammatic syndromes when lesion sites are closely observed in the patients reported (e.g., Janowsky et al., 1989, p. 1045; Swick et al., 2006, p. 163).
Johnson and colleagues (1993) stated that memories for directly experienced events contain more vivid perceptual details than for events inferred or imagined. The source misattribution patterns suggest that there was a ‘perceptual bias’ as the directly experienced events was a default option that the agrammatic speakers relied on. This explains the reduced identification performance for inferred and reported events. However, such a bias does not seem to be enough to explain the high number of ‘thought to have seen’ source misattributions. A potential issue that limits us to draw conclusions on the nature of such an identification deficit is the source identification task we used. It included sentence level processing of obligatory source markers. It remains unclear whether the identification errors result from a deficit in linguistic processing of evidential forms or from a source memory problem. The poor performance on the task for identifying source types for inferred and reported events signals a need for closer inspection of source monitoring and sentence processing of evidential forms with separate tasks in aphasic individuals.

### 2.4.3. Evidentials and neuroanatomical representations

Considering that the participants’ brain lesions lead to malfunctioning in the left inferior frontal gyrus (and, probably of other brain areas, but that is not the point here), verb production deficits and source confusions fit with the idea that the substructures of language processing and source memory overlap, as suggested by a number of studies. The left prefrontal cortical lesions, including lesions in Broca’s area and its surrounding connections, have been identified to lead to impairments in production of grammatical and functional categories (Badecker & Caramazza, 1986; Bastiaanse, Rispens, Ruigendijk, Rabadán, & Thompson, 2002; Clahsen & Ali, 2009; Faroqi-Shah & Thompson, 2007; Jonkers & de Bruin, 2009; Nanousi, Masterson, Druks, & Atkinson, 2006 and many others) and in source memory (Mitchell & Johnson, 2000; 2009 for reviews). The current study has shown that both production of evidential categories and source identification are affected in individuals with agrammatic aphasia, albeit the
contrasting direction of the errors. In Turkish, we have discussed that source monitoring and evidentials might be correlated. For instance, the data of Tosun and colleagues (2013) showed that grammatical encoding of evidentials affects the memory for source in healthy adult Turkish speakers, implying that the obligatory coding of evidentiality leads to a degree of influence on memory for information source. Although the precise neural correlates will have to be left for future research, the current findings support the idea that monitoring the information source and coding of evidential forms on which they are mapped have overlapping processes that recruit areas in the left frontal lobe.

2.5. Conclusions

Across two tasks, we provided evidence that Turkish agrammatic speakers found the direct perception evidential more difficult to produce than the inferential and reportative evidentials. However, they misattributed the sources that map on the inferential and reportative evidentials (inference and verbal report of others, respectively) to seen events. We would like to suggest that information source values that are conveyed by evidential forms are dissolved in agrammatic aphasia. Turkish agrammatic speakers have problems in producing the direct perception evidential while they have a well-retained recognition of its source. We argued that the direct perception evidential refers to past evaluation time, whereas the inferential and reportative evidentials are bound to non-past evaluation times. The latter two, therefore, do not require discourse-linking. Hence, the production deficits are consistent with the PADILIH (Bastiaanse et al., 2011) which predicts that verb forms referring to the past are discourse-linked, and thus, difficult for agrammatic speakers. These findings are the first data pertaining to neurological representation of grammatically marked evidentials with regard to their dissolution in agrammatic Broca’s aphasia.