

Neurolinguistic & Psycholinguistic Investigations on Evidentiality in Turkish

Seçkin Arslan



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The work reported in this thesis has been carried out under the auspices of the Erasmus Mundus Joint International Doctorate for Experimental Approaches to Language and Brain (IDEALAB) of the Universities of Groningen (NL), Newcastle (UK), Potsdam (DE), Trento (IT) and Macquarie University, Sydney (AU) under grant no: 2012-1713/001-001-EMII EMJD.

A part of the work reported in this thesis was partially supported by an Alexander-von-Humboldt Professorship awarded to Prof. Harald Clahsen. Publication of this thesis was financially supported by the University of Groningen.



Groningen Dissertations in Linguistics 144

ISSN: 0928-0030

ISBN: 978-90-367-8532-7 (printed version)

ISBN: 978-90-367-8531-0 (digital version)

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Cover design: Ersel Aktaş (<https://www.behance.net/erselaktas>)

Printed by RUG Grafimedia

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Neurolinguistic and psycholinguistic investigations on evidentiality in Turkish

PhD thesis

to obtain the joint degree of PhD at the University of Groningen, the
University of Potsdam, the University of Trento, Newcastle University and
Macquarie University

on the authority of
the Rector Magnificus of the University of Groningen, Prof. E. Sterken, the
President of the University of Potsdam, Prof. O. Günther, the Rector of the
University of Trento, Prof. P. Collini, the Pro-Vice-Chancellor of the
University of Newcastle upon Tyne, Prof. S. Cholerton, and the Deputy
Vice Chancellor of Macquarie University, Prof. S. Pretorius
and in accordance with the decision by the College of Deans
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Acknowledgements

Studying evidentiality has been my passion last few years. I am so grateful that Roelien Bastiaanse, my supervisor and promoter, encouraged me to work on evidentiality. This thesis would not have been possible without her exceptional supportive attitude and eagerness to share her wisdom. I heartily thank Claudia Felser for accepting to be my second supervisor during and beyond my mobility at the University of Potsdam. I am grateful to Ayhan Aksu-Koç, who was my co-supervisor during my masters' studies, for invaluable discussions about evidentiality during various stages of my PhD, from which this thesis has benefitted abundantly. This thesis would not have been possible without İlknur Maviş who kindly accepted to collaborate with us on our aphasia projects. I am filled with gratitude that she helped while I assessed patients with aphasia and that from her involvement I gained many invaluable experiences. I am grateful to Dörte de Kok for all the help and supervision she had done for me during the first year of my PhD.

Although we have never met in person, I should be giving my sincere regards to Alexandra Aikhenvald for writing such a seminal book on evidentiality (OUP, 2004) that had turned into a *holy book* for me during the last three years.

I heartily thank IDEALAB directors, namely, Roelien Bastiaanse, David Howard, Barabara Höhle, Gabriele Miceli, and Lyndsey Nickels for bringing together wonderful means for us to conduct research across three continents, five main universities and over fifteen research centers and associate partner institutions. In particular, I would like to express my sincere gratitude to Gabriele Miceli and Lyndsey Nickels who organized the winter schools in Trento and Sydney, respectively. I am also very grateful to my IDEALAB colleges and professors for their constant feedback on the data that conformed this thesis. I express my warm thanks to Harald Clahsen for allowing me to be a part of Potsdam Research Center for Multilingualism (PRIM) as well as for the trust he have put in me and for his very supportive attitude.

I thank my colleagues from the IDEALAB program for their sincere friendship: Adrià, Ana, Farnoosh, Jakolien, Jinxing, Katharina, Leigh, Laura, Miren, Michela, Nastia, Rimke, Rui, Kata, Fleur, and Srdjan. I owe a lot to (past) members of the Neurolinguistics Group at the University of Groningen: Roel, Dörte, Toivo, Tom, Silvia, Stéfanie, Camilla, and Alice. I feel very contented to have met my colleagues at the PRIM: Anna, Clare, Gunnar, Judith, Joao, Sol, Mona, Vera, Yulia, and Michaela. I am also very grateful to members and associates of Groningen Turkish Students Association for their endless friendship: Turhan başgan, Funda, Yağız, Veclal, Meniz, Yiğit, Hasan, Arman, and many others who I have not yet mentioned. I am particularly indebted to Burcu Arslan and Elif Bamyacı for several occasions of very fruitful discussions on evidentiality (and for the drinks).

Collecting the data reported in this dissertation required me to travel to many places: Groningen, Berlin, Eskişehir, Amsterdam, and so on. A big ‘thanks’ goes to all the participants who volunteered to take part in our experiments and surveys.

I am indebted to Ria de Bleser, Kees de Bot, Ayşe Gürel, and Pieter Muysken for kindly accepting to be in my assessment committee. My sincere appreciation also goes to organizers of the Science of Aphasia conference, Aphasia Young Day, and to the members of Netherlands Aphasia Foundation (SAN) for allowing me to present our data and get feedback on it from several other colleagues and researchers. I express my sincere gratitude to members and teachers of GraduatFe School for Behavioral and Cognitive Neurosciences (BCN) and Neuroimaging Center Groningen (NIC) for their help.

Last, but not the least, I thank my dear wife, Pınar, who never suspended her support and confidence in me. I also thank her for being the ‘female native speaker voice’ of our experimental stimuli sentences, and for her endless support during recruiting participants. This thesis would never have been possible without her standing by me.

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CHAPTER 1

1. General introduction

In about a quarter of the world languages, choosing a verbal form to describe an event depends on the type of evidence available to the speaker (Aikhenvald, 2004). This is referred to as ‘evidentiality’, the linguistic expression of information sources the speaker has available for his statement (Aikhenvald, 2004; Chafe & Nichols, 1986; De Haan, 1999; Givón, 1982; Lazard, 2001; Mushin, 2000; Plungian, 2001, 2010; Willett, 1988). In recent years, there have been an increasing number of analyses describing different types of evidential systems in languages around the world; however, experimental studies on those systems are limited. The next four chapters cover the experimental investigations on evidentiality in Turkish.

1.1. Introduction

In Turkish, finite verbs are marked for direct (**-DI**) and indirect evidential (**-mİş**) forms, requiring the speaker to distinguish whether the event being described is known from direct or indirect sources. This dissertation aims to unveil the cognitive underpinnings of evidential morphology in Turkish with regard to its loss in aphasia and in bilingual heritage speakers. In particular, the following experimental aspects of evidentiality are investigated: (1) *Neurolinguistic aspects*, whether and how the evidential forms dissolve in speakers with aphasia, and (2) *Psycholinguistic aspects*, how evidential forms are processed in real-time by healthy monolingual and bilingual speakers of Turkish, with a focus on heritage speakers. In this section, the neurolinguistic and psycholinguistic lines of research will be briefly introduced, relevant features of the evidential forms in Turkish will be described, and issues addressed in this dissertation will be spelled out.

1.1.1. Neurolinguistic aspects: Studies on agrammatic aphasia

Aphasia is an acquired language disorder as a result of brain damage. There are several reasons that cause aphasic symptoms to surface. One of the most common causes is a stroke, which, in the case of aphasia, disrupts the blood supply to the language areas of the brain. However, aphasia can also be a consequence of traumatic brain injury, brain tumors, intracranial infection, or other forms of neurodegenerative diseases. Post-stroke aphasia is the most commonly observed clinical case in Turkey, where about 100,000 people suffer from stroke each year, and quite a high proportion of those patients acquire aphasia (Maviş, 2007). Types of aphasia are often classified on the basis of speech output: fluent and non-fluent (agrammatic). The current dissertation deals with the latter.

Most incidences of non-fluent aphasia demonstrate an agrammatic speech pattern, which is characterized by reduced grammatical complexity and correct sentences, short utterances, telegraphic speech pattern, and a sustained difficulty with verbs and verb morphology (Bastiaanse & Jonkers, 1998; Menn & Obler, 1990; Miceli, Silveri, Romani, & Caramazza, 1989; Saffran, Berndt, & Schwartz, 1989). Agrammatic speakers frequently omit and/or substitute inflectional morphology (Badecker & Caramazza, 1986). However, many studies have shown that not all areas of inflectional morphology are equally prone to agrammatic impairments: while agreement and/or mood morphology is relatively spared, tense morphology is affected (e.g., Burchert, Swoboda-Moll, & De Bleser, 2005; Clahsen & Ali, 2009; Stavrakaki & Kouvava, 2003; Wenzlaff & Clahsen, 2004, 2005).

Within Tense impairments in agrammatism, however, the degree and likelihood of a Tense form being impaired are related to the semantic category onto which they map. That is, verb forms that refer to the past are found to be more impaired in agrammatic speakers than verb forms that refer to present and future time frames (Abuom & Bastiaanse, 2013; Bastiaanse et al., 2011; Bos & Bastiaanse, 2014; Bos, Dragoy, Avrutin, Iskra, & Bastiaanse, 2014; Yarbay-Duman & Bastiaanse, 2009). Bastiaanse et al. (2011) hypothesize that past time-reference (be it through verbs or aspectual adverbs) is difficult for agrammatic speakers. This is based on Zagana's (2003) claim that past tense verbs require discourse linking¹ and Avrutin's (2000; 2006) results showing that discourse-linked elements are impaired in agrammatic aphasia. Bastiaanse coined this hypothesis the Past Discourse Linking Hypothesis (PADILIH; see Bastiaanse, 2013 for an overview).

¹ Zagana (2003) proposes that the use of a Tense form is licensed with regard to relations between event-time and speech-time as internal/external arguments. According to this hypothesis, past tense is a referential expression requiring an external argument (i.e., at the level of discourse) and event-time is disjointed from speech-time whereas in non-past tenses, event-time is within the maximal projection of the verb.

1.1.2. Psycholinguistic aspects: Studies on heritage bilingualism

A heritage language is defined as the ‘family language’ that is spoken by the households of an individual which is different than what the society speaks (Valdés, 2005). The term *heritage language* is also used in reference to ‘immigrant’, ‘refugee’ and ‘indigenous’ languages (Wiley, 1999). Within the European perspective, however, heritage languages are commonly referred to as ‘minority languages’ (De Bot & Gorter, 2005).

In this thesis, a rather narrow definition of a heritage-language speaker is adopted: an early bilingual speaker of a heritage (immigrant, minority, or family language)² and a dominant majority-language pair. Essentially, heritage speakers are asymmetrical bilinguals, as they acquire their family language in childhood, but in time, their second language becomes more dominant (see also Benmamoun, Montrul, & Polinsky, 2013). Heritage-language speakers, especially those who have acquired their languages in an immigrant setting, tend to diverge from monolingual speakers in several aspects of their first language. For instance, Doğruöz and Backus (2009) have shown that Turkish spoken in the Netherlands differs in many ways from Turkish spoken in Turkey.

Experimental investigations on heritage-language speakers are relatively new and expanding. Most of these studies have concentrated on heritage languages spoken in the U.S. (see studies on Spanish by Montrul, 2002, 2008, 2009; Silva-Corvalán, 1994, on Portuguese by Rinke & Flores, 2014; Rothman, 2007, on Russian by Polinsky, 2008, 2011; Sekerina & Sauermann, 2014, on Korean by Kim, Montrul, & Yoon, 2009, and on Arabic by Albirini & Benmamoun, 2012; Albirini, Benmamoun, & Chakrani, 2013; Albirini, Benmamoun, & Saadah, 2011). What these studies have shown is that heritage speakers perform worse on linguistic tasks in their first language as compared to monolingual speakers; and that

² Not to be confused with minority communities (e.g., religious and ethnic groups), here the term minority language is taken as a language that is used by a smaller number of speakers as compared to the speakers of a dominant majority language.

verbal morphology is particularly affected. That is, heritage speakers tend to be less sensitive to grammatical properties of their first language than monolingual speakers.

Roughly, there are two accounts that attempt to explain the nature of language loss shown in heritage speakers' performances in verbal morphology: *attrition* and *incomplete acquisition*. Attrition means that certain language structures erode after full acquisition of the first language (Cook, 2003; De Bot & Weltens, 1991; Gürel, 2004; Köpke, Schmid, Keijzer, & Dostert, 2007; Köpke & Schmid, 2004; Pavlenko, 2004; Seliger & Vago, 1991; Sorace & Serratrice, 2009; Yağmur, 1997). First language attrition has been associated with late bilingualism, yet there is evidence that heritage speakers may also be affected by attrition (Polinsky, 2011). Incomplete acquisition means that properties of the first language, especially the ones that do not occur in the second language, are prone to incomplete acquisition processes during childhood, and hence, are not properly acquired by heritage speakers, which leads to 'gaps' in their grammars (e.g., Albirini et al., 2013; Albirini et al., 2011; Montrul, 2002, 2008, 2009; Polinsky, 2006).

Not all areas of inflectional morphology are globally affected in heritage grammars. Most of the studies that demonstrated asymmetrical incomplete acquisition and attrition patterns in heritage speakers have argued in favor of the *interface vulnerability*. This is based on the Interface Hypothesis (Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009). According to this point of view, integrating information from different linguistic levels into an interface (e.g., the syntax–pragmatics interface) is effortful for bilingual individuals. However, language structures requiring knowledge in a single linguistic domain (e.g., core syntax) are relatively spared in language attrition and incomplete acquisition.

1.2. Linguistic introduction

1.2.1. Evidentiality: A brief snapshot

Evidentiality expresses how a speaker obtains knowledge about an event, such as, but not limited to, eye-witnessing, hearing, reporting, and inferring (Aikhenvald, 2003, 2004; Aksu Koç, 2009; Boas, 1938; Jakobson, 1957; Mushin, 2000; Plungian, 2010; Willett, 1988). In most languages, evidentiality may be expressed by either lexical means or verb semantics. For instance, the speaker attests witnessed information in the following sentence: “I saw two boys walking home.” However, referring to information sources constitutes an obligatory grammatical category in certain languages, as Boas (1938) and Jakobson (1957) pointed out. That is, by using these grammatical ‘evidential’ forms, the speaker is able to communicate from which sources he/she obtains knowledge about an event. However, not all ‘evidential’ languages have a universal way of marking evidentiality. The number of evidential terms in a language and their semantic complexity vary considerably across languages.

Table 1.1 presents an overview of Aikhenvald’s (2004) classification of information sources marked by evidential forms. According to Aikhenvald’s analysis, the following information sources surface as verbal forms: VISUAL, SENSORY (or non-visual), INFERENCE, ASSUMPTION, REPORTED, and QUOTATIVE. It is unknown whether a language with all these evidential forms exists. Occasionally, one or two of those semantic categories of information sources may be expressed within one evidential form. For instance, most Balkan languages morphologically mark indirect information that may cover inference and reported (and sometimes, assumed) information sources.

Table 1.1. *Types of evidential forms and their meanings based on Aikhenvald's (2004, pp. 63-64) classification*

<i>Evidential form</i>	<i>Meaning</i>
VISUAL	Witnessed (seen) information
NON-VISUAL	Non-witnessed information acquired by hearing, smelling, taste, or touch
INFERENCE	Non-witnessed information evidenced on the basis of physical clues or resultant states
ASSUMPTION	Information deduced on the basis of logical reasoning or general knowledge
REPORTED	Reported information from another speaker (i.e., hearsay)
QUOTATIVE	Reported information with a particular reference to its source

Turkish is a member of the *two-term* evidential languages, like several other Eurasian languages (including Armenian, Bulgarian, Georgian, Iranian). As the name suggests, two-term evidential languages typically have two verb forms designated to express information source, commonly referred to as *direct* and *indirect* evidentials (Friedman, 2003; Johanson & Utas, 2000; Slobin & Aksu, 1982, among others).³

In larger paradigms, there may be three to five evidential forms available. Consider Cuzco Quechua, a Quechuan language mostly spoken in Peru, where information source distinctions are expressed through three verb forms: direct (**-mi**), inference or conjectural (**-ch'a**), and reportative (**-si**) evidential enclitics (Faller, 2002). See also Floyd (1999); Muysken (1995), and Weber (1986) for other Quechuan languages/dialects. In contrast to the Turkish indirect evidential, Quechua has grammatical ways to dissociate inferred information from reported information. There are

³ Friedman (1986) refers to the direct-indirect opposition as *definite* and *indefinite* past tenses. This is possibly based on the typological tradition that evidentiality in most Balkan languages is assumed to have been derived from past tenses and/or perfect aspect markers historically; see also Friedman (1978, 2004).

some other languages, where direct information is divided into visual and non-visual (sensory) evidence marked by separate verb forms. Consider Tucano, a language spoken in the Amazon in Brazil, where there are four evidentials allowing the speaker to express visual (**-ámi**), non-visual (**-ásĩ**), inferred (**-ápi**), and reported (**-ápi**) information (Aikhenvald, 2004, p. 52).

To summarize, evidentials are expressed through inflectional morphology referring to types of information sources in a number of languages. Availability, distribution, and semantic complexity of different evidential terms vary typologically. Turkish belongs to a two-term evidential system, whereby types of direct and indirect evidence of the speaker for his proposition are grammaticalized. Below, relevant properties of evidentiality in Turkish are described in detail.

1.2.2. Evidentiality in Turkish

Describing events in the past for a Turkish speaker comes with two ‘flavors’: Either the direct or the indirect evidential form is chosen for situations known through direct or indirect information sources, respectively. These evidential forms are inflectional morphemes designated for finite verbs and non-verbal predicates. The morpheme **-DI** is used when one aims to communicate that what is being said is based on direct information: the speaker is the firsthand source. The morpheme **-mİş** is chosen when the speaker is not the firsthand source and the information asserted is known indirectly by report of another speaker or by inference; see Aksu-Koç and Slobin (1986); Erguvanlı-Taylan (1997); Sezer (2001); Slobin and Aksu (1982). Hence, if someone wants to communicate the meaning of the sentence “Kemal arrived” in Turkish, there are two options: with a direct evidential or with an indirect one, as illustrated in (1a)-(1b).

- (1) a. Kemal **geldi** [Slobin and Aksu (1982, p. 187)]
 Kemal come DIRECT EVID 3SG
 “Kemal arrived” (witnessed information)
- b. Kemal **gelmiş**
 Kemal come INDIRECT EVID 3SG
 “Kemal arrived” (inferred or reported information)

The default reading of the evidential forms, when appended to simple, finite verbs, indicates that the event being described happened in the past, unless supported by non-past temporal adverbs. Hence, the use of a direct evidential, as in (1a), is typically licensed by the speaker’s direct experience regarding a past event, and the use of an indirect evidential, as in (1b), is linked to a form of indirect evidence about a past event. See also section 1.2.5 for time reference in Turkish evidentials.

1.2.3. The direct evidential

The direct evidential, marked by the morpheme –DI as well as the predicate-final particle IDI, denotes that asserted information is based on the speaker’s firsthand access to its source, which can be the speaker’s eye-witnessing, participation, or direct perception.⁴ Lewis (1967) defines -DI as the “past events known to the speaker” and Underhill (1976) referred to this verb form as the “definite witnessed past.” Aksu-Koç (1988, 2000); Aksu-Koç and Slobin (1986); Slobin and Aksu (1982) argued that the morpheme

⁴ Notice that the direct evidential form may also be used for non-witnessed but well-assimilated historical events. In (i) below, a historical event is described, which the speaker cannot have witnessed, yet a direct evidential is used. Well-known historical events are assumed to be witnessed by the society, thus, the use of direct evidential is reasonable in such contexts, see also Plungian (2010).

- (i) Kemal Paşa Selanik’tе doğdu. [Johanson (2006, p. 85)]
 Kemal Paşa Thessaloniki LOC bore DIRECT EVID.3SG
 “Kemal Paşa was born in Thessaloniki”

marks the “past of the direct experience.” On the basis of these accounts, in this dissertation, we argue that the morpheme –DI marks the ‘direct evidential’ whose use is appropriate in contexts that relate to the speaker’s direct experience⁵ see (2a)-(2c) for examples.

- (2) a. Adam sütü içti
 Man milk_{ACC} drink_{DIRECT EVID.3SG}
 “The man drank the milk” (visual firsthand evidence: the speaker witnessed the event)
- b. Adam bizimle top oynadı
 Man_{us} _{INSTRUMENTAL} ball play_{DIRECT EVID.3SG}
 “The man played football with us” (participatory firsthand evidence: the speaker participated in the event)
- c. Güller çok güzel koktu
 Roses very beautiful smell_{DIRECT EVID.3SG}
 “The roses smelt so nice” (sensory firsthand evidence: the speaker smelled the roses)

As argued above, the uses of the direct evidential is associated with a form of direct evidence. In (2a), for instance, it is conceivable that the speaker saw that the man was drinking milk. The use of a direct evidential form may also be licensed by the speaker’s participation in the event, as illustrated in (2b). A third possible context where the use of a direct

⁵ Notice that the precise evidential status of the direct evidential is subject to debate among Turkish linguists. According to Johanson (2003), the morpheme –DI, which we introduced as the direct evidential form here, does not consistently make reference to direct experience or visual evidence. This is based on an assumption that the direct evidential is taken to be an unmarked neutral opposition of the indirect evidential form. Many other descriptive analyses, however, suggest the contrary; see for instance, Aksu-Koç (2000); Kornfilt (1997b); Lewis (1967).

evidential would be appropriate is the speaker's direct non-visual experience based on a piece of sensory evidence, as shown in (2c).⁶

1.2.4. The indirect evidential

The indirect evidential, marked with the morpheme *-(I)mİş*⁷ as well as the predicate-final particle *Imİş*, conveys that the description of an event is based on a type of non-firsthand or indirect information. Turkish linguists treat the morpheme *-(I)mİş* as the past of indirect experience (Banguoğlu, 1974; Johanson, 1971) or as a marker of inferred past (Cinque, 2001; Lewis, 1967). Underhill (1976) states that *-(I)mİş* codifies that a piece of information is not a part of the speaker's previous knowledge.

The indirect evidential form marks three differential contexts: inference, report (hearsay), and surprise (Slobin & Aksu, 1982).⁸ Inferential readings associated with the indirect evidential are linked to a type of non-witnessed evidence on the basis of which the speaker conjectures that an event happened without previous knowledge about that event. Kinds of

⁶ Non-visual sensed events may also be described using the indirect evidential form, see Johanson (2000). For instance, one can utter *Çorba çok tuzlu olmuştur* INDIRECT EVID "The soup happens to be very salty" after taking a sip from the soup.

⁷ According to some studies, there are two distinct morphological forms to mark indirect evidence. Namely *-mİş* and *-(I)mİş*; see for instance, Csátó (2000). According to these analyses, the morpheme *-mİş* is used on the bare verb stem, marking both past time-reference and inferential contexts, while the morpheme *-(I)mİş* is used on complex verbs (i.e., after aspectual or mood suffixes) and nominal predicates to mark indirect information, especially in reportative contexts (e.g., Aksu-Koç, 2000); but see also Gül (2009).

⁸ Marking of surprise is referred to as *mirativity*. In Turkish, mirative readings of the indirect evidential may indicate that the event indirectly experienced by the speaker is unexpected and surprising (Aksu-Koç & Slobin, 1986; DeLancey, 2001). Since the current thesis concentrates on information source specifications of the evidential forms, their mirative connotations will not be further discussed.

evidence that lead to inference may be physical or sensory clues that are either results of the event or the speaker's deferred realization of an existing state. The reportative readings of the indirect evidential encode that the speaker knows an event through 'hearsay' or utterances of another speaker. See (3) for an example.

- (3) Adam sütü içmiş
 Man milk_{ACC} drink_{DIRECT EVID}
 "The man drank the milk" (non-witnessed, indirect information)
 a. *Inference*: the speaker saw an empty glass of milk, which
 possibly the man had drunk
 b. *Report*: the speaker has been told about this event

The use of an indirect evidential in (3) gives rise to two possible scenarios with regard to the information source of the event being referred to. One possible scenario is that the event is known to the speaker through an inferential process, as provided in (3a). Here in this specific example, the speaker may see an empty glass and that the man seems pleased, leading the speaker to infer that man had drunk the milk. Another possible scenario for the use of the indirect evidential, as described in (3b), is that the event has been reported to the speaker.

The use of indirect evidential is compatible with contexts where the speaker's information on an existing state is delayed (i.e., deferred realization), although the actual event may have been in progress within the immediate environment as the speaker. Consider (4).

- (4) Bu ağaç ne çabuk büyümüş
 This tree what quick grow_{INDIRECT EVID 1.SG}
 "How quickly this tree has grown"

The use of the indirect evidential in (4) is triggered by the speaker's deferred realization of the event. Such uses of the indirect evidential are

consistent with verbs expressing slow gradual progress, which is often not immediately possible to witness (i.e., one needs to wait day-and-night to actually attest how quickly a tree grows).

Deciding which evidential form to choose in describing an action is determined by whether the information has been accessed by the speaker himself or by someone else. Hence, the marking of an evidential context and that of person is correlated. Arguably, indirect evidentials may be preferably used with non-first-person rather than first-person (Curnow, 2002). Aikhenvald (2004) argues that it works against intuition when one talks about his own information while using an indirect evidential form, as the use of a direct evidential is linked to a type of witnessed evidence. In Turkish, this mismatch between the first-person context and indirect evidential is largely reasonable. Aksu-Koç (2000); Aksu-Koç and Slobin (1986) state that the indirect evidential form may convey a “lack of conscious involvement” of the speaker; as shown by examples (5a)-(5b).

- (5) a. Elimi kesmişim
 Hand ISG POSS ACC cut INDIRECT EVID ISG
 “I have cut my hand” (speaker lacks control over an
 unintentional action); (Aksu-Koç & Slobin, 1986, p. 160).
- b. ? Kitap okumuşum
 Book read INDIRECT EVID 1ST SG
 “I have read a book” (speaker lacks control over an intentional
 action?)

In (5a), an indirect evidential is used in the first-person context. However, this is a reasonable reading since the verb “cut” here conveys an unintentional action (i.e., it is a non-volition verb). The action was carried out without the speaker’s intention, and the speaker notices the action at a later time. In (5b), the speaker claims that he has read a book without consciously participating in it. Thus, the use of an indirect evidential in (5b) is unreasonable or counter-intuitive, at least in standard Turkish.

A final note on the indirect evidential: this evidential form has been traditionally analyzed as an epistemic modal marker (Aksu-Koç, 2000; Aksu-Koç & Slobin, 1986) relating the attitude of the speaker towards the truth of his proposition.⁹ However, Johanson (2000, p. 81) disagrees with this and states that “the markers [i.e. the indirect evidential forms] are certainly epistemic in the sense that they concern the dimension of experience, but their task is not to express the speaker’s attitude to the truth of the propositional content.” Integrating these two points of view, it is assumed here that epistemic implications are marked by the indirect evidential to an extent. This is based on the idea that expressing information evidenced indirectly hinders the reliability of its source. However, as we will argue in this dissertation, epistemic modality is not the primary function of the evidential forms.¹⁰

1.2.5. Time reference and Turkish evidentials

Information source and time reference interact in contexts where Turkish evidentials are marked. As mentioned above, when applied to simple verbs, evidentials refer to past events. This is a possible reason why traditional Turkish grammars treat the evidential forms as past tenses (e.g., Banguoğlu, 1974; Underhill, 1976). This viewpoint seems to be legitimate to a degree,

⁹ Whether evidentiality is a part of a modal system or has its own category is a much-debated controversy in the literature. Some treat evidentiality as a part of epistemic modality that deals with “degree of commitment of the speaker to the truth of his proposition” (Chafe & Nichols, 1986; Givón, 1982; Palmer, 1986; Willett, 1988). However, evidentials are assumed to constitute their own grammatical category independent of mood by recent studies (Aikhenvald, 2003, 2004; Cornillie, 2009; De Haan, 1999, 2005; Joseph, 2003; Plungian, 2001); but see Boye (2010) for arguments.

¹⁰ In the current dissertation, information source specifications of the evidential forms are addressed in their narrow semantics. Hence, extended semantics of the epistemic connotations will not be further discussed at this stage; however, interested readers can see Aksu-Koç (2014); Erguvanlı-Taylan (2014); Palmer (1986).

at least for the direct evidential, which is assumed to mark past events consistently.¹¹ However, when interactions between time reference and information source are considered, the picture becomes too complex to simply assume that both direct and indirect evidentials are past tenses only. Moreover, the aspectual nature of the evidential forms has been addressed in several studies, establishing that both the direct and indirect evidentials mark perfect aspect, which conveys completeness of the event being referred to (e.g., Erguvanlı-Taylan, 1997; Johanson, 1971, 2003; Kornfilt, 1997b; Taylan, 1984). Hence, the so-far conducted analyses on the temporal characteristics of the evidential forms are inconclusive when explaining the interactions between information source and time reference. Therefore, if it is assumed that both of the evidential forms are past tense and perfect aspect, the choice of one evidential over the other must be determined by their temporal or aspectual values. However, Yavas (1980) argues that when used on complex verbs or nominal predicates, the indirect evidential is not a tense/aspect marker but an evidential marker only.¹²

It is assumed here that evidentials have their own temporal characteristics, distinct from that of tense. This is based on Aikhenvald (2004, p. 99) who

¹¹ Also see Sezer (2001) who shows that the direct evidential, or the "definite past" as he calls it, marks present time-reference with verbs that indicate psychological or physical states, as shown in (ii).

(ii) şimdi	çok	üzüldüm	(Sezer, 2001, p. 10)
now	very	sadden	DIRECT EVID. 1SG
"I am very saddened now"			

¹² Consistent with this idea, the indirect evidential may be used after a tense/aspect marker, indicating that a non-past event is known through indirect information. In such contexts, the indirect evidential waives its past time reference value, as given in (iii).

(iii) Ali	akşam	çaya	gelecekmiş
Ali	night	tea _{ACC}	come _{FUTURE.INDIRECT EVID. 1SG}
"Ali will come for tea tonight, as I was told"			

argues that “time reference of an evidential does not have to coincide with that of the event.” Applying this analysis to Turkish, it reveals that the assumed ‘indirect past’ may indeed shift to present readings. Sezer (2001) shows that the uses of indirect evidential are consistent with past, present, and future temporal adverbs. This is an unexpected condition for a past tense or (present) perfect aspect morpheme. In a similar vein, Enç (2004) shows that the indirect evidential form may be ambiguous between past and non-past readings. In this thesis, we combine the idea that evidentials have their own temporal characteristics with the observations of Sezer (2001) and Enç (2004). In this respect, the reference point that best suits the Turkish evidentials is the time when the speaker receives the information about an event (i.e., evaluation time), rather than the actual event time. This issue is discussed in detail in Chapter 2.

1.2.6. Turkish evidentials in interrogative clauses

So far, the use of evidential forms in declarative clauses has been discussed, however, several studies have shown that evidentials in interrogative clauses have different meanings than those in declarative clauses (Aikhenvald, 2004; Faller, 2002; San Roque, Floyd, & Norcliffe, in press). Aikhenvald (2004) suggests that evidentials in interrogative clauses may convey information sources available to the questioner or to the addressee. Not much has been written about the uses of Turkish evidential forms in interrogative clauses.

In (6a)-(6b) and (7a)-(7b), question and answer pairs are given to illustrate direct and indirect evidentials in *wh*-questions, respectively.¹³

- (6) a. Hangi adam elmayı yedi?
 Which man apple ACC eat DIRECT EVID.3SG
 “Which man ate the apple?” (The speaker assumes that the
 addressee has direct evidence)

¹³ For the purposes of the current thesis, only *wh*-questions are addressed. However, interaction between the evidential terms and interrogativity is drastically large.

b. Bu adam yedi
 This man eat DIRECT EVID.3SG
 “This man ate (the apple)” (The addressee has direct evidence or
 witnessed the apple being eaten)

(7) a. Hangi adam elmayı yemiş?
 Which man apple ACC eat DIRECT EVID.3SG
 “Which man ate the apple?” (The speaker assumes the that
 addressee has no direct evidence)

b. Bu adam yemiş
 This man eat DIRECT EVID.3SG
 “This man ate (the apple)” (The addressee has no direct
 evidence)

The choice of a direct evidential form, as in (6a), signals that the information source is available to the addressee. The questioner presumes that the addressee witnessed the person eating the apple, hence, a direct evidential is selected. However, in (7a), the questioner surmises that the addressee has indirect information (e.g., inference or report); thus, an indirect evidential is preferred. In Chapter 5, this issue will be further discussed.

1.2.7. Evidentials and their narrative functions

The evidential forms are often used as narrative conventions, based on how the story being narrated is known to the speaker. In Turkish, the indirect evidential form is utilized as a narrative marker in relating events in conventional stories such as fairy tales etc. (Aksu-Koç, 1988; Johanson, 1971). The direct evidential is the appropriate form for narrating events that are relevant to the personal experience of the speaker.

1.3. Issues addressed within this dissertation

As discussed above, evidentiality is expressed through verb inflections in Turkish. Previous studies on aphasia and heritage bilingualism have shown that verb morphology is affected in these populations. In this thesis, the nature and extent of the language loss in evidential morphology is investigated from both pathological and non-pathological perspectives. The outcomes of these two lines of research are informative to the linguistic theories on evidentiality.

1.3.1. Neurolinguistic aspects of evidentiality

It has been shown that individuals with aphasia have problems with discourse-linked language structures (Avrutin, 2000; 2006). Bastiaanse et al. (2011) argue that reference to the past through grammatical morphology is impaired in agrammatic speakers for this reason: past time reference requires discourse linking. Past Discourse Linking Hypothesis (PADILIH) captures this by predicting that past time-reference involves access to information outside the sentence whereas non-past time reference does not since speech time and event time coincide. The PADILIH has received support from studies on several languages: Chinese, English, Turkish (Bastiaanse et al., 2011), Dutch (Bos & Bastiaanse, 2014), Russian (Bos, Dragoy, Avrutin, Iskra, & Bastiaanse, 2014; Dragoy & Bastiaanse, 2013), Spanish and Catalan (Martínez-Ferreiro & Bastiaanse, 2013; Rofes, Bastiaanse, & Martínez-Ferreiro, 2014), and Swahili and English (Abuom & Bastiaanse, 2013), to cite a few. In all of these languages, there is a selective impairment in referring to the past.

However, Turkish differs from these languages as it expresses evidentiality as a grammatical category, forcing the speaker to make a choice between the two verb forms that refer to the past. To find out how evidentials are affected in agrammatic aphasia, two studies have been carried out investigating *neurolinguistic aspects of evidentiality*. In

particular, two main research questions have been addressed by these studies:

- 1) Are Turkish agrammatic speakers able to produce the evidential verb forms that are linked to the respective information sources; are they able to identify the information source perspectives that the evidential verbs map onto?
- 2) Are the uses of the evidential verb forms affected compared to other verb forms in Turkish agrammatic speakers' narrative speech production?

These issues are addressed in Chapters 2 and 3.

1.3.2. Psycholinguistic aspects of evidentiality

As mentioned above, one of the aims of this dissertation is to understand how evidential verb forms are affected in bilingualism, especially in heritage speakers, whose first language (Turkish in this case) is a minority language. Previous studies on heritage speakers of Spanish (Montrul, 2002, 2008, 2009), Russian (Polinsky, 2006, 2008), and Arabic (Albirini et al., 2013; Albirini et al., 2011) among others have shown that verb inflections are particularly affected in this group as compared to monolingual speakers. Turkish typologically differs from these heritage languages with regard to the grammatical expression of evidential distinctions. The nature of evidentiality processing in heritage bilingualism has not been experimentally studied before.

In order to explore how the evidential forms are prone to attrition and/or incomplete acquisition in heritage speakers, two studies have been performed focusing on the *psycholinguistic aspects of evidentiality*. The following two research questions have been addressed in these studies:

- 3) To what extent is Turkish heritage speakers' processing of the evidential verb forms affected by incomplete acquisition or

attrition? Do the heritage speakers retain a monolingual-like sensitivity to sentential contexts where evidential forms are violated?

- 4) How do Turkish heritage speakers, as compared to late bilinguals and monolinguals, interact with forms of visual evidence presented in a virtual visual-world setting while listening to sentences with evidential forms, consistent with the given visual stimuli?

1.4. Outline of this dissertation

The following four chapters in this dissertation address the above-mentioned research questions. The next two chapters aim to contribute to our understanding of the *Neurolinguistic aspects of evidentiality*:

Chapter 2 aims at investigating production of evidential morphology and identification of the information sources that the evidential forms refer to in Turkish agrammatic aphasia. This is made possible by using two tasks: a sentence-production task where evidential verb forms were to be produced, and a source-identification task where the participants were asked to recollect information sources that map onto the evidential forms. According to theories of ‘tense impairment’, agrammatic speakers have more problems with tense forms over mood or agreement morphology (i.e., Friedmann & Grodzinsky, 1997; Wenzlaff & Clahsen, 2004, 2005). According to PADILIH, however, verb forms that refer to the past pose difficulties for agrammatic speakers (Bastiaanse et al., 2011). However, the validity of these hypotheses can best be tested through studying languages with rich inflectional paradigms. As introduced above, Turkish evidential morphemes may mark past time-reference and epistemically modal distinctions, besides their functions of marking information sources. Evidential morphemes have not been studied before in individuals with agrammatic aphasia. Results from this study provide us with insights into the underlying nature of the deficits in Turkish agrammatic aphasia.

In Chapter 3, we addressed the issue of verb production in Turkish agrammatic aphasia from a broader perspective by using a narrative speech-production experiment. The studies in which experimental tasks were administered to the agrammatic speakers showed that the direct evidential form is impaired as compared to present and future tense forms (see e.g., Bastiaanse et al., 2011; Yarbay-Duman and Bastiaanse, 2009) and to the indirect evidential forms (Arslan et al., 2014). However, it is not known whether the evidential forms are impaired as compared to inflectional morphemes other than tense and evidentiality. Furthermore, experimental tasks have technical limitations: it is fairly impossible to assess several inflectional morphemes in separate experimental conditions, and the agrammatic speakers tend to have low attention span, and thus, long experiments are not ideal. Therefore, as reported in Chapter 3, a narrative-speech study was administered to the agrammatic speakers of Turkish. This allows us to analyze several inflectional forms in the language.

The following two chapters seek to extend our knowledge about the *Psycholinguistic aspects of evidentiality*:

Chapter 4 aims to show how adult Turkish heritage speakers living in the Netherlands process evidentiality and time-reference morphology in Turkish as compared to a control group of Turkish monolingual speakers. Studies by Montrul and her colleagues, as introduced above, besides the others, have shown that inflectional morphology in heritage grammars is particularly vulnerable. Moreover, heritage speakers' problems are not similar in all inflectional forms. An account was put forth to explain the incomplete acquisition patterns in the heritage speakers. The interface vulnerability suggests that language structures requiring information integration at the interface of two linguistic levels (e.g., when syntax needs to be linked to pragmatics) are more effortful for heritage speakers to acquire than the structures that require knowledge of a single linguistic level. If this is true, Turkish heritage speakers are expected to have problems with evidential forms during their processing. This was exactly what we aimed to address in Chapter 4.

Chapter 5 focuses on moment-by-moment processing of evidentiality in heritage speakers of Turkish living in Germany as compared

to late bilingual speakers of Turkish and German (i.e., late arrivals) and Turkish monolinguals. Previous research on evidential forms in Turkish heritage speakers involved narrative speech-production tasks (e.g., Aarssen, 2001; Arslan & Bastiaanse, 2014b) and response-time tasks (see Chapter 4). Therefore, the moment-by-moment processing of evidential forms has been left unexplored. To investigate this, an eye-movement monitoring experiment was administered, as reported in Chapter 5. The findings have clear implications about whether the language loss in heritage bilinguals' processing of evidentiality is due to attrition or to incomplete acquisition. Furthermore, a discussion of the findings is provided, which includes, but is not limited to, the question of whether interface vulnerability or other linguistic factors can explain the attrition pattern in evidentiality.

Chapter 6 includes a general discussion of the results from the experimental studies reported in this dissertation. With this dissertation, an effort has been made to understand the cognitive underpinnings of evidentiality in Turkish with regard to its deterioration in individuals with aphasia and in speakers of Turkish as a heritage language. Aphasia and heritage bilingualism are completely different areas of language loss. However, the outcomes from the studies presented in the remainder of this dissertation indicate that the evidentials share similar 'fates' when it comes to their impairments in aphasia and the way they attrite in heritage speakers and late bilinguals.

**Neurolinguistic aspects of
evidentiality: *studies on agrammatic
aphasia***

CHAPTER 2

2. Finite verb inflections for evidential categories and source identification in Turkish agrammatic Broca's aphasia¹⁴

¹⁴ This chapter is adapted from Arslan, S., Aksu-Koç, A., Maviş, I., & Bastiaanse, R. (2014). Finite verb inflections for evidential categories and source identification in Turkish agrammatic Broca's aphasia. *Journal of Pragmatics*, 70, 165-181.

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 aspect¹⁵ 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 LInking 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’ evidence¹⁶ (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.

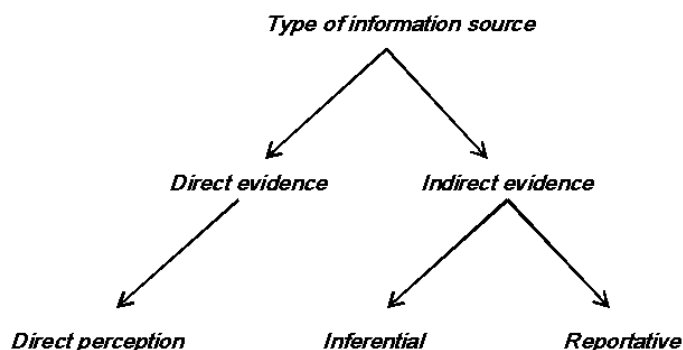


Figure 2.1. *Evidential categories of evidential verb forms used in expressing past events in Turkish*

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,¹⁷ and has been described as the

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 –*mİş* 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)*mİş* 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*

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

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* –mİş are considered to have temporal/aspectual and evidential (as well as modal) functions. However, a number of studies have shown that the *reportative* –(I)mİş behaves differently from the *inferential* –mİş, 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).¹⁹ 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

¹⁹ Whether –(I)mİş and –mİş 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; 2006, 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 gel**miş**
 Man come INDIRECT EVID
 “the man came, inferably”
- (2) Adam gelecek**miş**[’]
 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* –mİş are tense/aspect inflections, the *reportative* –(I)mİş 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).²⁰ 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

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).

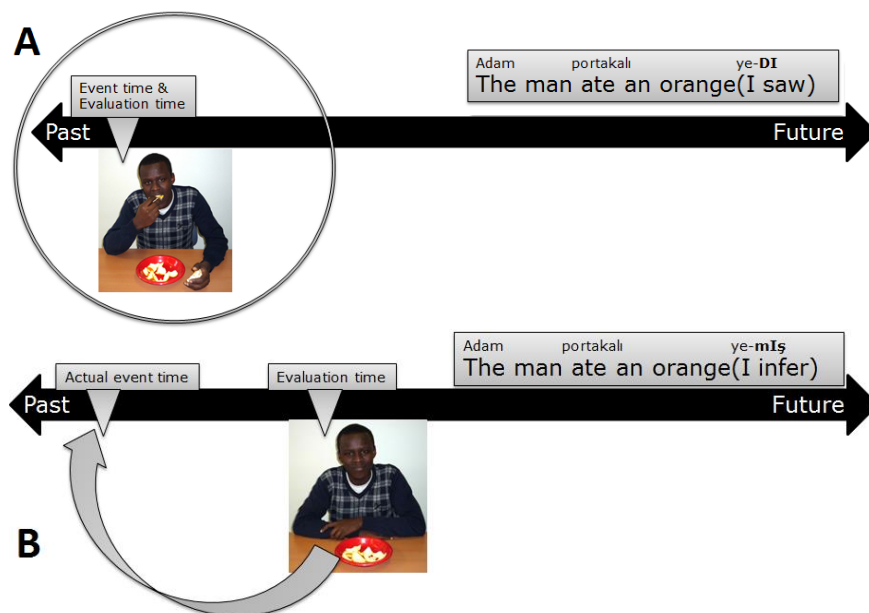


Figure 2.2. Graphical representation of time reference in Turkish (A) direct perception evidential; and (B) the inferential and reportative evidential forms (photos are taken from the TART: Bastiaanse, Jonkers, & Thompson, 2008)

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*

Agrammatic	Gender	Age	Handedness	Education	Etiology	Post-onset (months)
A1	Male	65	Right	Secondary	Left CVA	5
A2	Female	36	Right	Primary	Left CVA	38
A3	Female	33	Right	Primary	Left CVA	1.5
A4	Female	46	Right	Primary	Left CVA	5
A5	Male	60	Right	Secondary	Left CVA	11
A6	Female	24	Right	Secondary	Left CVA	5.5
A7	Male	37	Right	College	Left CVA	14
Control						
C1	Male	65	Right	Secondary		
C2	Female	36	Right	Primary		
C3	Female	33	Right	Primary		
C4	Female	46	Right	Primary		
C5	Male	60	Right	Secondary		
C6	Female	24	Right	Secondary		
C7	Male	37	Right	College		

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

has no morphemes. You should tell me the verb form to complete the sentence. There is no time limit, please, do not hurry.”

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.

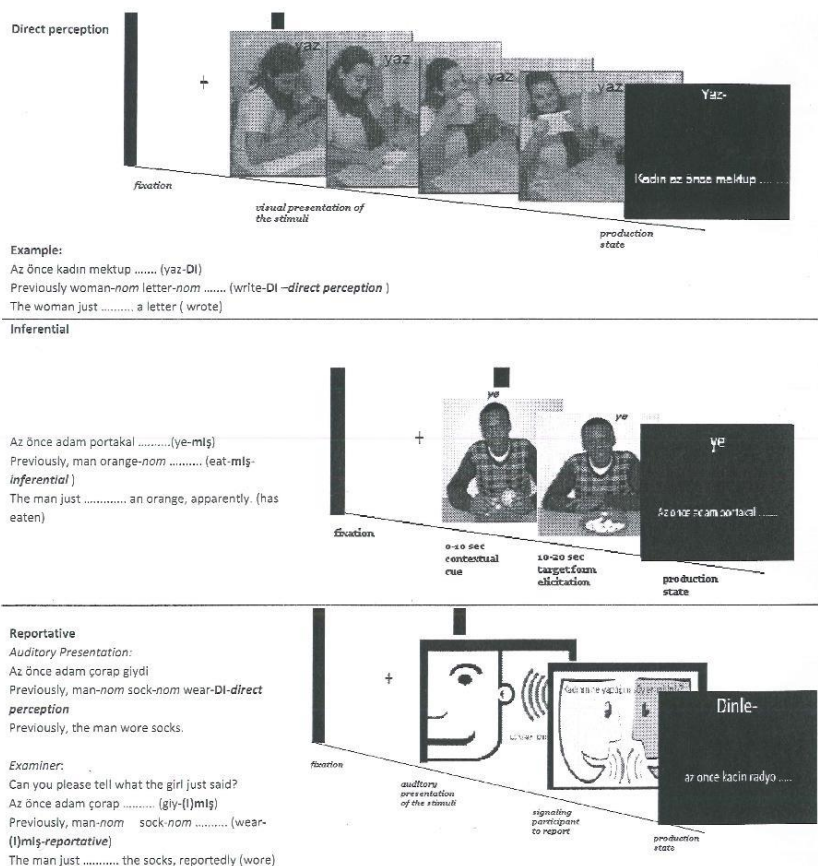


Figure 2.3. Sample items from tasks used for elicited production of the evidential forms. In parentheses: expected correct responses.

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

“A woman just watered a flower”

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.²¹

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 2.3. *Mean number of correctly inflected verb forms by agrammatic speakers across conditions (max=10 each condition; ranges in brackets).*

Direct perception evidential –DI	Inferential evidential –mİş	Reportative evidential – (I)mİş
2.14	8.29	8.29
(0-8)	(4-10)	(5-10)

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 (*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*: ‘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 2.4. *Mean number of correctly identified categories of information source by agrammatic and NBDs. Ranges in brackets (max=10 per condition)*

Source for	Direct perception	Inferential	Reportative
Agrammatic	7.71 (5 - 10)	2.29 (0 - 5)	2.71 (0 - 6)
Control	8.43 (6 - 10)	7.57 (6 - 10)	8.00 (4 - 10)

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 2.5. *Number and percentage of source identification errors and source misattributions made by the agrammatic speakers per condition (total number of source errors = 121; 91 of these are misattributions)*

	Direct perception	Inferential	Reportative
<i>Source Error Types:</i>			
(1) No-recognition	7 (44%)	10 (19%)	13 (25%)
(2) Source misattribution	9 (56%)	44 (81%)	38 (75%)
<i>Source misattributions:</i>			
Thought to have seen	-	36 (82%)	33 (87%)
Thought to have inferred	2 (22%)	-	5 (13%)
Thought to have heard	7 (78%)	8 (18%)	-

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*, $z = -.681$; $p = .496$). 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 (–mİş or –(I)mİş, 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.

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 Aphasia. 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; Farooqi-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.

CHAPTER 3

3. A characterization of verb use in Turkish agrammatic narrative speech²³

²³ This study reported in this chapter is under review: Arslan, S., Bamyacı, E., and Bastiaanse, R. (Submitted) A characterization of verb use in Turkish agrammatic narrative speech. *Clinical Linguistics and Phonetics*.

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

3.1. Introduction

Narrative speech of individuals with agrammatic aphasia is well-studied across languages. There is the invaluable source book from (Menn & Obler, 1990) but there are also many studies on individual languages (Anjarningsih, Haryadi-Soebadi, Gofir and Bastiaanse (2012) for Indonesian; Bastiaanse and Jonkers (1998) for Dutch; Miceli et al. (1989) for Italian; Saffran et al. (1989) for English) and a study on a group of bilingual (Swahili-English) agrammatic speakers (Abuom & Bastiaanse, 2012). All these studies show that apart from non-fluent speech, short utterance length and lack of grammatically complex and correct sentences, verbs and verb morphology seem to be particularly vulnerable in agrammatic speech.

3.1.1. Lexical verbs in narrative speech

Studies on agrammatic narrative speech employ quite different methodologies: some researchers prefer the retelling of a fairy tale (e.g., Thompson, Choy, Holland, & Cole, 2010) and analyze the whole sample, others use interviews (the studies of our group) and analyze a fixed number of words, whereas still others compare different elicitation methods (e.g., Olness, 2006). Also, the variables used to analyze the samples differ largely, but the conclusions are relatively in line: the production of lexical verbs in narrative speech is impaired, no matter whether measured by verb-to-noun ratios or by type-token ratios.

3.1.2. Verb inflection in agrammatic narrative speech

Agrammatic speakers often overuse non-finite verbs (e.g., infinitives, gerunds; Bastiaanse, Hugén, Kos, & van Zonneveld, 2002; Kolk & Heeschen, 1992; Thompson et al., 2010) or they produce incorrect verb inflections (Miceli, Mazzocchi, Menn, & Goodglass, 1983). There seems to be a language dependency here: in languages that allow bare stems, verb inflection is predominantly omitted, whereas in languages where no bare stems are allowed, inflections are substituted, as suggested by Grodzinsky (1991, 2000). Consistently, Abuom and Bastiaanse (2012) found this latter pattern in their group of Swahili-English agrammatic speakers: in Swahili, a language that does not allow bare verbs stems, verb inflections were substituted, whereas the same agrammatic speakers omitted the verb inflections when they spoke English. Another explanation for the different patterns that have been observed among languages with regard to verb inflection comes from Menn and Obler (1990). They suggest that most errors with verb inflections are made by agrammatic speakers of languages that have a diverse inflectional paradigm (Menn and Obler, 1990). English, for example, has four different ways to form past tense: three allomorphs – V+t ('he fixed'); V+d: ('he begged'); V+ed ('he created') – and irregular

forms ('he stood'). This theory predicts that past tense in English will be more difficult than in Swahili, which has only one morpheme for past tense, that is always pronounced similarly. This is exactly what was found in the studies of Abuom and colleagues (Abuom & Bastiaanse, 2012, 2013; Abuom, Obler, & Bastiaanse, 2011). Another interesting prediction has been made by Goral (2011). She suggests that verb inflections are better preserved in speakers of languages with a highly regular inflectional system. Usually, extended inflectional paradigms are highly regular. This is an alternative explanation for observed discrepancy between verb inflections in the Swahili-English bilingual agrammatic speakers.

Another question is whether all verb inflections within one language are equally affected. Bastiaanse et al. (2002) suggest that it is not verb inflection per se that is impaired, but rather the production of finite verbs. That is, the verb forms that are inflected for Tense, Aspect, Mood and Agreement with the subject are most vulnerable. In English, for example, the progressive form V+ing does not seem to be difficult for agrammatic speakers, although it is an inflected lexical verb (Abuom & Bastiaanse, 2012; Faroqi-Shah & Thompson, 2004).

There is, however, quite some variation in the use of finite verbs: Miceli et al. (1989) showed that some of their agrammatic speakers are better in finite verb production than others. Thus, these authors assumed that agrammatism is not a unitary syndrome, but that different underlying disorders may result in different patterns of agrammatic speech. Bastiaanse (1995) argued that it is not necessarily a different underlying disorder that caused this variation, but rather different reactions to a similar underlying disorder. Bastiaanse and Jonkers (1998) elaborated this idea further in a group study to agrammatic spontaneous speech, which showed that some agrammatic speakers were relatively good in producing finite verbs, but had little variation in their use of lexical verbs (i.e., a low type-token ratio), whereas others had more variety in their lexical verbs but produced relatively few finite verbs. The authors argued that retrieving lexical verbs and inflecting them is difficult for speakers with a grammatical deficit. That raised the question whether it is agreement and / or tense that causes the problems with finite verbs in agrammatic speakers. Agreement manifests as an inflectional morpheme that reflects the relation between words or

constituents (in this case, between subject and the finite verb). Tense, however, is an inflectional morpheme that links the verb to a time frame, thus carrying more semantic and pragmatic content than agreement does.

Anjarningsih and Bastiaanse (2011) showed that it is not the combination of verb retrieval and verb finiteness that is the problem in agrammatic aphasia. They analyzed the narrative speech of agrammatic speakers of Standard Indonesian (henceforth SI). In SI, verbs are not inflected for tense or for agreement with the subject. Time reference is morphosyntactically expressed only when reference to a time frame is not clear from the context, in which case ‘aspectual’ adverbs are used. These are free-standing grammatical morphemes that express whether an event has finished, is going on or still has to commence. Interestingly, the trade-off between lexical diversity and finiteness that was observed for Dutch was also observed in SI between lexical diversity and the use of aspectual adverbs. Particularly, agrammatic SI speakers who produced lexical verbs (or ‘verbal predicates’ as they are usually called in SI) with a relatively normal variety, produced relatively few aspectual adverbs and vice versa. This suggests that neither agreement, nor tense as such is the source of the problem in agrammatism, but it is rather retrieving the name of an event and simultaneously expressing the time frame of the event through grammatical morphology.

This trade-off was not observed in the Swahili-English bilingual agrammatic speakers. However, it was observed that verb forms referring to the past were affected in both English and Swahili, whereas verb forms referring to present and future showed a normal distribution. What reference to the past through verb inflection and reference to a time frame by aspectual adverbs have in common is that they require ‘discourse linking’. According to Zagona (2003), past tense morphology requires discourse linking and according to Avrutin (2000, 2006), discourse linking is impaired in agrammatic aphasia. Bastiaanse et al. (2011) proposed that reference to the past, not only through Tense as suggested by Zagona (2003), but through grammatical morphology in general is difficult for agrammatic speakers, because it requires discourse linking. Bastiaanse (2013) refined this idea on the basis of the data from SI (Anjarningsih & Bastiaanse, 2011; Anjarningsih et al., 2012). For agrammatic SI speakers, aspectual adverbs

referring to past, present and future were equally difficult to produce (i.e., they produce fewer aspectual adverbs than normally would be expected). Since these aspectual adverbs are used to disambiguate time reference when context is not conclusive, they are used for linking the event to discourse. Hence, these aspectual adverbs are difficult for agrammatic SI speakers.

So far, the features of agrammatic narrative speech in Turkish have not been described. This is a caveat, since Turkish is an interesting language for studying agrammatic speech: it is an agglutinative language. Most interestingly, it has a kind of inflection on the finite verb that does not exist in the languages that have been analyzed so far. In the next section, the specific features of Turkish that are of interest for the current study will be presented.

3.1.3. Linguistic background

Turkish is an agglutinative language with a rich and regular inflectional paradigm. Verbs are inflected for Tense / Aspect, Mood, Evidentiality and Agreement. Tense is used to refer to the time of the event in relation to speech time (Reichenbach, 1947). Turkish verbs require inflection for Tense, which marks past, present or future. Furthermore, Turkish verbs are inflected for another semantic feature: evidentiality. Evidentials require the speaker to monitor different types of information sources (e.g., Papafragou et al., 2007). That means that the inflection on the finite verb should denote whether the event was (1) witnessed personally or (2) either heard from another source or inferred (Aksu-Koç and Slobin, 1986; Slobin and Aksu, 1982). Evidentiality marking is obligatory within the past time reference (see 1-2).²⁴

²⁴ Evidentiality is assumed to constitute an independent grammatical category, not a sub-category of tense or modality (see Aikhenvald, 2004 for an overview). Although evidentiality marking in Turkish is more common and obligatory for past events, future events can also be reported by using the indirect evidential form (see Aksu-Koç, 1988; Johanson, 2000). For the purposes of this study, we only discuss evidential forms used in past time reference.

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

(1) Direct evidential (witnessed past)

Kedi	sütü	içti
Cat	milk _{ACC}	drink _{DIRECT EVIDENTIAL 3.SG}

“The cat drank the milk”

(2) Indirect evidential (reported or inferred past)

Kedi	sütü	içmiş
Cat	milk _{ACC}	drink _{INDIRECT EVIDENTIAL 3.SG}

“The cat drank the milk”

The direct evidential –Dİ in (1) marks that the speaker has directly witnessed or personally participated in the past event s/he is talking about. The indirect evidential -mİş in (2) reflects that the speaker knows about a past event through indirect or second-hand information sources: inference or report of another speaker (see Aksu-Koç, 1988; Aksu-Koç and Slobin, 1986; Slobin and Aksu-Koç, 1982). The present progressive –İyor in (3) marks imperfect aspect and refers to the present. Although it does not formally mark an evidential term, Aksu-Koç (2000) argues that the present progressive often specifies an evidential value akin to direct evidence.

(3) Present progressive

Kedi	sütü	içiyor
Cat	milk _{ACC}	drink _{PRESENT PROGRESSIVE 3.SG}

“The cat is drinking the milk”

Selection of one evidential over the other is determined by genre and discourse types: while direct evidentials usually occur in stories about

personal experiences and in first person narration, indirect evidentials are used for conventional accounts of story telling (Aikhenvald, 2004, 2014; Aksu-Koç, 1988; de Villiers & Garfield, 2009). Aikhenvald (2014) argues that when a speaker is asked about his personal experience, direct evidentials will be used. Arslan and Bastiaanse (2014b) showed that Turkish speakers use a higher number of direct evidentials than other inflections when they talk about their personal experiences. Some story-telling genres, however, require the use of indirect evidentials in Turkish. According to Aksu-Koç (1988, p. 25) ‘accounts of myths, fairytales, folktales, or pure fantasy which has no basis in reality and are far distant from normal experience’ are often narrated with the use of indirect evidentials. Based on the theoretical framework on time reference in relation to Tense, Aspect and Evidentiality (Enç, 2004; Johanson, 2000; 2006; Erguvanlı-Taylan, 2001), Arslan, Aksu-Koç, Mavis and Bastiaanse (2014) adopted the view that direct evidentials are discourse linked, whereas indirect evidentials are not.

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

(4) Embedding with a finite verb

Adam	müzik	dinledim	dedi
Man	music	listen _{DIRECT EVID 3.SG}	say _{DIRECT}
EVID 3.SG			

“The man said (that) he listened to music”

(5) Embedding with a non-finite verb

Adamın dinlediği	müzik	gürültülüydü
[Man listen _{OBJ.PARTICIPLE 3.SG}	music]	noisy _{DIRECT EVID 3.SG}

“The music that the man listened to was noisy”

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

(6) Infinitive in an embedded clause

Adam	müzik	dinlemeyi	seviyor
[Music	music	listen _{INFINITIVE.ACC}]	love _{PRES. PROG. 3.SG}
“The man loves to listen to music”			

Participles (or verbal adjectives) are used in different types of relative clauses. The subject participle –An is used in Subject Relatives (see 7), whereas the object participle –DIK is used in Object Relatives²⁵ (see 8) and refers to non-future events. The other participle forms, inflected with –EcEk and –mİş, can be used in Object and Subject Relatives, and express future and past events respectively (Kornfilt, 1997a).

(7) Subject participle

Müzik	dinleyen	adam
[Music	listen _{SUBJ.PARTICIPLE}	man]
“The man that listens to music”		

²⁵ The object participle –DIK can also be used in adverbial clauses. The other uses of –DIK are however outside the scope of the current study.

sabah	olduğunda
[morning	become _{-participle.loc}]
“when the morning comes”	

(8) Object participle²⁶

adamin	dinlediđi	müzik
[Man _{GEN}	listen _{OBJ.PARTICIPLE 3.SG.}	music]
“The music that the man listened to”		

Finally, gerunds are often used to construct adverbial relative clauses. Depending on the function of the adverbial clause, different markers can be used: the suffix –Iken expresses temporal simultaneity, as demonstrated in (9), while the suffixes –Ip and –IncE can be used to express sequential events.²⁷

(9) Yürüyüş	yaparken	müzik	dinliyorum
[Walk	do _{GERUND}]	music	listen _{PRES. PROG. 1.SG}
“(I am) listening to music while taking a walk”			

In sum, two features are particularly interesting to analyze in Turkish agrammatic narrative speech: (1) Verb inflection, because Turkish has a rich verb inflection paradigm and verb forms referring to past must be inflected for evidentiality, a phenomenon that has not previously been studied in agrammatic narrative speech. (2) Clauses without finite verbs, but with infinitives, participles or gerunds, are frequently used. The participles require derived word order and, interestingly, derived word is known to be

²⁶ Notice that in the Object Relative (8), the object participle must agree with the subject of the embedded clause, whereas in the Subject Relative (7) there is no such agreement. Furthermore, the subject of the Object Relatives is assigned genitive case. It should be noted that in Turkish SOV is the base word order. In the Subject Relative, the subject is moved to the end of the clause, resulting in OVS-order (7), whereas in the Object Relatives, the object is in clause final position, resulting in SVO (8).

²⁷ We only include –Iken, –Ip, –IncE gerundal suffixes for this study. However, gerunds in adverbial clauses are not only limited to these, see Taylan (1984) for further examples.

difficult for agrammatic speakers (Bastiaanse & van Zonneveld, 2005, 2006).

3.1.4. Agrammatic aphasia in Turkish individuals

There are not many studies on Turkish aphasia and, so far, none on agrammatic narrative speech. Experimental studies revealed that grammatically complex sentences are particularly difficult in agrammatic speakers' sentence production (Yarbay-Duman, Aygen, Özgirgin, & Bastiaanse, 2007). Turkish agrammatic speakers are also poor on comprehending and producing subject and object relatives (Aydin, 2007; Yarbay-Duman, Aygen, & Bastiaanse, 2008), even though the verbs are used in non-finite form (i.e., participles).

Finite verbs are difficult for Turkish agrammatic speakers: it has been shown in several experimental studies that finite verb forms that refer to the past are most vulnerable (Bastiaanse et al., 2011; Yarbay-Duman & Bastiaanse, 2009), just like in many other languages (for an overview, see Bastiaanse, 2013). However, not all finite verb forms that refer to the past are equally affected. Arslan et al. (2014) conducted a production task with sentences requiring either direct or indirect evidential verb forms. Visual and verbal materials were used to elicit evidential forms appropriate for directly witnessed, inferred or reported events. The direct evidential forms were found to be more difficult for Turkish agrammatic speakers to produce than the indirect evidentials were.

3.1.5. The current study

As summarized above, several experimental studies showed that verb inflection in Turkish is impaired and that derived word order is difficult. The question is how these problems emerge in narrative speech. We, therefore, analyzed the narrative speech of a group of agrammatic speakers

and compared the results with those of a group of non-brain-damaged speakers, with particular emphasis on verb production. It has been shown that different genres elicit different verb forms (Armstrong, 2000; Olness, 2006). Hence, we elicited narrative speech through an interview about the personal life of the participants.

There were 4 main research questions:

- (1) Is narrative speech of Turkish agrammatic speakers disturbed along similar lines as in other languages?

The aphasic participants were diagnosed as suffering from Broca's aphasia. It was expected that their speech rate and utterance length were decreased and that they would produce fewer grammatical sentences than NBDs, with fewer embedded clauses.

- (2) Is production of verbs in Turkish agrammatic speech impaired?

In other languages, it was found that it is not the number of lexical verbs that is reduced, but rather there is little variety in the produced verbs. We expect to find a similar pattern in Turkish.

- (3) Is production of finite verbs and participles impaired in Turkish agrammatic speech?

Verb inflection of agrammatic speakers of languages with a regular inflectional verb paradigm may be relatively spared (Goral, 2011). Hence, it is expected that Turkish agrammatic speakers will not encounter many problems. According to Menn and Obler (1990), however, verb inflection in Turkish agrammatism may be affected, because of the large number of allomorphs. Participles in Turkish are used (highly frequent) in object and subject relativization. Since sentences with embedding and derived word order are difficult for agrammatic speakers (Abuom and Bastiaanse, 2012; 2013; Saffran et al., 1989; Thompson et al., 2010; Yarbay Duman et al., 2007; 2008), we expect that the use of participles is limited.

- (4) Is the production of direct and indirect evidentials affected?

In previous experimental studies, it was shown that reference to the past through verb inflection in Turkish agrammatic speakers is impaired (Yarbay

Duman and Bastiaanse, 2009; Bastiaanse et al., 2011) and that direct evidentials were particularly difficult (Arslan et al., 2014). We, therefore, expect problems with the production of the direct evidentials.

3.2. Methods

3.2.1. Participants

Ten agrammatic speakers participated in this study. They were recruited from the Hacettepe University Department of Audiology; Ankara University, Department of Speech Therapy; Ankara University Department of Neurology; and Ankara Hospital for Physical Medicine. They were diagnosed by their SLTs as having Broca's aphasia. There were 6 men and 4 women and their age ranged from 43-74 years (mean 58.6 years). All agrammatic speakers were right-handed and suffered from a stroke in the left hemisphere. The time post-onset varied from 1-22 months (mean 7.9 months). They all had a right-sided hemiparesis. All agrammatic speakers completed at least primary education and were literate individuals who had regular reading habits prior to their aphasia, as reported by their proxies. Further individual data are given in Appendix B1.

A control group was composed of non-brain-damaged speakers in the age range of 37-67 years (mean 51.7 years), who came from the same regions as the agrammatic speakers. All participants signed an informed consent and allowed us to use their data for research.

3.2.2. Narrative speech elicitation

The methods to elicit narrative speech were similar to that of Abuom and Bastiaanse (2012). First, an interview was conducted by means of open-ended questions, as shown in (8) below. Afterwards, the participants were asked to tell a story about two pictures. To elicit those stories, the questions

mentioned in (9) were asked, based on Olness (2006). The pictorial materials used were the ‘cookie theft’ picture (Goodglass & Kaplan, 1972) and the ‘flood rescue’ picture, a Pulitzer Prize winning photo of Annie Wells.

- Interview questions
 - *Konuşma güçlükleriniz nasıl başladı?* “How did your speech problems start?”
 - *Daha önce ya da şuan yaptığınız işlerden bahsedebilir misiniz?* “Could you tell me about your present or previous job?”
 - *Ailenizden bahsedebilir misiniz?* “Could you tell me about your family?”
 - *Hobilerinizden bahsedebilir misiniz?* “Could you tell me about your hobbies?”

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

3.2.3. Procedure

Sessions were administered with each participant individually in a quiet room. The order of questions was as mentioned above for each participant, who was encouraged to tell as much as possible. The sessions were audio recorded with a voice recorder.

3.2.4. Analysis

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

Since we had no data from a diagnostic aphasia test, the first analysis was performed to evaluate whether the aphasic speakers were truly agrammatic. They were supposed to speak non-fluently, in simple and short, frequently ungrammatical utterances. Ungrammatical utterances were defined as utterances that did not contain a finite verb or in which other morphological, syntactic or lexical-semantic errors are made. Minor phonological and articulation errors were ignored. In order to determine the agrammatic nature of the aphasic samples the following variables were included:

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

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

- (5) Number and diversity of lexical verbs (including non-finite verbs and the copular verb *ol* ‘to become’, but excluding nominal predicates).²⁸ The number of lexical verbs was counted, as well as

²⁸ The verb *ol* ‘to become’ was counted as a lexical verb, although it may sometimes be used as a copula. However, it behaves similarly to all other lexical verbs. The existential copulas *var* ‘there is’, *yok* ‘there is not’ were counted as nominal predicates. Note that the evidential morphemes can be inflected on nominal predicates and existential copulas, while present tense and future tense cannot.

the number of lexical verbs per utterance. Diversity of the lexical verbs was measured by type-token ratios (number of different verbs divided by the total number of verbs; when the sample size and the total number of verbs are equal, this is a reliable measure of variability of verbs (see Richards & Malvern, 1997).

- (6) Number and proportion of finite verbs and nominal predicates (that include a finite form of the copula *var* “there is” or *yok* “there is not”) and number of non-finite verbs. The non-finite verbs include the infinitives, participles, and gerunds.
- (7) Tense inflection. Three types of finite verbs were distinguished:²⁹
 - (i) direct evidential (witnessed past); (ii) indirect evidential (inferred/reported past); (iii) and present progressive. For each of these inflection types the frequency as well as the diversity was calculated.

T-tests were used to test the reliability of the differences between the agrammatic and NBD group.

3.3. Results

3.3.1. General agrammatic features

In Table 3.1, the scores on the four general features of agrammatic speech are given for both groups. Individual data are in Appendix B2.

²⁹ Future and habitual tense were tallied as well, but they were hardly used in either group and they will further be ignored

Table 3.1. *The means and standard deviations (sd) for the general measures for agrammatism (MLU= mean length of utterances)*

	Speech rate	MLU	% correct sentences	# embeddings with finite verbs	with non-finite verbs
<i>Agrammatic speakers</i>					
mean	33.70	2.52	48.40	1.10	5.60
sd	11.63	0.50	20.37	1.44	4.00
<i>NBDs</i>					
mean	82.80	5.06	92.60	1.80	11.10
sd	13.98	1.00	10.23	1.61	6.29

Speech rate of the agrammatic speakers is significantly lower than that of the NBDs ($t(18) = 8.539$; $p < .0001$) and their utterances are significantly shorter ($t(18)=7.166$; $p < .001$). As expected, the percentages of correct sentences ($t(18) = 6.007$; $p < .0001$) are significantly reduced. The agrammatic speakers produce fewer embeddings with non-finite verbs than the NBDs do ($t(18) = -2.330$; $p = .032$), whereas no group difference is found in the number of embeddings with a finite verb ($t(18) = -1.019$; $p = .322$).

These data show that agrammatism in Turkish resembles agrammatism in other languages: speech is severely delayed and the sentences are shorter and less complex. Also, a large proportion of sentences is incorrect and embedded clauses with non-finite verbs are scarce.

3.3.2. Production of lexical verbs

In Table 3.2, the group data of the production of lexical verbs are given. The individual data are in Appendix B3.

Table 3.2. Means and standard deviations (*sd*) for the measures of the lexical verbs (*TTR* = type token ratio)

	verb tokens	TTR verbs	verbs per utterance
<i>Agrammatic speakers</i>			
mean	46.90	0.49	0.61
sd	12.46	0.15	0.23
<i>NBDs</i>			
mean	46.30	0.62	1.16
sd	5.96	0.06	0.27

The use of lexical verbs is normal when it comes to verb tokens ($t(18) = -0.1373$, $p = .8923$). Lemma frequencies of the produced tokens from the agrammatic group, as verified from a web-based Turkish corpus, are similar to those of the NBDs; a group comparison yielded no significant difference³⁰ ($t(199) = .123$; $p = .902$). However, like in the other studies, the diversity of the produced verbs is significantly reduced compared to NBDs ($t(18)=2.604$; $p = .018$). As expected, the number of verbs per utterance of the agrammatic speakers is reduced ($t(18) = 5.02$; $p = .0001$).

³⁰ The lemma frequencies were taken from the TS corpus (Sezer and Sezer, 2013). The comparison was done on LOG-transformed frequency scores. Mean verb lemma frequencies: agrammatic speakers=5.64, and NBDs=5.60.

3.3.3. Production of finite and non-finite verbs

Table 3.3 presents the data for the finite verbs and participles. The individual data are in Appendix B4. As expected, the Turkish agrammatic speakers have no problems with finite verbs: the number is similar as in NBD speech ($t(10) = -0.4708$; $p = .643$). The proportion of finite verbs (number of finite verbs divided by the number of finite+non-finite verbs) is also similar in both groups ($t(18) = 1.579$; $p = .132$).

In Turkish, non-finite verbs are described in three categories: infinitives, participles (in Object and Subject Relatives) and gerunds (in adverbial clauses). The agrammatic speakers' use of infinitives³¹ and gerunds is normal as compared to the NBDs (infinitives: $t(18) = -.211$; $p = .835$; gerunds $t(18) = -.274$; $p = .787$). Since agrammatic speakers have problems with derived word order, a characteristic of Object / Subject Relatives in Turkish, it is expected that they will produce fewer participles than the NBDs. This is confirmed by our data ($t(18) = -2.717$; $p = .014$). Post-hoc comparisons showed that the agrammatic speakers produced fewer object participles than the NBDs did (1.00 vs. 3.30; $t(18) = -2.203$; $p = .040$). No group differences were found for the production of subject participles (1.00 vs. 0.40; $t(18) = -1.567$; $p = .135$), or any of the other participle forms ($-mİş$ ³² and $-EcEk$: both $ps > .11$).

³¹ The infinitives produced by all participants were in embedded clauses. However, agrammatic participant A10 (see Appendix B4) produced most of the infinitives in isolation and only few in embeddings.

³² Not to be confused with the indirect evidential $-mİş$. The participle $-mİş$ is used in relative clauses and is not a finite verb nor does it make reference to indirect information. The indirect evidential and the participle $-mİş$ were analyzed separately.

Table 3.3. *The means and standard deviations for the measures of verb inflection*

	# finite verbs	prop. finite verbs	Infinitives	# non-finite verbs Participles	Gerunds
<i>agrammatic speakers</i>					
mean	42.8	0.87	3.90	1.10	1.90
sd	9.78	0.10	4.88	1.44	1.85
<i>NBDs</i>					
mean	41.2	0.78	4.30	4.60	2.10
sd	9.53	0.14	3.46	3.80	1.37

3.3.4. Verb tense and evidentiality

In Table 3.4, the use of inflectional morphology for tense/aspect and evidentiality for both groups is given. The individual data are in Appendix B5.

Table 3.4. *Means and standard deviations (sd) of the numbers and type token ratios (TTR) for the 3 most frequently used verb forms*

	direct evidentials		indirect evidentials		present progressive	
	number	TTR	number	TTR	number	TTR
<i>agrammatic speakers</i>						
mean	20.5	0.72	4.0	0.68	11.6	0.71
sd	11.3	0.14	3.06	0.32	5.82	0.19
<i>NBDs</i>						
mean	12.8	0.86	3.4	0.86	15.0	0.83
sd	8.0	0.13	2.59	0.31	7.51	0.16

There is no difference between the use of each type of inflection between the groups, although there is a trend for agrammatic speakers to produce more direct evidentials than the NBDs (direct evidentials: $t(18) = -$

1.758; $p = .096$; indirect evidentials $t(18) = -0.473$; $p = .642$; present progressive: $t(18) = 1.132$; $p = .273$).

Since the number of direct evidentials of the agrammatic speakers was surprisingly high, we inspected the raw data and looked at the diversity of the verbs that were used within each inflectional category.

The individual performances of the agrammatic speakers reveal a pattern similar to that of Bastiaanse and Jonkers (1998) and Anjarningsih and Bastiaanse (2011) with regard to the production of time reference. In particular, the Turkish agrammatic speakers who produce relatively many direct evidentials (a verb inflection that is difficult to them; Arslan et al., 2014), show little diversity of the lexical verbs used in direct-evidential forms and vice versa: agrammatic speakers who produce direct evidentials with a relatively high diversity produce relatively few of them. This is graphically represented in Figure 3.1. For the other tenses and for the healthy speakers this pattern is not found.

3.3.5. Summary of results

Turkish agrammatic speakers had a slow speech-rate and used short utterances, which were simple and often incorrect. They produced a normal number of lexical verbs on 200 words of narrative speech, but they used fewer verbs per utterance. The diversity of the verbs was reduced. However, verb inflection was retained as they produced as many finite verbs as the NBDs. The produced finite verbs were equally distributed over the main verb tenses: direct evidentials, indirect evidentials and present progressive, although the agrammatic speakers produced marginally more direct evidentials than the NBDs. Within these direct evidentials, there was a trade-off pattern between verb inflection and verb diversity in the agrammatic group. A similar pattern was not observed for the NBDs or for the other tenses. The agrammatic speakers produced fewer embeddings with non-finite verbs than the NBDs did yet, not all non-finite verbs were equally affected. The agrammatic speakers performed as normal in producing infinitives and gerunds, whereas they produced fewer participles than the

NBDs did. However, this was due to a reduced number of object participles; the number of other participles is normal.

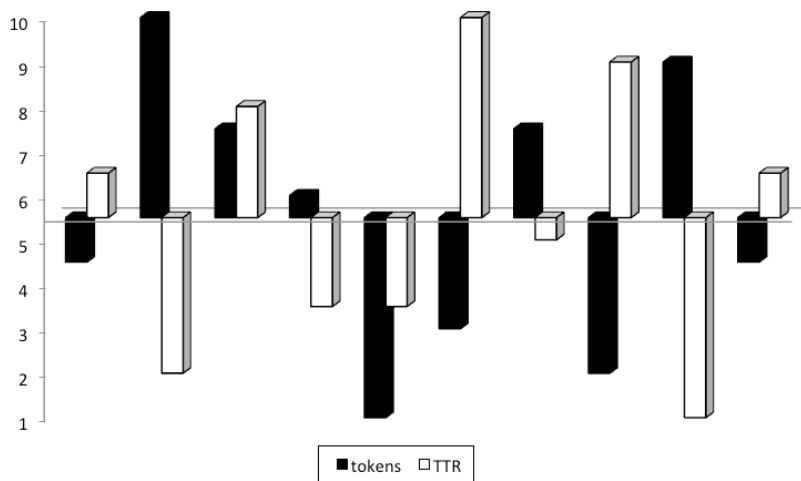


Figure 3.1. Graphical representation of the number of direct evidentials (tokens) and the type token ratios (TTR). On the Y-axis are the ranks (median is 5). Each black and white pair represents one agrammatical speaker.

3.4. Discussion

3.4.1. General characteristics of agrammatical aphasia

Since not much is known about agrammatic narrative speech in agglutinative languages, we first analyzed whether the general characteristics were reflected in Turkish. The general characteristics are: slow, non-fluent speech, with reduced sentence complexity. The speech of the Turkish agrammatical speakers was indeed slow: the speech rate was reduced compared to that of NBDs. Grammatical abilities were also

compromised: the utterances of the agrammatic speakers were shorter and more often incorrect, and the number of embeddings with non-finite verbs was lower than normal. The question was whether narrative speech of Turkish agrammatic speakers disturbed along similar lines as in other languages and the data show that this is indeed the case.

3.4.2. Production of lexical verbs

The second question was whether production of verbs in Turkish agrammatic speech is impaired. As expected, the number of lexical verbs on the 200 words sample was similar for both groups, like it was in other languages in which the analysis was done over a fixed number of words (Abuom and Bastiaanse, 2012; Anjarningsih et al., 2012; Anjarningsih and Bastiaanse, 2011; Bastiaanse and Jonkers, 1998). However, since the agrammatic speakers have a reduced utterance length, they produce more utterances. When this is taken into account and the numbers of verbs per utterance are compared between agrammatic and NBDs, the differences between the groups emerge: the agrammatic speakers produce fewer verbs per utterance. This is in line with the results of authors who analyzed samples of certain duration (Saffran et al., 1989) or retold fairy tales (e.g., Thompson et al., 2010)

Although the agrammatic speakers produce the same number of verbs, the information they provide with these verbs is limited: the diversity, as measured with a type-token ratio is lower than normal. This lack of variation in verb use has been reported before for Dutch (Bastiaanse and Jonkers, 1998), Indonesian (Anjarningsih et al., 2012) and Italian (Crepaldi, Ingignoli, Verga, Contardi, Semenza and Luzzatti, 2011) agrammatic speakers.

3.4.3. Verb finiteness

The third question was whether the use of finite verbs and non-finite verbs (i.e., infinitives, participles, and gerunds) was affected in Turkish agrammatic speech. Since Turkish is an agglutinative language in which bare verb stems are not allowed, we did not expect omission of verb inflections, but not all verb inflections are equally affected. In non-agglutinative languages, such as Dutch and English, verbs that are inflected for tense and agreement with the subject (i.e., finite verbs) are impaired. However, this has not been shown in agrammatic narrative speech in another agglutinative language: Swahili. The bilingual agrammatic speakers of Abuom and Bastiaanse (2012) had problems with finite verbs in English, but not in Swahili. The authors argued that this was the case because in Swahili, Tense and Agreement morphemes cannot be omitted. However, contrary to what Grodzinsky (1991; 1999) suggested and what Miceli et al. (1989) reported for part of their agrammatic speakers, the bilingual agrammatic speakers did not make substitution errors in Swahili. Most of their finite verbs in Swahili were correct. The same holds for the Turkish agrammatic speakers in the current study: they produce a normal proportion of finite verbs and these are predominantly used correctly. This is in line with the predictions of Goral (2011) who suggests that regular verb inflection paradigms are relatively spared, but not with Menn and Obler (1990) who argue that the number of allomorphs is the critical factor.

If agrammatic speakers only have problems with finite verbs, it is expected that the use of non-finite verbs will be normal. This is, however, not the case: they produce fewer participles (but not infinitives or gerunds) than the NBDs. Adding onto the findings of Aydın (2007) and Yarbay Duman et al. (2008), only object participles are found to be reduced (despite the very scarce use of the subject participle in both groups). This may be due to several reasons. One is that the object participles in relative clauses are morphologically marked for agreement and time reference: the object participle expresses non-future (i.e., present and/or past) events. Subject participles, by contrast, do not require agreement marking and they do not make time reference. Both the object and subject participles require derived word order whereas other non-finite forms (infinitives or gerunds) do not.

Another reason why fewer object participles are produced in the agrammatic speech may be the complexity of the construction in which they appear. Kornfilt (1997) argues, for instance, that the Object Relatives have rather complex syntactic representations: the Object Relatives require subject agreement whereby the subject is assigned genitive case. The Subject Relatives, by contrast, do not require subject agreement and genitive case assignment. According to Yarbay-Duman, Altinok, Özgirgin and Bastiaanse's (2011) Integration Problem Hypothesis, integrating information provided by derived word order and non-base case adds to the problems of agrammatic speakers. On the basis of the current data it is impossible to decide whether the lack of object participles is due to a problem with inflection or because these participles are associated with object relativization. It is worthwhile to develop an experiment to find out what underlies the sparse use of participles in Turkish narrative speech.

3.4.4. Evidentials

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

Although the frequency of morphemes referring to the past is normal for both direct and indirect evidentials, a post-hoc analysis revealed that

there is a trade-off pattern. Such a trade off pattern was observed earlier between time reference markers in Dutch and SI and diversity of the produced verbs. This is also visible in Turkish, but only for direct evidentials. Direct evidentials refer to an event in the past that is witnessed by the speaker. It was shown by Arslan et al. (2014) that these verb forms are more difficult for agrammatic speakers than indirect evidentials (that refer to an event that was heard of or inferred) and than verbs with present and future tense (Bastiaanse et al., 2011; Yarbay Duman and Bastiaanse, 2009). Recall that the direct evidential is used in personal narratives while the indirect evidential is the typical form for story-telling. The trade-off pattern cannot be attributed to the use of evidentials as narrative markers, as both groups have an equal number of instances of both personal narration and story-telling which were analysed. Alternatively, Bastiaanse (2013) suggests that what makes finite verbs in narrative speech difficult for agrammatic speakers is the fact that the name of the event should be retrieved and inflected for the time frame in which the event takes place. This requires a high processing load. The current data suggest that this is most difficult for verb forms that need to be linked to events that one witnessed.

Although the number of evidential verb forms is similar in agrammatic speakers and NBDs, in analogy to the findings in Swahili (Abuom and Bastiaanse, 2012), the agrammatic group provides less information with these verbs. However, there are important individual differences here: those agrammatic speakers who produce relatively many direct evidential markers, do not provide much information with them (as shown by the relatively low diversity); whereas those agrammatic speakers who provide relatively much information with direct evidentials (high diversity) use them relatively less frequently. These problems with grammatical morphemes that relate the event to the time frame in which it happened have been observed before for verb inflections in Dutch and aspectual adverbs in SI. In SI, such a pattern was observed for all time frames (for Dutch no analysis per time frame was done). In Turkish, this only holds for direct evidentials. This trade-off was not observed in Swahili, but in this language, reference to the past in narrative speech was impaired. What seems to be the common denominator here is that the verb forms for which discourse linking is required are difficult: direct evidentials in

Turkish, past tense in Swahili and all aspectual adverbs in SI require discourse linking, as suggested by Zagana (2003). This morphological information needs to be parsed by discourse syntax, which is hard for agrammatic speakers (Avrutin, 2000; 2006; Bastiaanse et al., 2011; Bos and Bastiaanse, 2013).

**Psycholinguistic aspects of evidentiality: *studies
on heritage bilingualism***

CHAPTER 4

4. Processing grammatical evidentiality and time reference in Turkish heritage and monolingual speakers³³

³³ This chapter is adapted from Arslan, S., De Kok, D. and Bastiaanse, R. (in press). Processing grammatical evidentiality and time reference in Turkish heritage and monolingual speakers. *Bilingualism: Language and Cognition*

Abstract. *In the current study, we examined how adult heritage and monolingual speakers of Turkish process evidentiality (the linguistic expression of information source) through finite verb inflections and time reference, expressed on non-finite participles. A sentence-verification task was used to measure participants' sensitivity to evidentiality and time-reference violations in Turkish. Our findings showed that the heritage speakers were less accurate and slower than the monolinguals in responding to both evidentiality and time-reference violations. Also, the heritage speakers made more errors and had longer RTs when responding to evidentiality violations as compared to time-reference violations. The monolinguals had longer RTs (and more accurate responses) to time reference than to evidentiality violations. This study shows that evidentiality is susceptible to incomplete acquisition in Turkish heritage speakers. It is suggested that the requirement for simultaneous processing at different linguistic levels makes the evidentiality markers vulnerable.*

4.1. Introduction

Heritage speakers are early bilingual individuals who have grown up acquiring a minority language alongside the dominant language spoken in a country (Benmamoun et al., 2013). Heritage speakers typically acquire their first language (L1) from birth in family settings while they are either exposed to the majority language simultaneously or shortly after the onset to L1 (i.e., at school). However, exposure to L1 tends to be more limited during heritage speakers' childhood and L2 gradually gains dominance as compared to monolingual acquisition. Hence, in adulthood, it is assumed that heritage speakers have not reached the 'ultimate attainment' of their L1 as compared to their monolingual peers (Montrul, 2002, 2008; Polinsky, 2006). That is, heritage speakers' knowledge of their L1 grammar is thought to be incomplete due either to 'inadequate input conditions' during early

childhood (Montrul, 2008) or to effects of attrition after full acquisition of the L1 (Polinsky, 2011).³⁴

Not all areas of heritage speakers' L1 structures are equally affected by incomplete acquisition or attrition, however. Inflectional morphology has shown to be particularly vulnerable across different languages (Albirini et al., 2013; Albirini et al., 2011; Anderson, 1999, 2001; Bolonyai, 2002, 2007; Montrul, 2002, 2008, 2009; Montrul, Bhatt, & Bhatia, 2012; Polinsky, 2006, 2008; Rothman, 2007; Silva-Corvalán, 1994). Other properties (e.g., word order, verb agreement) have been shown to be virtually unaffected (Albirini et al., 2013; Albirini et al., 2011; Bolonyai, 2007). However, heritage speakers' knowledge of their L1 inflectional morphology is rather asymmetrically affected and there is not a unified explanation for these 'asymmetries'. For the purpose of the current study, we will consider the following two accounts: 'interface vulnerability' and 'maturational constraints'.

The interface vulnerability account states that heritage speakers' incomplete knowledge of their L1 structures is correlated with a difficulty of integrating information from different linguistic levels (Bolonyai, 2007; Montrul, 2002, 2009; Montrul et al., 2012; Rothman, 2007). This is captured by the Interface Hypothesis³⁵ (Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009). According to this hypothesis, structures at the interface of two linguistic domains, in particular the syntax-pragmatics interface, are more problematic for heritage speakers than structures that can be processed at one single level. To illustrate, Bolonyai (2007) showed that

³⁴ Please note that we use the term 'incomplete acquisition' in its narrow sense to label permanent losses in certain grammatical features or syntactic constraints in heritage speakers' L1; see Montrul (2011). Also note that incomplete acquisition assumes that a part of a language has not been fully acquired while attrition means that a language structure has been acquired before it is attrited. Whether or not incomplete acquisition and attrition result in differential outcomes in adult heritage speakers is beyond the scope of the current study.

³⁵ Please note that the Interface Hypothesis originally sought to account for the performances of native-like bilinguals in their second language; see also Sorace (2011) for arguments.

possessive agreement in Hungarian, which corresponds to the syntax–semantics interface, is more prone to errors than verb agreement in the production of young heritage-speakers’ production. Similarly, Montrul et al. (2012) showed that adult heritage speakers of Hindi are less sensitive to case morphemes that signal semantic content (e.g., specificity) than to morphemes that do not, on both oral production and grammaticality judgment tasks. Rothman (2007) reported that adult heritage-speakers of Brazilian Portuguese perform poorer when verifying uninflected infinitives compared to inflected verbs on a grammaticality judgment-task. As an explanation, Sorace and Serratrice (2009, pp. 199–200) propose that bilingual individuals may have access to “fewer processing resources and may therefore be less efficient at integrating multiple types of information efficiently”. Hence, bilingual speakers are assumed to rely on ‘default’ forms during online processing or production to reduce processing costs.

A second theory attributes heritage speakers’ incomplete knowledge of the L1 verbal inflections to maturational constraints. Within this perspective, the Regression Hypothesis holds that language attrition exhibits the reversed pattern of language acquisition³⁶ (Jakobson, 1941). According to this hypothesis, structures acquired later in life are more likely to attrite first in bilingual speakers (Keijzer, 2010). Heritage speakers’ asymmetrical incomplete acquisition patterns have been shown to be partly governed by maturational constraints (Montrul, 2008). Using an elicitation and a grammaticality judgment task, Montrul (2009) showed that adult heritage speakers of Spanish retained their sensitivity to Aspect (Preterite–Imperfect) but not to Mood (Subjunctive–Indicative) distinctions. Mood is acquired later than Aspect in Spanish, and, thus, the author argues that her findings are reconcilable with the Regression Hypothesis.

The present study aims to contribute to the understanding of whether and how inflectional morphology in adult heritage speakers of Turkish living in the Netherlands (i.e., early bilinguals of Turkish/Dutch) is

³⁶ Please note that the Regression Hypothesis originally sought to account for language loss in aphasia (Jakobson, 1941). For instance, De Bot and Weltens (1991) cautions against extending the Regression Hypothesis to attrition in bilingualism settings, but see Keijzer (2010) for arguments.

affected during online sentence processing. As most of the studies presented above concentrated on heritage speakers living in the United States, incomplete acquisition and attrition patterns in heritage speakers speaking L2 languages other than English is less well known. Turkish is one of the most widely spoken minority languages in Western Europe. It has a rich inflectional paradigm, like so-far-studied languages, but also presents grammatical features yet to be investigated in heritage speakers. First, in Turkish, finite verbs referring to the past are inflected for evidentiality, which encodes how the speaker obtained information about an event. Second, reference to past or future time frames is not only expressed on the finite verb, but also on non-finite participles. In the next section, features of evidentiality and time reference through non-finite participles in Turkish are described.

4.1.1. Expression of evidentiality and time reference in Turkish

Evidentiality expresses information sources that the speaker has for his or her statement, such as witnessing, report and inference (see Aikhenvald, 2004). In Dutch, evidentiality is not marked on the verb. In Turkish, however, speakers have two options to choose from, depending on whether a past event is known on the basis of ‘direct’ or ‘indirect’ information³⁷ (Aksu-Koç & Slobin, 1986; Slobin & Aksu, 1982). Both direct and indirect information source perspectives are exclusively marked by inflectional morphemes, as given in (1)-(2), respectively.

³⁷ Evidential morphology marks past events when appended on simple verbs (i.e., past reading is the default one). However, evidential forms are not restricted to past contexts and may well mark present states (e.g., Sezer, 2001). The current study deals with the use of the evidential forms in reference to past events only.

(1) Direct evidential form:

Adam yemeği yedi

Man food ACC eat DIRECT EVID 3 SG

“The man ate the food” [witnessed past]

(2) Indirect evidential form:

Adam yemeği yemiş

Man food ACC eat INDIRECT EVID 3 SG

“The man ate the food” [reported/inferred past]

The use of the direct evidential inflection –DI, in (1), indicates that the speaker witnessed all stages of that event –from beginning to end. The use of the indirect evidential –(I)mİş, in (2) conveys that the speaker has either inferred the event or heard about it from another speakers.³⁸

Within the evidential paradigm, the indirect evidential is the ‘marked’ form, as it conveys a spectrum of indirect information sources depending on contexts, whereas the direct evidential is taken to be a default or less marked form (Johanson, 2003). Furthermore, the indirect evidential harbours rather complex semantics, as it is assumed to have epistemically modal connotations (Aksu-Koç, 1988, 2000). That is, the use of an indirect evidential is often correlated with the speaker’s attitude towards the ‘certainty’ or ‘reliability’ of information in his/her proposition (see also Palmer, 1986).

Arguably, an indirect evidential is the preferred form in non-first-person contexts, since its use presupposes that the speaker is not the first-hand source. According to Aikhenvald (2004), uses of indirect evidentials in first-person contexts often expose counter-intuitive semantic effects. For

³⁸ Some researchers treat –mİş as an inferred evidence marker and –(I)mİş as a reported evidence marker (Aksu-Koç, 1988; Aksu-Koç & Slobin, 1986; Csató, 2000), whereas others traditionally analyze inferred and reported contexts as connotations of the same morphological unit. We do not deal with specific distinctions between inferred and reported forms but take both as the indirect evidential for the purposes of the current investigation.

instance, in Turkish, the indirect evidential indicates ‘lack of control of the speaker’ when used in first-person contexts, if verb semantics allow (Aksu-Koç & Slobin, 1986). Nonetheless, when the action requires intentionality, the use of an indirect evidential in first-person contexts results in rather unreasonable readings as shown in (3).

(3) Dün akşam kitap okumuşum

Last night book read_{INDIRECT EVID 1ST SG}

“Last night I read a book” [speaker claims that s/he did not participate in this action]

Turkish participles embedded in object-relative clauses do not convey evidential content. These participles are inflected, but they are non-finite. Albeit not formally marked for Tense, these non-finite participles undertake the role of referring to past and future events (Erguvanlı-Taylan, 1993; Underhill, 1972). Examples for past (4) and future (5) participles are given below.

(4) Past participle:

Kızın yazdığı mektup geldi

Girl_{GEN} write_{PAST PART ACC} letter arrive_{PAST.DIRECT EVID}

“The letter that the girl wrote arrived”

(5) Future participle:

Kızın yazacağı mektup gelecek

Girl_{GEN} write_{FUTURE PART ACC} letter arrive_{FUTURE}

“The letter that the girl will write will arrive”

The past participle morpheme –DIK conveys past events and non-future states. For instance, in (4), the use of –DIK signals that the action of writing the letter occurred before the time of speech. The future participle morpheme –EcEk, by contrast, expresses situations that are yet to come. For

example, –EcEk in (5) encodes that the action of writing the letter has not yet happened at the time of speech.

4.1.2. Acquisition of evidentiality and participles in Turkish

Aksu-Koç (1988) studied the production and comprehension of *evidential verb forms* in monolingual Turkish children (aged 3-6). Her data showed that evidential morphology emerge shortly before the age of 4, and that the direct evidential emerges earlier than the indirect evidential by a few months. However, successful comprehension of evidential morphemes does not stabilize before the age 6. Öztürk and Papafragou (2007) found that monolingual children (aged 3-6) produced evidential morphemes virtually faultlessly, but had difficulties recognizing the semantic and pragmatic information expressed by the different evidential forms. Öztürk and Papafragou (2008) showed that children (aged 5-7) use the direct evidential form more often correctly than the indirect evidential form and that the latter form was hardly used in younger age groups. The study also indicated that the children at the age of 7 had more problems discriminating information obtained from indirect sources than from visually witnessed events.

Slobin (1986) investigated the development of participles in relative clauses in 3-4;8 year-olds performing a narrative speech task. He found that the use of participles is limited in all age groups. Similarly, Aksu-Koç (1994) showed that the past participle (–DIK) does not emerge before the age of 5 in monolingual children's narrative speech. Ekmekçi (1990) compared Turkish children's (aged 3-6) interpretation of sentences with relative clauses containing participles and simple sentences without relative clauses, using a sentence-imitation and a production task. The author showed that, by the age of 6, children tend to understand both the relative clauses and the simple sentences equally well. Nonetheless, Özge, Marinis, and Zeyrek (2010) showed that Turkish children's (aged 5-8) production of

object relatives (containing –DIK participle form) are prone to errors even in the oldest group.

4.1.3. Studies on evidentiality in Turkish heritage speakers

Evidentiality and time reference, as signalled by inflectional morphology, have been scarcely studied in Turkish heritage-speakers. What is known about the possible erosion of evidential forms is restricted to a handful of narrative-speech studies. Aarssen (2001) showed that Turkish heritage speakers (aged 4 -10) born in the Netherlands tend to overuse the present progressive over the evidential forms in their retellings of *frog stories*. Akıncı (2003) reported similar findings for heritage speakers (aged 12-17) born in France. Specifically, Aarssen (2001) observed a high number of inappropriate choices of evidentiality³⁹ where speakers shift from one evidential form to the other without a clear pragmatic reason. Since evidential morphemes indicate how the speaker knows an event, the use is expected to remain consistent during a story. Aarssen's (2001) findings imply that the heritage speakers' control over semantic and pragmatic content signaled by the evidential forms is not yet consolidated by the age of 10.

Karakoç (2007) investigated narrative speech production in heritage speakers born in Germany (aged 5-8) using a fairy tale retelling-task. Her data pointed to similar directions as the previously mentioned studies: the evidential forms are inconsistently used. Notably, the heritage speakers did not produce any narratives with the indirect evidential as the dominant

³⁹ The direct and indirect evidential forms can also be used to introduce 'temporal shifts' such as foreshadowings or flashbacks from the on-going temporal basis of the narrative. These are not regarded as inappropriate choices. What is meant by an 'inappropriate choice' here is to shift between the direct and indirect evidential forms without establishing that what has been said in an utterance is known through a different type of information source from the previous.

form,⁴⁰ although the indirect evidential is the appropriate form for (re)telling a fairytale in Turkish. Aksu-Koç (1994) found that monolingual Turkish children are able to use the indirect evidential as a narrative convention, and that by the age of 9, monolingual children tend to pattern with adults in their ability to narrate events using a consistent inflection-form.

Arslan and Bastiaanse (2014b) analyzed narrative speech of heritage speakers in the Netherlands (aged 16-18) using a spontaneous-speech interview, a picture description, and a storytelling task. Compatible with the aforementioned studies, the heritage speakers made a large number of substitution errors by using the direct evidential in contexts where the indirect evidential was more appropriate. The data indicated that the heritage speakers used the evidential forms to refer to past events, ignoring information source distinctions.

To summarize, previous studies have shown that Turkish monolingual children acquire the direct evidential earlier than both the indirect evidential and participle forms (Aksu-Koç, 1988; Ekmekçi, 1990; Öztürk & Papafragou, 2007, 2008). The evidential forms tend to be problematic in both child and adult heritage-speakers' narrative speech (e.g., Aarssen, 2001; Arslan & Bastiaanse, 2014b). Nevertheless, there are still some questions to be answered. For instance, it is unclear whether Turkish heritage speakers are aware of the semantic and pragmatic content carried by the evidential morphemes; this is the topic of the current study.

4.1.4. The current study

We administered a sentence-verification task to adult Turkish heritage speakers living in the Netherlands and to a reference group of Turkish monolingual speakers living in Turkey. The objective was to study

⁴⁰ Inflection for tense/aspect or evidentiality is considered as the dominant tense (also called as 'favored' or 'anchor' tense) in narratives when it is used in more than a certain proportion (i.e., two-thirds) of all utterances produced (Aksu-Koç, 1994).

participants' sensitivity to sentences with evidentiality and time reference violations, as measured by accuracy and response times (RTs). This allowed us to explore heritage speakers' sensitivity to violations of the semantic and pragmatic contents of differential verb inflection morphemes. The question was to what extent incomplete acquisition or attrition of inflectional morphology in Turkish heritage speakers affects their sentence processing. To address this, we posed two research questions:

- (Q1) Do Turkish heritage speakers differ from monolingual Turkish speakers in processing evidentiality violations in finite verbs and time-reference violations in non-finite participles?
- (Q2) Do Turkish heritage speakers differ in processing evidentiality violations in finite verb inflections from that of time-reference violations in non-finite participles?

Considering the studies on heritage speakers in the United States, verb inflections are susceptible to incomplete acquisition. This was confirmed by the narrative speech studies on Turkish heritage speakers. Therefore, it is expected that the adult heritage speakers will encounter more problems than monolingual Turkish speakers while processing both evidentiality and time reference violations. Nevertheless, the hypotheses introduced above predict an asymmetry in the heritage speakers' responses. The Interface Hypothesis predicts that integrating differential information from multiple linguistic domains is effortful, and that marked forms are more prone to processing limitations than default forms. Hence, the Interface Hypothesis anticipates that the heritage speakers will make more errors when responding to evidentiality violations than to time-reference violations, and that detecting indirect evidential violations will be more difficult than detecting direct evidential violations. The Regression Hypothesis predicts that heritage speakers will experience less difficulty processing violations by a direct evidential than both indirect evidential and time reference violations, as the latter two are acquired later by Turkish children. In sum, the heritage speakers' performances are predicted as follows:

Interface hypothesis: indirect evidential < direct evidential < time reference

Regression hypothesis: direct evidential < indirect evidential = time reference

4.2. Methods

4.2.1. Participants

Twenty-one heritage speakers of Turkish living in The Netherlands (8 females, age = 19.6, range = 16-26), raised by native Turkish-speaking parents, were tested. As a reference group, 24 monolingual speakers of Turkish living in Turkey (10 females, age = 28.2, range = 18-48) participated. The monolingual participants were college students or graduates who never had an extended stay in a foreign country nor spoke a second language at a proficient level. The heritage speakers' first exposure to both Turkish and Dutch was before the age of 4. None of the heritage speakers were involved in employment or education in Turkey that they only visited for summer holidays.

To further understand the nature of their bilingualism, the heritage speakers were given a 'bilingualism history questionnaire', adapted from Li, Sepanski, and Zhao (2006). The responses, as shown in Appendix C1, indicated that the heritage speakers typically use Turkish to communicate with their parents, and either Turkish or Dutch to interact with their siblings and peers. Proportions of daily language use, as shown by the responses to the questionnaire, were balanced between Turkish and Dutch. The heritage speakers were asked to rate their language abilities in both languages. As shown in Appendix C2, all of the heritage speakers rated their language abilities in Dutch as 'advanced', whereas 61% of them did so for Turkish. The participants were paid €10 for their participation in the experiment.

4.2.2. Materials

The RTs task included two parts: the first part tested the participants' sensitivity to the evidentiality distinctions (i.e., direct vs. indirect information) while the second part tested their sensitivity to the time reference distinctions (i.e., past vs. future time frames). For these purposes, 200 Turkish sentences were constructed across eight conditions, as illustrated in Table 4.1.

4.2.2.1. Evidentiality through finite verb inflections

To test evidentiality processing, 30 volition verbs, each conveying the intentionality of an action, were selected to construct 120 sentences across four conditions. The same verbs appeared in all four conditions. Each verb was matched with an inanimate object (e.g., *portakal soymak* “to peel an orange”); see Appendix C3 for the list of verbs. The sentences consisted of a two-word contextual support clause followed by a critical clause. The target verbs were situated in a clause-final position of the critical clause, which was followed by a padding phrase so that the trials did not end with the target verbs. To establish the past time reference, all of the evidential sentences contained a temporal adverb *az önce* “just before” previous to the critical verbs, as given in Table 4.1.

The sentences in the first two conditions (1 & 2: *Seen-Direct* and *Seen-Indirect*) included a contextual support clause signaling ‘seen’ information observed by the first person (e.g., *yerken gördüm* “I saw him while he was eating”). To form the correct baseline, in the *Seen-Direct* condition, the target verbs were inflected with a direct evidential. In the *Seen-Indirect* condition, by contrast, the indirect evidential forms were used on the target verb resulting in a violation of seen information source (see Table 4.1 for examples).

The sentences in the other two conditions (3 & 4: *Heard-Indirect* and *Heard-Direct*) started with a contextual support clause denoting ‘heard’ information reported in third-person (e.g., *yerken görmüşler*, “they saw him while he was eating”). This signals that the information came from a non-firsthand source and that the speaker himself did not witness the event. To create the correct baseline in the condition *Heard-Indirect*, the target verbs in the critical clause were inflected with an indirect evidential. However, in the condition *Heard-Direct*, the direct evidential forms were used on the target verbs leading to a violation of heard information source (see Table 4.1 for examples).

4.2.2.2. Time reference through non-finite participles

To test participants’ sensitivity to time reference violations, 20 verbs were selected to form 80 sentences across four conditions (see Appendix C4 for the list of verbs). Each sentence comprised two relative clauses followed by a matrix clause. The first relative clause served as contextual support while the second formed the critical clause in which the target verbs (i.e., the past/future participle) appeared. The target verbs used in the time reference sentences were different from those used in the evidentiality sentences.

As provided in Table 4.1, in the fifth condition (5: *PsPs*), a lexical adverb for the past (*dün* “yesterday”) was paired with a past participle leading to a correct past time reference. In the sixth condition (6: *FutPs*), the lexical adverb for the future was followed by a past participle resulting in a time reference violation. In the seventh condition (7: *FutFut*), a lexical adverb for the future (*yarın* “tomorrow”) was matched with a future participle ensuring correct future time reference. In the eighth condition (8: *PsFut*), the lexical adverb for the past was paired with a future participle resulting in a time reference violation. Note that time reference violations and correct baselines appeared in relative clauses, which were all followed by a matrix clause. Therefore, verb tenses of the matrix clauses were compatible with the time reference made by the past and future participles.

Table 4.1. Examples for the evidentiality (1-4) and time reference (5-8) sentences used in the during-listening RTs task, sentences that contain the evidentiality violations violation are shown in conditions 2 & 4, the time reference violations are given in conditions 6 & 8.

Condition	Contextual support	Critical clause	Padding phrase
(1) Seen-Direct	Yerken gördüm, Eat see DIRECT EVID 1 SG 'Previously I saw the man eating.'	az önce adam yemeği yedi. just before man food ACC eatDIRECT EVID 3 SG 'he ate the food (witnessed). I was surprised by how he ate.'	Hem de nasıl yemek! Şaşıtm kaldım And how eating surprise stay DIRECT EVID 1 SG
(2) Seen-Indirect	Yerken gördüm, Eat see DIRECT EVID 1 SG 'Previously I saw the man eating.'	az önce adam yemeği *yemiş. just before man food ACC *eatINDIRECT EVID 3 SG 'he *ate the food (reportedly). I was surprised by how he ate.'	Hem de nasıl yemek! Şaşıtm kaldım And how eating surprise stay DIRECT EVID 1 SG
(3) Heard-Indirect	Yerken görmüşler, Eat see INDIRECT EVID 3 SG 'Previously they saw the man eating.'	az önce adam yemeği yemiş. just before man food ACC eatINDIRECT EVID 3 SG 'he ate the food (reportedly). He didn't even wash the dishes.'	Hem de buluşkları yıkamamış bile And dishes ACC washNEG INDIRECT EVID 3 SG even
(4) Heard-Direct	Yerken görmüşler, Eat see INDIRECT EVID 3 SG 'Previously they saw the man eating.'	az önce adam yemeği *yedi. just before man food ACC *eatINDIRECT EVID 3 SG 'he *ate the food (witnessed). He didn't even wash the dishes.'	Hem de buluşkları yıkamamış bile And dishes ACC washNEG INDIRECT EVID 3 SG even
(5) PsPs	Şu okuldan çıkan That school ABL leave S PART 'That man leaving the school (is) the man for whom I cooked food yesterday' (and he) did not like the food'	benim dün yemek pişir-dik-im my yesterday food cook PAST PART POSS 1 SG 'I cooked food yesterday' (and he) did not like the food'	adam yemeği beğenmedi man food ACC like NEG DIRECT EVID 3 SG
(6) FutPs	Şu okuldan çıkan That school ABL leave S PART 'That man leaving the school (is) the man for whom I cooked* food tomorrow' (and he) did not like the food'	benim yarın yemek pişir-dik-im my tomorrow food cook PAST PART POSS 1 SG 'I will cook food tomorrow' (and he) did not like the food'	adam yemeği beğenmedi man food ACC like NEG DIRECT EVID 3 SG
(7) FutFut	Şu okuldan çıkan That school ABL leave S PART 'That man leaving the school (is) the man for whom I will cook food tomorrow' (and he) won't like the food'	benim yarın yemek pişir-ecek-im my tomorrow food cook FUTURE PART POSS 1 SG 'I will cook food tomorrow' (and he) won't like the food'	adam yemeği beğenmeyecek man food ACC like NEG FUTURE 3 SG
(8) PsFut	Şu okuldan çıkan That school ABL leave S PART 'That man leaving the school (is) the man for whom I will cook* food yesterday' (and he) won't like the food'	benim dün yemek pişir-ecek-im my yesterday food cook FUTURE PART POSS 1 SG 'I will cook* food yesterday' (and he) won't like the food'	adam yemeği beğenmeyecek man food ACC like NEG FUTURE 3 SG

4.2.3. Material evaluation through offline-ratings

The sentences constructed to test participants' processing of evidentiality and time-reference distinctions were rated in two separate offline questionnaires. Forty-one Turkish monolingual speakers (19 females, age = 29.0, ranges = 22-52) rated the evidentiality sentences and thirty-seven Turkish monolingual speakers (22 females, age = 26.8, ranges = 20-35) rated the time-reference sentences. Each of the participants responded to one questionnaire only and none of them took part in the main RTs task. The participants were instructed to read the sentences at their own pace and to rate the acceptability of the sentences on a four-point scale (1 highly acceptable, 4 highly unacceptable).

With respect to the evidentiality violations, paired *t*-tests showed that the non-violated seen information source contexts in the condition *Seen-Direct* were more acceptable than the seen information contexts violated by an indirect evidential in the condition *Seen-Indirect* (1.22 vs. 3.66, $t(40) = -33.03$, $p < .001$). The non-violated heard information contexts in the condition *Heard-Indirect* were more acceptable than the heard information contexts violated by a direct evidential in the condition *Heard-Direct* (1.24 vs. 3.65, $t(40) = -31.2$, $p < .001$). The ratings did not differ between the sentences containing a violation by direct or indirect evidentials (3.66 vs. 3.65, $t(40) = .86$, $p > .05$) or between the non-violated seen and heard information source contexts containing a direct versus indirect evidential (1.22 vs. 1.24, $t(40) = -.41$, $p > .05$).

Regarding the time-reference violations, the non-violated past participles in the condition *PsPs* were more acceptable than the past time contexts violated by a future participle in the condition *PsFut* (1.88 vs. 3.84, $t(36) = -15.75$, $p < .001$). Similarly, the non-violated future participles in the condition *FutFut* were more acceptable than the future time contexts violated by a past participle in the condition *FutPs* (1.98 vs. 3.92, $t(36) = -15.62$, $p < .001$). The sentences containing a violation by either a past or future participle did not differ from each other (3.92 vs. 3.84, $t(36) = 1.51$, $p > .05$), nor was there a difference between the non-violated sentences with past and future participles (1.88 vs. 1.98, $t(36) = -1.58$, $p > .05$).

4.2.4. Procedure

The sentences were read aloud and recorded by a female Turkish speaker. The stimuli were programmed in E-prime 2.0 (Psychology Software Tools, Pittsburgh, PA) and were presented in two lists counterbalanced across the participants. A participant was presented with either a violated or a non-violated version of the evidentiality sentences. For instance, while one list contained a verb in the violated, seen-information context, the other list contained the correct baseline for that verb. The violated and non-violated sentences were equally distributed over the lists. The non-violated sentences served as the baseline so that participants could differentiate between violated and grammatically correct sentences. Each list accommodated all of the time reference sentences. If a verb had to appear in different conditions in the same list, these items were programmed in distant positions from each other (i.e., in different blocks). During the experiment, there was a pause after each 25% of all sentences in a list ($n = 35$).

Each participant listened to 140 sentences in total. The sentences were presented in pseudo-randomized order. Data collection was done in a quiet room using a computer equipped with headphones. The paradigm was similar to a speeded grammaticality-judgment task used in Blackwell, Bates, and Fisher (1996). The participants were instructed in Turkish in the following way:

Now you will begin a language experiment in Turkish, in which you will hear several types of sentences through your headphones. When you see a hash tag on the screen, please be ready. It means that a sentence is coming soon. Some of the sentences are grammatically well-formed, but some are not. Please listen to the sentences very carefully and press the space bar as soon as you notice a part of the sentence mismatching the rest of the sentence. When you press the space bar, the sentence will not stop. If the sentence sounds good, do not do anything and wait for the next sentence.

4.2.5. Analysis

In the task, RTs and response-accuracies were measured. The data were analyzed in R version 3.1.1. (R-Core-Team, 2012) using the ‘lme4’ package. Response-accuracies were analyzed with generalized linear mixed-effects regression models, as the dependent variable was binomial (accurate vs. non-accurate). For the RTs, linear mixed-effects regression models were used. We excluded the RTs exceeding 2.5 standard deviations above the group means. Note that the analyses on the RTs were performed for accurate responses only. In both evidentiality and time-reference violations, RTs from ‘false alarms’ (i.e., where a participant mistook a correct sentence to be ungrammatical) were quite long, thus, were not further analyzed. Responses to one item in the evidentiality sentences were excluded due to a technical error (i.e., incorrectly programmed sentence). In the analyses, both the items and participants were introduced as random intercepts and random slopes where applicable (Baayen, Davidson, & Bates, 2008). First, a full model was built, and then the model was repeated with the omission of intercepts, slopes, and fixed-effects. By using the Akaike Information Criterion, the model that fit the data best was reported. Post-hoc comparisons were computed with the ‘multcomp’ package in R using ‘Tukey’ tests. The sentences with evidentiality and non-finite participles were first modeled separately and then compared to each other in one model.

4.3. Results

4.3.1. Processing evidentiality through finite verb inflections

Mean response-accuracies and RTs are illustrated in Figure 4.1; outputs from the mixed-effects regression models performed on the accuracy and RTs data are provided in Table 4.2. In the models, group (monolingual vs. heritage speakers) and condition (*Seen-Indirect* vs. *Heard-Direct*) were added as fixed-effects.

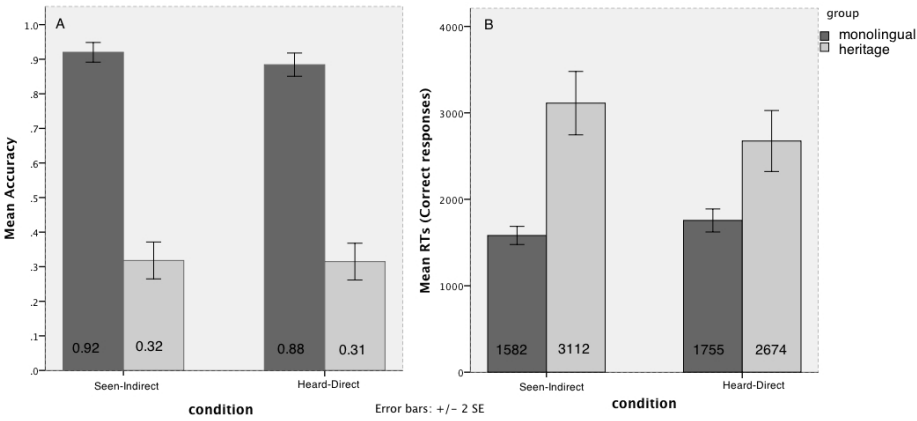


Figure 4.1. Mean accuracies (A) and RTs (B) of monolingual and heritage speakers’ responses to the evidentiality violations by the direct and indirect evidential forms. Conditions: *Seen-Indirect* = seen information contexts violated by indirect evidential; *Heard-Direct* = heard information contexts violated by direct evidential.

Table 4.2. Fixed-effects from the generalized linear mixed-effects model performed on response-accuracies and fixed-effects from the linear mixed-effects model performed on RTs to the evidentiality violations (Group = monolingual vs. heritage speakers; Condition = *Seen-Indirect* vs. *Heard-Direct*).

Fixed-effects for	Estimate	SE	z-value	p-value
accuracy				
Intercept	3.199	0.368	8.687	< .001
Condition	-0.471	0.270	-1.742	.081
Group	-4.269	0.295	-14.453	< .001
Condition x Group	0.451	0.337	1.337	0.181
Code in R: accuracy ~ condition * group + (1 participant) + (1 item)				
Fixed-effects for RTs	Estimate	SE	t-value	p-value
Intercept	3639.0	201.3	18.077	< .001
Condition	-427.6	158.6	-2.697	.007
Group	-2067.3	125.9	-16.421	< .001
Condition x Group	593.5	172.9	3.432	.001
Code in R: RTs ~ condition * group + (1 + condition participant) + (1 item)				

Regarding the response-accuracies, the model output showed significant effects of group with negative estimate-values. That is, the heritage speakers proved to be less accurate than the monolinguals. While the heritage speakers were 32% accurate in their responses to the violations by both evidential forms, the monolinguals were 92% accurate in the *Seen-Indirect* and 88% in the *Heard-Direct* conditions. However, no effects of condition or of interactions between the two factors were significant.

An error analysis was performed on the inaccurate responses to the non-violated sentences (i.e., where participants should not have responded). Outputs from a mixed-effects regression model showed significant effects of group ($\beta = 2.496$, $SE = 0.485$, $z = 5.142$, $p < .001$) but not of condition ($\beta = -0.080$, $SE = 0.388$, $z = -0.207$, $p = .83$). The effect of group confirmed that the monolinguals judged the non-violated sentences to be ungrammatical less often than the heritage speakers did. Since interactions between group and condition were significant ($\beta = -1.596$, $SE = 0.563$, $z = -2.834$, $p = .004$), post-hoc comparisons were performed. The heritage speakers inaccurately responded to the non-violated sentences for both types of evidential forms with an equal likelihood ($\beta = 0.369$, $SE = 0.252$, $z = 1.467$, $p = .14$). The monolinguals, however, responded incorrectly to the non-violated sentences with the indirect evidential more often than to those with the direct-evidential forms ($\beta = -1.075$, $SE = 0.481$, $z = -2.235$, $p = .025$).

For RTs, the model outputs, as given in Table 4.2, showed significant effects of group, condition, and an interaction between the two factors. Negative estimate-values of group effects affirmed that the heritage speakers were slower in responding to the evidentiality violations than the monolinguals. As the effects of condition and interaction between group and condition were significant, post-hoc tests were performed. The heritage speakers did not differ in their RTs to the violations by either evidential form ($\beta = -208.2$, $SE = 231.1$, $z = -0.901$, $p = .36$). However, the monolinguals had longer RTs to violations by direct evidentials, the *Heard-Direct* condition, than to violations by indirect evidentials, the *Seen-Indirect* condition ($\beta = 177.13$, $SE = 75.81$, $z = 2.336$, $p = .019$).

4.3.2. Processing time reference through non-finite participles

Mean response-accuracies and RTs are shown in Figure 4.2; outputs from the mixed-effects regression models performed on the accuracy and RTs data are given in Table 4.3. In the models, the fixed-effects were group (monolingual vs. heritage speakers) and condition (*FutPs* vs. *PsFut*).

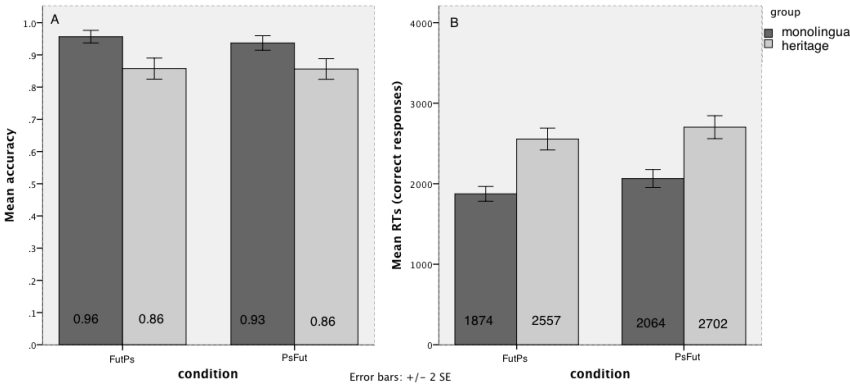


Figure 4.2. Mean accuracies (A) and RTs (B) of monolingual and heritage speakers’ responses to the time reference violations by the past and future participles. Conditions: *FutPs* = future time contexts violated by a past verb form; *PsFut* = past time contexts violated by future verb forms.

With regard to response-accuracies, the model outputs indicated significant effects of group but not of condition or of interactions between these two factors. This demonstrates that the heritage speakers were less accurate in their responses to the time reference violations than the monolinguals regardless of condition; see Figure 4.2. Both the heritage and monolingual speakers made errors by judging the non-violated sentences to be ungrammatical. An error analysis did not show significant effects of condition or group; therefore, these errors were not further analyzed.

Table 4.3. *Fixed-effects from the generalized linear mixed-effects model performed on response-accuracies and the linear mixed-effects model performed on RTs to the time reference violations (Condition = monolingual vs. heritage speakers; Group = FutPs vs. PsFut).*

Fixed effects for	Estimate	SE	z-value	p-value
accuracy				
Intercept	2.042	0.276	7.396	< .001
Condition	< 0.001	0.200	-0.003	.997
Group	1.367	0.290	4.708	< .001
Condition x Group	-0.401	0.361	-1.111	.267
Code in R: accuracy ~ condition * group + (1 participant) + (1 item)				
Fixed effects for RTs	Estimate	SE	t-value	p-value
Intercept	2654.94	123.15	21.558	< .001
Condition	139.10	79.28	1.754	.007
Group	-776.35	83.75	-9.270	< .001
Condition x Group	45.83	110.78	0.414	.679
Code in R: RTs ~ condition * group + (1 item) + (1 participant)				

With regard to RTs, outputs from the model, as shown in Table 4.3, indicated significant effects of group and condition without an interaction between these two factors. The heritage speakers were slower in their responses to the time-reference violations than the monolinguals. In both groups, RTs to the condition *PsFut* (i.e., violations by a future participle) were longer than to the condition *FutPs* (i.e., violations by a past participle). However, the between- and within-group differences did not interact.

4.3.3. Evidentiality and Time reference violations compared

We ran new models on the response-accuracies and RTs for both the evidentiality and time reference violations to compare the participants' sensitivity to these violation types. Sentence type (evidentiality vs. non-finite participles) and group (monolingual vs. heritage speakers) were programmed as the fixed-effects in the models.

With respect to the accuracy of responses, the model outputs showed significant effects of sentence type ($\beta = 2.878$, $SE = 0.147$, $z = 19.532$, $p < .001$), of group ($\beta = 3.481$, $SE = 0.175$, $z = 19.867$, $p < .001$), and an interaction between these two factors ($\beta = -2.244$, $SE = 0.246$, $z = -9.116$, $p < .001$). The heritage speakers were less accurate than the monolinguals. Given the interaction between sentence type and group, post-hoc comparisons were performed. Despite the different sizes of difference across groups, both the heritage speakers ($\beta = 3.010$, $SE = 0.156$, $z = 19.3$, $p < .001$) and the monolinguals ($\beta = 1.119$, $SE = 0.222$, $z = 5.024$, $p < .001$) were more accurate in their responses to the time-reference violations than to the evidentiality violations. Further output from post-hoc testing for all comparisons confirmed that the heritage speakers performed worse in responding to the evidentiality violations than to the time-reference violations: *Seen-Indirect* vs. *FutPs*, $\beta = 3.006$, $p < .001$; *Seen-Indirect* vs. *PsFut*, $\beta = 2.995$, $p < .001$; *Heard-Direct* vs. *FutPs*, $\beta = 3.025$, $p < .001$; *Heard-Direct* vs. *FutPs*, $\beta = 3.014$, $p < .001$.

With regard to RTs, the model outputs revealed significant effects of sentence type ($\beta = -421.7$, $SE = 99.1$, $t = -4.256$, $p < .001$), of group ($\beta = -1379.2$, $SE = 100.9$, $t = -13.665$, $p < .001$), and of interactions between the two factors ($\beta = 662.4$, $SE = 117.0$, $t = 5.663$, $p < .001$). Overall, the heritage speakers had longer RTs to both the evidentiality and time-reference violations compared to the monolinguals. Post-hoc comparisons showed that the heritage speakers were slower in their responses to the evidentiality violations than to the time-reference violations ($\beta = -519.6$, $SE = 101.0$, $z = -5.145$, $p < .001$). The monolinguals, however, showed the opposite pattern: longer RTs to the time-reference violations than to the evidentiality violations ($\beta = 84.67$, $SE = 51.53$, $z = 1.643$, $p < .001$).

4.3.4. Summary of results

The Turkish heritage speakers investigated in the current study were less accurate and slower in their responses to both the evidentiality and time-reference violations than Turkish monolinguals. The heritage speakers did

not differ in their responses to the violations of the direct- and indirect-evidential verb forms. However, the monolinguals responded with longer RTs to the violations by a direct evidential than to the violations by an indirect evidential. Furthermore, the heritage speakers frequently judged the non-violated sentences with evidentiality to be ungrammatical more often than monolinguals did. The heritage speakers performed both less accurately and more slowly on the evidentiality violations than on the time-reference violations. The monolinguals showed the opposite pattern: They had longer RTs but more accurate responses to the time-reference violations than to the evidentiality violations.

4.4. Discussion and conclusions

Results from this study provide us with further insights into online processing of evidentiality and time reference in Turkish heritage speakers. We sought to answer two main questions. The first was whether the heritage speakers differ in their processing of the evidentiality and time-reference violations from the monolinguals. The second question was whether there are differences in the heritage speakers' sensitivity to the evidentiality and time-reference violations.

With regard to the first question, our findings confirmed that the heritage speakers were at a disadvantage compared to the monolinguals when processing both evidentiality and time-reference violations. The heritage speakers demonstrated a reduced sensitivity to both the evidentiality and time-reference violations, which was shown by their lower accuracy and longer RTs than the monolinguals. Regarding the second question, an asymmetry was found in the heritage speakers' online processing of the evidentiality and time-reference violations. The heritage speakers were less sensitive to evidentiality violations than to time-reference violations, as evidenced by both their response-accuracies and RTs. The monolinguals had longer RTs (but more accurate responses) to the time-reference violations than to the evidentiality violations.

Previous studies have attributed heritage speakers' difficulties in their L1 inflectional morphology to incomplete acquisition and / or to attrition (Montrul, 2002, 2008; Polinsky, 2006, 2011). Given the lack of longitudinal investigations on Turkish heritage speakers' acquisition of evidentials and past/future participles, we consider the effects of incomplete acquisition and attrition to be equally likely. The interesting point is, however, that the heritage speakers' online processing of inflectional forms in Turkish was selectively affected. They responded more slowly and less accurately to the evidentiality violations than to the time-reference violations. The findings reported here are compatible with those of previous studies that showed asymmetrical erosion of inflectional morphology in heritage speakers of other languages (e.g., Bolonyai, 2007; Montrul, 2002, 2009; Montrul et al., 2012; Rothman, 2007). In the Introduction, two accounts for the asymmetries were discussed: interface vulnerability (i.e., the Interface Hypothesis) and maturational constraints (i.e., the Regression Hypothesis).

4.4.1. Interface vulnerability

According to the Interface Hypothesis, integrating information from different linguistic levels into an interface (e.g., syntax–pragmatic) is vulnerable in language attrition (see Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009). Therefore, the Interface Hypothesis predicts that the evidentiality violations pose greater difficulties to heritage speakers than the time-reference violations. This is what we have found. Hence, our findings can be explained by the vulnerability of the syntax–pragmatic interface. In evidential morphology, morphosyntactic knowledge has to be integrated with the knowledge from domains of semantics and pragmatics, thus the evidential forms easily erode under attrition or incomplete acquisition. The past and future participles, by contrast, are non-finite verb forms used in object-relative clauses, and thus, their semantic and pragmatic content (i.e., time reference) are bound by the arguments of matrix clause verbs (see Enç, 1987; Underhill, 1972). In principle, the use of these participle forms can be licensed by syntactic knowledge. In accordance with

the Interface Hypothesis, the heritage speakers' sensitivity to time reference-violations by participle forms was relatively spared.

The Interface Hypothesis makes another prediction. According to Sorace and Serratrice (2009), bilinguals are likely to encounter more difficulty processing 'marked' forms compared to default forms. In Turkish, the indirect evidential is the marked form, as it is used in differential information source contexts (i.e., inference and report). The direct evidential, that is linked to direct experience, is the default form within the evidential paradigm (see Johanson, 2003). Therefore, it is expected that the heritage speakers encounter more difficulties with the violations by an indirect evidential as compared to those by a direct evidential. Our data do not support such an interpretation. Instead, the heritage speakers performed equally poor in responding to the violations by a direct evidential (less marked form) and by an indirect evidential (more marked form). Therefore, our data do not support the idea that marked forms are more vulnerable to processing limitations than the unmarked forms.

4.4.2. Maturational constraints

A specific claim about the compatibility of heritage speakers' incomplete knowledge of inflectional morphology and the age of acquisition has been made in Montrul (2009). Her data indicated that incomplete acquisition and attrition might affect heritage speakers as a mirror image of acquisition, compatible with the Regression Hypothesis. According to this hypothesis, the first acquired-language structure is least affected by language attrition. In monolingual children's acquisition, the direct evidential is mastered before the indirect evidential and participle forms (e.g., Aksu-Koç, 1988; Ekmekçi, 1990; Özge et al., 2010). Therefore, the Regression Hypothesis predicts that heritage speakers perform better in responding to violations by a direct-evidential form as compared to the violations by indirect-evidential and participle forms. This is not what we found. The heritage speakers were equally poor in responding to the violations by both evidential forms, whereas processing of participles was relatively good. A relatively spared

performance on time-reference violations by the participles is not what the Regression Hypothesis predicts.

Data on Turkish children's acquisition of evidential and participle inflectional morphology are limited. The available studies indicate that the conceptual development of the direct-evidential form precedes that of the indirect evidential. This is reasonable, since the indirect evidential form requires higher cognitive functions (e.g., inferential reasoning), which may not be fully developed in younger children when the direct evidential is already mastered. Moreover, the indirect evidential is more complex in its semantics as it may also mark epistemic modality. Given the acquisition data, at the age of 6-7, the conceptual development of the indirect evidential form is not yet complete (e.g., Aksu-Koç, 1988; Öztürk & Papafragou, 2007, 2008). At this point, lack of acquisition studies on evidential morphology in older age groups (e.g., 7-12)⁴¹ prevents us from further contemplating the exact relationship of incomplete acquisition patterns found in heritage speakers with maturational constraints.

4.4.3. A vulnerable grammar domain: evidentiality

The current study has shown that Turkish heritage speakers' sensitivity to semantic and pragmatic content signaled by the evidential morphemes is considerably eroded under attrition and/or incomplete acquisition. Recall that heritage speakers under investigation performed equally poor in responding to violations in both evidential forms. This can be explained by problems in discriminating between different information sources that the evidential morphemes carry. That is, when they are given a sentence in which the information source context mismatches the evidential verb form, the heritage speakers encounter difficulties. However, our data suggest that heritage speakers are aware of the fact that the evidential forms indicate past events. Recall that all the evidential test sentences contained past temporal adverbs. Therefore, the heritage speakers must have processed the evidentiality violations as acceptable, as both evidential forms are taken to

⁴¹ A. Aksu-Koç, personal communication, 13 June 2015.

refer to the past. The error analysis supports this claim. The heritage speakers judged the non-violated evidential sentences to be ungrammatical more often than the non-violated time-reference sentences.

Possibly, erosions in the heritage speakers' sensitivity to the evidentiality violations are due to transfer effects from L2 (Dutch), which lacks evidential verb forms. Our data suggest that the heritage speakers are not fully aware of the information source distinctions carried by the evidential morphology, although they seem to understand that both evidential forms indicate past events. That is, in Turkish heritage grammar, the semantic content of the evidential morphemes may be simplified, especially when the dominant language lacks these forms. This is in line with what Montrul (2010) reported for the object-marking paradigm in Spanish; Polinsky (2006) for Aspect distinctions in Russian; Kim et al. (2009) and Gürel and Yilmaz (2011) for the pronominal systems in Korean and Turkish heritage grammars. However, given the lack of a reference group of bilingual speakers of two languages that both have grammatical markers for evidentiality, it is impossible to be sure about the extent to which the evidential system is prone to effects of language transfer.

Finally, two interesting processing asymmetries emerged from our monolingual group that were absent in the heritage speakers. The first was that monolinguals reacted quicker to seen information sources violated by an indirect evidential than to heard information sources violated by a direct evidential. Recall that speaking about one's personally perceived information as though it had been heard from another speaker is counter-intuitive (Aikhenvald, 2004). The monolingual Turkish speakers rejected such mismatches immediately, as shown by shorter RTs to violations by indirect evidentials than to violations by direct evidentials. However, this counter-intuitive semantic effect, reflected in the monolingual data, is not present in the heritage speakers who demonstrated no differences in their responses to the evidentiality violations. The second processing asymmetry was a speed-accuracy trade-off pattern as shown by the monolinguals' more accurate but longer responses in detecting the time-reference violations compared to the evidentiality violations. The time reference violations were constructed by mismatches between time-contexts and the participle verb forms in the embedded relative-clauses. Therefore, it is conceivable that the

speed-accuracy trade-off pattern was due to the monolinguals' increased 'attention', as the relative clauses are rather complex forms. The heritage speakers were both less accurate and slower in their RTs to the evidentiality violations than the time-reference violations.

In conclusion, the findings from the current study indicate that heritage speakers performed poorer than monolinguals in processing both evidentiality and time reference violations. Additionally, processing evidentiality violations proved more effortful for heritage speakers than processing time-reference violations by non-finite participle forms positioned in relative clauses. The data documented in this study do not support the Regression Hypothesis. We have argued that the heritage speakers' poorer performance on evidentiality violations can be explained by the fact that these verb forms require integration of information from different linguistic levels, in this case at the syntax-pragmatics interface. This is inline with the Interface Hypothesis. It looks as though evidentiality is 'simplified' in Turkish heritage grammar, and, thus, heritage speakers are less likely to be aware of the semantic and pragmatic requirements of evidential morphology.

CHAPTER 5

5. Looking at the evidence in visual world: eye-movements reveal how bilingual and monolingual Turkish speakers process grammatical evidentiality⁴²

⁴² This chapter is adapted from Arslan S, Bastiaanse R and Felser C (2015). Looking at the evidence in visual world: eye-movements reveal how bilingual and monolingual Turkish speakers process grammatical evidentiality. *Front. Psychol.* 6:1387. doi: 10.3389/fpsyg.2015.01387

Abstract. *This study presents pioneering data on how adult early bilinguals (heritage speakers) and late bilingual speakers of Turkish and German process grammatical evidentiality in a visual world setting in comparison to monolingual speakers of Turkish. Turkish marks evidentiality, the linguistic reference to information source, through inflectional affixes signaling either direct (-DI) or indirect (-mIş) evidentiality. We conducted an eye-tracking-during-listening experiment where participants were given access to visual ‘evidence’ supporting the use of either a direct or indirect evidential form. The behavioral results indicate that the monolingual Turkish speakers comprehended direct and indirect evidential scenarios equally well. In contrast, both late and early bilinguals were less accurate and slower to respond to direct than to indirect evidentials. The behavioral results were also reflected in the proportions of looks data. That is, both late and early bilinguals fixated less frequently on the target picture in the direct than in the indirect evidential condition while the monolinguals showed no difference between these conditions. Taken together, our results indicate reduced sensitivity to the semantic and pragmatic function of direct evidential forms in both late and early bilingual speakers, suggesting a simplification of the Turkish evidentiality system in Turkish heritage grammars. We discuss our findings with regard to theories of incomplete acquisition and first language attrition.*

5.1. Introduction

Evidentiality refers to the linguistic encoding of the type of information source an event description is based on, such as whether or not the event has been witnessed directly by the speaker (Aikhenvald, 2004). Most languages express evidentiality through lexical adverbs (e.g. *reportedly*). However, in Turkish, evidentiality is conveyed through verb inflections requiring the speaker to distinguish whether an event has been directly witnessed or has been indirectly inferred or reported (Slobin & Aksu, 1982). In this study, we provide pioneering data on how grammatical evidentiality is processed by

adult Turkish monolinguals, early bilinguals (i.e. heritage speakers of Turkish), and late bilinguals (i.e. L2 learners of German) in an eye-tracking-during-listening experiment.

Effects of bilingualism on one's native language are subject to a number of variables; in the current study, we will focus on the onset of bilingualism. Two types of bilinguals are of interest in this respect: early bilinguals (heritage speakers of a minority language) and bilingual individuals who learnt the dominant majority language after childhood. A possible consequence of bilingualism is the selective loss of properties of an individual's first language. Verbal morphology and certain syntactic constraints have been shown to be susceptible to selective erosion ('attrition') after full acquisition of the first language (Cook, 2003; De Bot & Weltens, 1991; Gürel, 2004; Köpke et al., 2007; Köpke & Schmid, 2004; Pavlenko, 2004; Seliger & Vago, 1991; Sorace & Serratrice, 2009; Yağmur, 1997). First language attrition has specifically been associated with late bilingualism. In early bilinguals (in particular, 'heritage speakers'), properties of the first language have instead been argued to be prone to disrupted acquisition processes during childhood (Albirini et al., 2013; Albirini et al., 2011; e.g. Montrul, 2002; Montrul, 2008, 2009; Polinsky, 2006). That is, early bilinguals are often assumed to not have reached full acquisition of several properties of the heritage language, due to reduced input conditions.

Köpke (2004, 4) defines attrition as the "loss of the structural aspects of the language, ie., change or reduction in form". In bilingual acquisition contexts, first language attrition is a possible outcome in bilinguals who acquired their second language later in life (e.g. after puberty), and after fully acquiring their first language during childhood (Cook, 2003; De Bot & Weltens, 1991; Gürel, 2004; Köpke, 2004; Köpke et al., 2007; Pavlenko, 2004; Seliger & Vago, 1991; Tsimpli, Sorace, Heycock, & Filiaci, 2004; Yağmur, 1997). In contrast to language attrition in late bilinguals, Montrul (2002, 2008) and Polinsky (2006) have shown that an early onset of bilingualism may lead to incomplete acquisition, that is, to a failure in acquiring part(s) of the first language grammar during early childhood. Incomplete acquisition has mainly been observed in heritage speakers, who during childhood were exposed to their first language within a minority

population away from where that language is spoken natively. Studies on heritage speakers of Spanish (Montrul, 2002, 2008, 2009), Russian (Polinsky, 2006, 2008), and Arabic (Albirini et al., 2013; Albirini et al., 2011) have confirmed that several aspects of the first language grammar are subject to divergent performance and/or competence from monolingual speakers.

Montrul (2002, 2008) suggests that a disrupted acquisition process may result in unsuccessful ultimate attainment of the inherited (first) language in early bilingual adults, and that the effects of incomplete acquisition may be more severe compared to the effects of first language attrition in late bilinguals. Incomplete acquisition does not seem to affect all areas of inflectional morphology equally, however. Montrul (2009), for example, investigated adult Spanish heritage speakers' sensitivity to aspectual (preterit – imperfect) and modal (subjunctive – indicative) distinctions using an elicited oral production task, a written morphology recognition task, and a judgment task. She found that the heritage speakers' knowledge of aspectual distinctions was better retained than their knowledge of modal distinctions, suggesting that the heritage speakers were affected by incomplete acquisition of Mood. Given that Aspect tends to be acquired earlier than Mood, Montrul (2009) attributes the heritage speakers' greater problems with Mood to maturational factors (i.e. the order of acquisition of inflectional distinctions).

Montrul's (2009) observation of Mood distinctions being eroded more than aspectual ones in Spanish heritage language is consistent with Jacobson's (1941) Regression Hypothesis, which holds that linguistic properties that are acquired late will be lost first (see Keijzer, 2010). Montrul's findings are also compatible with the Interface Hypothesis (Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009), according to which linguistic properties at 'interfaces' (e.g. syntax–discourse interface) may prove particularly problematic in bilingual acquisition. Linking syntactic and discourse-level information is claimed to be particularly difficult. Sorace and Serratrice (2009, p. 199) argue that “bilinguals may have fewer processing resources available and may therefore be less efficient at integrating multiple types of information in on-line comprehension and production at the syntax – pragmatics interface”. Therefore, even highly proficient bilinguals may show difficulty using or

processing grammatical forms that are marked in the sense of requiring very specific pragmatic licensing conditions. Sorace (2011), however, cautions against extending the Interface Hypothesis, which originally sought to account for non-target like performance patterns in near-native second language speakers, to heritage speakers.

In past few years, there has been increasing interest in understanding the properties of subtractive bilingualism, when the first language is a minority language. Most previous studies have focused on early and late bilinguals (i.e. heritage speakers and L2 speakers) living in the United States. The nature of language erosion in bilingual individuals living in Western Europe is less well understood. Turkish is one of the most widely spoken minority languages in Germany, and it differs typologically from most of the previously studied heritage languages. Turkish is an agglutinative language with rich inflectional morphology, including the grammatical expression of evidential distinctions. The linguistic features of Turkish evidentials are described in more detail below, as well as previous experimental studies on this phenomenon.

5.1.1. Evidentiality in Turkish

Evidentiality refers to the linguistic encoding of a particular type of evidence for a speaker's utterance (Aikhenvald, 2004; Chafe & Nichols, 1986; Lazard, 2001; Plungian, 2001; Willett, 1988). The nature of the evidence relates to how a speaker has access to the information in his or her statement: witnessing, inference, or hearsay. Turkish expresses evidentiality through a verbal inflection paradigm with two choices for direct (witnessing) and indirect evidence (inference or hearsay), as illustrated in (1) and (2), respectively.

- (1) Adam elmayı yedi
 Man apple ACC eat DIRECT EVID
 "The man ate the apple" [witnessed]

- (2) Adam elmayı yemiş
 Man apple_{ACC} eat_{INDIRECT EVIDENTIAL}
 “The man ate the apple” [reported or inferred]

The direct evidential suffix –DI is used to refer to past events that were directly witnessed, or participated in, by the speaker. For example, in (1) –DI signals that the speaker has witnessed the apple being eaten. The indirect evidential suffixes –mİş and –(I)mİş are appropriate for use in inference or reportative contexts, respectively. For instance, in (2) the speaker has been either told that the man ate the apple, or has (physical) evidence leading him or her to infer that the man ate the apple, such as seeing peelings and leftovers of an apple on the table.

In inference contexts, the use of an indirect evidential signals non-witnessed past events that are perceived through present states or results on the basis of physical or visual evidence (Aksu-Koç & Slobin, 1986). In reportative contexts it conveys that the information is known through ‘hearsay’ or verbal report from a third party (Slobin & Aksu, 1982). These semantic and formal distinctions in Turkish evidentials are well understood. Several studies have indicated that the indirect evidential is the marked term on the basis of its semantic complexity since it refers to different information sources (i.e., inference and report), whilst the direct evidential is the unmarked form for referring to witnessed past events (Aksu-Koç, 1988, 2000; Aksu-Koç & Slobin, 1986; Johanson, 2006; Sezer, 2001; Slobin & Aksu, 1982). These authors also agree that while the indirect evidential bears epistemically modal connotations, the direct evidential is a non-modal term.

The use of evidentials in interrogative contexts has not been explored much in Turkish linguistics. Aikhenvald (2004, pp. 244 - 248) claims that evidentials in an interrogative clause reflect the type of information source available to the questioner or to the addressee. This indicates that the semantic and pragmatic uses of evidentials differ in declarative and interrogative contexts. In *wh*-interrogative clauses such as (3) and (4)

below, for example, the use of a particular evidential reflects the type of information source available to the addressee of the question, while the questioner may not necessarily have access to the same information source.

(3) Hangi adam elmayı yedi?

Which man apple_{ACC} eat_{DIRECT EVID}

“Which man ate the apple?”

(4) Hangi adam elmayı yemiş?

Which man apple_{ACC} eat_{INDIRECT EVID}

“Which man ate the apple?”

The questioner’s choice of a particular evidential form indicates that he or she is making assumptions on the information source available to the addressee. In (3), the questioner assumes that the addressee has witnessed who has eaten the apple; thus, a direct evidential is used. In (4), by contrast, the questioner presumes that the addressee has access to information about the event through an indirect source (e.g. inference or hearsay), hence, an indirect evidential is used. Therefore, a particular evidential is selected in an interrogative clause depending on what the questioner assumes as to how the addressee may have acquired knowledge of the event concerned.

5.1.2. Experimental studies on Turkish evidentials

Experimental studies on evidentiality in mono- and bilingual Turkish speakers are scarce. The psycholinguistic understanding of grammatical evidentiality is limited to developmental studies in monolingual children and a small number of studies on adult bilinguals. One of the earliest empirical studies was conducted by Aksu-Koç (1988), who examined the production and comprehension of evidential morphology (among other morphemes) in Turkish-speaking children (aged 3-6). She found that the direct evidential morpheme was one of the first to be acquired, followed by

the indirect evidential morpheme after a delay of about few months. Aksu-Koç (1988) notes, however, that children's early use of evidential morphemes tends to be limited to directly perceived events or present states, and that at this developmental stage children may not yet be able to distinguish the direct vs. indirect information contrast. This was confirmed by more recent studies. Öztürk and Papafragou (2007), for example, studied young monolingual Turkish children (aged 3-6) using elicited production and semantic and pragmatic comprehension tasks. The children used evidential forms appropriately but tended to have difficulty distinguishing the semantic and pragmatic content signaled by these forms. In a later study, Öztürk and Papafragou (2008) examined Turkish children (aged 5-7) using both an elicited production and a non-linguistic source monitoring task. The data reveal that Turkish children in all age groups are able to produce direct evidential forms almost faultlessly while their use of indirect evidential develops with age. Inferred and reported information sources proved more difficult for children than directly witnessed information sources even in the oldest age group; see also Ünal and Papafragou (2013). Aksu-Koç (1988) reports that monolingual Turkish children tend to gain control over the semantic and pragmatic content of direct evidentials around the age of three. The inferential readings related to the indirect evidential, however, only stabilize around the age of four in monolingual children, while reportative contexts develop around the age of four and a half. Aksu-Koç (2014); Aksu-Koç, Terziyan, and Taylan (2014) argue that modal distinctions (including epistemic readings associated with indirect evidentials) are acquired later, and that children at earlier stages of development produce non-modalized markers instead, such as the direct evidential.

Some recent studies show that evidentiality is susceptible to erosion or incomplete acquisition in Turkish heritage speakers. Arslan, de Kok, and Bastiaanse (in press) studied Turkish/Dutch early bilingual (i.e. second-generation heritage speakers) and Turkish monolingual adults using a sentence-verification task where participants listened to sentences containing evidential verb forms that mismatched the information contexts. For instance, an indirect evidential was mismatched to 'seen' information contexts (*Yerken gördüm, az önce adam yemeği yemiş* "I saw the man eating; he ate INDIRECT EVIDENTIAL the food") and a direct evidential was mismatched to 'heard/indirect' information contexts (*Yerken görmüsler, az*

önce adam yemeği yedi “They saw the man eating; he ate DIRECT EVIDENTIAL the food”). Participants’ sensitivity to evidential verb forms was measured by asking them to press a button when a sentence was incongruent. Arslan et al. (submitted) demonstrated that the bilinguals were largely insensitive to both types of evidential mismatches. Interestingly, however, the bilinguals retained their sensitivity to tense violations (i.e. violations by past and future participles without evidentiality marked). Arslan et al.’s (submitted) data showed that evidentiality is a particularly vulnerable part of Turkish grammar in early bilingual speakers.

Furthermore, Arslan and Bastiaanse (2014b) investigated narrative speech production in second-generation Turkish/Dutch early bilingual adults. The early bilinguals made a large number of substitution errors by inappropriately using direct evidentials in contexts that required an indirect evidential form. The early bilingual adults showed reduced sensitivity to the semantic distinctions between information sources that the evidential forms signal. Arslan and Bastiaanse (2014b), nonetheless, report that the early bilingual adults did not substitute the indirect evidential where a direct one should be produced. The authors suggest that the indirect information source is incorporated while direct evidence is ignored, as if the direct evidential does not carry an evidential value in early bilingual Turkish speakers’ oral production.

Summarising, previous studies indicate (i) that the direct evidential is acquired earlier than the indirect evidential, possibly due to the latter being more complex in terms of its semantics (e.g. Aksu-Koç, 1988; Öztürk & Papafragou, 2007, 2008); (ii) that evidential terms in Turkish are highly susceptible to erosion in adult heritage speakers (Arslan and Bastiaanse, 2014b; Arslan et al., submitted). The studies discussed above have also left some questions unexplored. First, it is not clear whether insensitivity to evidentiality distinctions is restricted to early bilingual heritage speakers or whether it can also be observed in late bilinguals. Second, although Arslan et al. (submitted) measured the processing of evidentiality using a response-time task, the moment-by-moment time course of processing evidentiality has not been investigated yet. Finally, recall that the use of evidential forms is linked to the kind of evidence available to the speaker (in declarative clauses) or the addressee (in interrogative clauses), and nothing is known as

yet about how comprehenders interact with this evidence during their processing of grammatical evidentiality.

In the current study, we carried out an eye-movement monitoring experiment with three groups of participants: early and late Turkish/German bilinguals and a reference group of monolingual Turkish speakers. Testing two different bilingual groups should allow us to explore whether differences in the age of bilingualism onset affects bilinguals' processing of evidentiality. The aim of the experiment was to unveil the nature of processing evidentiality through monitoring participants' eye movements while they listened to sentences with grammatical evidentiality in a visual-world paradigm. This is a very compelling way to test processing of evidentiality as the visual-world paradigm allows us to measure participants' moment-by-moment eye-movements while they interact with different types of visual evidence. Our visual stimuli included picture pairs that encoded either 'witnessed' or 'inferable non-witnessed' events, which were appropriate for the use of direct and indirect evidential forms, respectively. In particular, we sought to answer the following questions:

- Do early and late bilinguals differ from monolinguals in their processing of evidentiality?
- Do monolingual, early and/or late bilingual Turkish speakers differ in their processing of direct and indirect evidentials?

Given the findings of previous studies on early bilingual heritage speakers living in the U. S., inflectional morphology seems to be particularly affected. This is consistent with Arslan et al.'s (in press) findings for early bilingual speakers of Turkish in the Netherlands. Considering these data, we expect early bilinguals to show a reduced sensitivity to evidentiality in comparison to monolingual Turkish speakers. If this is a consequence of incomplete acquisition, then early bilinguals will also be sensitive to evidentiality compared to late bilinguals, who we expect to pair with the monolinguals. The hypotheses we introduced above moreover predict an asymmetrical insensitivity in bilingual participants' responses to direct and indirect evidential forms. Specifically, the Interface Hypothesis predicts more problems during bilinguals' processing of the indirect than the direct

evidential forms. According to this hypothesis, integrating information from multiple linguistic domains - in particular, integrating morphosyntactic and pragmatic information - is difficult for speakers who have not fully acquired the language under investigation. Recall that the use of indirect evidentials is licensed only in specific pragmatic contexts that require more or less complex inferential reasoning, whereas direct evidentials are used as an 'elsewhere' form in the absence of such contexts, signaling that an event was witnessed directly. The Regression Hypothesis also predicts more problems in bilinguals' responses to indirect than to direct evidential forms as the former are acquired later in development.

5.2. Materials and methods

5.2.1. Participants

Sixty-one adult Turkish speakers were recruited from the Turkish community of Berlin, Germany. They were categorized into three groups on the basis of their age of onset of bilingualism. A group of early bilinguals ($n=19$), who were all born in Germany (i.e. second generation heritage speakers of Turkish), and a group of late bilinguals ($n=20$) were recruited. The late bilinguals were L2 learners of German who came to Berlin after puberty (i.e. after the age of 13). Finally, a reference group of monolingual Turkish speakers ($n=22$) who had no previous contact with German also participated. A demographic information questionnaire was completed by all participants. In addition, the bilinguals responded to a short language test in both German and Turkish, adapted from the Goethe (Goethe-Institut e.V.) and telc (telc GmbH) placement tests; see Table 5.1.

Table 5.1. *Numbers and age of participants, AoA = age of acquisition in years with min-max age range, and proficiency test scores (ranges in brackets) in Turkish and German for bilingual participants*

	<i>N</i>	Age	AoA Turkish	AoA German	Turkish Score	German Score
Monolingual	22	24 (20-36)	From birth	NA	NA	NA
Late bilingual	20	30 (21-46)	From birth	13-27	89.5% (63-100)	61.3% (23-93)
Early bilingual	19	27 (22-36)	From birth	1-4	71.1% (13-100)	91.2% (76-100)

The monolinguals were native Turkish speakers from Turkey who were in Berlin for holidays or family visits during the time they were recruited. None of them spoke any German. All participants were highly educated (i.e. college students or graduates) and spoke the standard Turkish dialect. No speakers of any ethnical languages or dialects participated in this study. The participants had normal hearing and (corrected to normal) vision. They gave their consent under the Helsinki declaration and were paid a fee of 10€.

5.2.2. Materials

Sixty visual displays, each comprising a pair of photos presented next to each other, were created as shown in Table 5.1. One of the photos was the target picture and the other one served as a context picture. To create the visual displays, 20 action verbs were combined with six different people and ten different inanimate objects (i.e. *süt içmek* ‘to drink milk’). The same actions were displayed in two experimental conditions, a direct and an indirect evidential one, as well as in a non-evidential distractor condition involving the future tense ($n=20$ each). The photographs used in this experiment were taken from European, Asian, and African versions of the Test for Assessing Reference of Time: TART (Bastiaanse et al., 2008).

Different ‘models’ from different versions of TART were used with the same action displayed in different conditions in a counterbalanced manner. For example, drinking milk appeared once in the direct evidential condition acted by a European-looking person, once in the indirect evidential condition acted by a person of Asian appearance, and once in the future tense condition acted by a person of African appearance as shown in Figure 5.1. An equal number of male and female ‘models’ appeared in each condition.



Figure 5.1. *Examples of visual displays appeared in three different conditions: A – direct evidential, B – indirect evidential, C – future tense.*

To encode direct and indirect evidentiality contexts visually, different states of the same action were represented next to each other. For the direct evidential condition, an action was shown while it was happening in one of

the photographs and its end-state in the other (see Figure 5.1 A). This was an example of a witnessed event, appropriate for the use of a direct evidential form. For the indirect evidential condition (Figure 5.1 B), an action was displayed in its end-state and in a ‘pre-action’ state, that is, before the action was initiated. This means that the action could only possibly be inferred, making this kind of visual display appropriate for the use of an indirect evidential form. In both evidential conditions, the target picture was the photograph that depicted the end-state of the action. For the future tense condition (Figure 5.1 C), an action was shown in the target photo in its pre-action state. The future items also included a context photo, which was showing the action as ongoing in half of the future items, and in its end-state in the other half. The order of the two photographs was reversed in half of the items so that the target picture did not always appear on the same side.

The auditory stimuli consisted of interrogative clauses that were read by a female Turkish native speaker and digitally recorded. Examples for each of the three conditions are given in (5)–(7) below. In the two evidential conditions, the participants were asked to identify the picture showing the result of the action. In the future tense condition, the target picture was the one depicting a pre-action state (e.g. with the glass of milk still full and untouched).

A three-word padding phrase (e.g. *ender bir istekele* ‘with unusual desire’) was added at the end of each interrogative clause to preclude the auditory stimuli from terminating at the critical verb. Extending the stimuli sentences in this way was necessary so as to extend measuring time and thus enable us to capture potential spillover effects, and to reduce the possibility of our eye-movement data being affected by global end-of-sentence wrap-up processes.

(5) Direct evidential

Hangi fotoğraftaki adam dün sütü içti
 Which photograph_{LOC} man yesterday milk_{ACC} drink_{DIRECT EVID}

ender bir istekle?
 unusual one desire.

“In which photograph did the man drink the milk yesterday with an unusual desire?”

(6) Indirect evidential

Hangi fotoğraftaki adam dün sütü içmiş
 Which photograph_{LOC} man yesterday milk_{ACC} drink_{INDIRECT EVID}

ender bir istekle?
 unusual one desire.

“In which photograph did the man drink the milk yesterday with an unusual desire?”

(7) Future tense (non-evidential)

Hangi fotoğraftaki adam birazdan sütü
 Which photograph_{LOC} man soon milk_{ACC}

içecek ender bir istekle?
 drink_{FUTURE} unusual one desire.

“In which photograph will the man drink the milk soon with an unusual desire?”

5.2.3. Evaluation of the experimental sentence stimuli⁴³

The plausibility of our experimental stimuli was evaluated in an offline rating study using a four-point Likert scale (1 = very plausible, 4 = very implausible). To construct plausible test items, the evidentiality sentences exemplified by (5) and (6) were converted into declarative clauses. The ‘plausible direct evidential condition’ (n=20) contained semantically coherent sentences with a direct evidential form (e.g. *adam dün süti içti, ender bir istekle* “the man drank the milk with unusual desire”), and the ‘plausible indirect evidential condition’ (n=20) contained semantically coherent sentences with an indirect evidential form (e.g. *adam dün süti içmiş, ender bir istekle* “the man drank the milk with unusual desire”). To create implausible counterparts of the plausible conditions, the agent and theme arguments in those sentences were reversed (e.g. *süt dün adamı içti, ender bir istekle* “the milk drank the man with unusual desire”). The plausible and implausible sentences were distributed across four presentation lists, counterbalanced across participants. Sentences constructed with a same verb in different conditions appeared in different lists so as to minimize potential effects of repetition. In addition, 30 plausible and implausible filler sentences were added to each list, resulting in a total of 50 items per list.

Participants included forty-three monolingual speakers of standard Turkish (mean age=26.3, range=17-45, 24 males), none of whom took part in the main eye-tracking experiment. All participants were living in Turkey and none of them reported to speak any foreign language proficiently. The

⁴³ A reviewer suggests that the use of evidential sentences with the padding phrases positioned at the end of the sentences sounds rather unnatural, especially for the indirect evidential sentences. The reviewer claims that the indirect evidentiality sentences used in the current study cannot be combined with adverbial phrases such as *ender bir istekle* “with unusual desire” since the indirect evidential signals a “non-witnessed” event. This is on the assumption that in inference contexts, where there is nobody who actually witnessed how the action was performed, adverbials of this kind cannot be used to modify the action. The purpose of our offline rating task was to ascertain whether our direct and indirect evidentiality stimuli sounded equally plausible.

rating task was administered as a web-based questionnaire. At the beginning of the task, the following instructions were provided in Turkish: “You are being asked to rate the plausibility of some Turkish sentences (i.e. how ‘intuitive and reasonable’ do these sentences sound to you). Please read each sentence carefully and click on one of the answer choices provided under each sentence. On every page, there are five sentences. When you have finished rating the sentences on one page, click on ‘continue’, and when you have finished rating all of the sentences, please click on ‘submit’.”

The results showed that the plausible direct evidential condition was rated significantly more favourably than its implausible counterpart (1.66 vs. 3.73, $t(42)=-19.4$, $p<.0001$), and the plausible indirect evidential condition was rated as more plausible than its implausible counterpart (1.60 vs. 3.83, $t(42)=-23.3$, $p<.0001$). Crucially, participants' ratings of the plausible direct and indirect evidential conditions did not differ statistically ($t(42)=1.39$, $p=.17$), and neither did their ratings of the two implausible conditions ($t(42)=1.76$, $p=.09$).

5.2.4. Procedure

Presentation of visual and audio stimuli was programmed in two lists by using the SMI experiment builder software (SensoMotoric Instruments GmbH). A participant saw two photos presented next to each other in each trial, as described above. The evidential items were counterbalanced across participants over the two lists, so that an evidential item only appeared in either the direct or the indirect evidential condition. Each participant saw ten direct and ten indirect evidential items. In addition, 20 future tense items were added to each list as non-evidential distractor items. Therefore, each participant was exposed to an equal number of evidential and non-evidential items. A further 20 filler items, containing a subject participle complement clause (i.e. a non-finite verb form: *Hangi fotoğraftaki adam dün yemeği pişiren adam* “which photograph_{LOC} man yesterday food_{ACC} cook SUBJECT PARTICIPLE man?”), were added so that each presentation list contained 60 items. Presentation of the auditory stimuli was delayed by one second with

respect to the visual stimuli in all items. Pauses were programmed after every block of 20 items. The items were presented in a randomized manner.

Participants were tested individually in a dedicated testing room in Berlin. They were asked to sit within a convenient sight distance from a 1680x1050 pixels-wide (i.e. 22 inches) PC screen. They were then given the following instructions in Turkish: “You are about to begin an eye-tracking experiment. Please listen to the sentences carefully, and click on the photograph that corresponds to the sentences you hear. When you click the next item will begin.” Two practice trials were presented during which the participants were provided with feedback and the opportunity to ask questions if they had any. Before the main eye-tracking experiment began, participants were reminded not to turn their gaze off the screen. When participants responded, the presentation of the next stimulus was initiated manually by the experimenter. Eye movements were monitored and sampled at a rate of 60 Hz, one frame per 16 ms, by a remote SMI eye-tracking system positioned underneath the stimulus screen. The research was approved by the ethics committee of the University of Potsdam (application number 37/2011).

5.2.5. Analysis

Three types of dependent variables were obtained and analyzed separately: accuracy of clicks, response times (RTs), and proportion of looks. The accuracy data were analyzed using generalized linear mixed-effects regression models, and the RTs data using linear mixed-effects regression models (Baayen, 2008). RTs that exceeded three standard deviations beyond the group means were excluded. Any responses made before the onset of critical verbs were rejected (around 1.5%). For the proportions of looks analysis, a time window of 2000 ms from the onset of critical verb was selected.⁴⁴ The first 200 ms after verb onset were excluded from this time

⁴⁴ The mean onset of the critical verbs was 4162 ms after each trial began, minus 1000 ms silence, and the mean sentence offset time was as 5470 ms from the beginning of the sentences.

window, since it takes about 200 ms to program and execute an eye movement (Rayner, Slowiaczek, Clifton, & Bertera, 1983). Proportion of looks was a binary variable indicating whether the participants fixated on the target picture or not. We excluded 0.92% of the data due to off-screen looks. The analyses were done on non-aggregated data. Participants' proportion of looks were analyzed with mixed-effects multilevel logistic regression models (Barr, 2008), using the 'lme4' and 'multcomp' statistical packages of R version 3.1.1 (R-Core-Team, 2012).

5.3. Results

5.3.1. Accuracy and response times

Mean accuracy and RTs data are shown in Table 5.2 and the fixed effects from mixed-effects regression models performed on accuracy and RTs of responses are given in Table 5.3. For the accuracy data, significant effects of group with negative estimate values indicate that both late and early bilinguals were less accurate than monolinguals.^{45, 46} However, the between-groups differences were modulated by condition, as witnessed by significant interactions between the factors group and condition. Therefore, post-hoc analyses were performed using Tukey tests. These revealed that both late ($\beta = 0.213$, $SE = 0.04003$, $z = 5.326$, $p > .001$) and early bilinguals ($\beta = 0.228$, $SE = 0.035$, $z = 6.418$, $p < .001$) responded less accurately to the direct

⁴⁵ An initial model was built with future tense items included, which showed no effects of condition for indirect evidential vs. future tense items ($\beta = -0.501$, $SE = 0.289$, $z = -1.731$, $p = .082$), and for direct evidential vs. future tense ($\beta = -0.528$, $SE = 0.286$, $z = -1.840$, $p = .065$). Effects of group were not found, as well: late bilinguals vs. monolinguals ($\beta = -0.3109$, $SE = 0.3758$, $z = -0.827$, $p = .40$), and for early bilinguals vs. monolinguals ($\beta = -0.4961$, $SE = 0.3752$, $z = -1.322$, $p = .18$). As the future items were used as distractors, they were omitted from the further analyses.

⁴⁶ The accuracy of responses in the direct and indirect evidential conditions in the late bilingual group correlated with their Turkish ($r = .102$, $p = .041$) and German ($r = .184$, $p < .001$) language proficiency scores, whereas no such correlations were found in the early bilingual group (both $ps > .36$), as shown by Pearson tests.

evidential than to the indirect evidential condition, whereas the monolinguals showed no difference between the two conditions ($\beta = 0.0105$, $SE = 0.029$, $z = 0.353$, $p = .072$). There were group differences in participants' responses in the direct evidential condition, with both the early ($\beta = -1.897$, $SE = 0.5404$, $z = -3.511$, $p = .0012$) and the late bilinguals ($\beta = -1.685$, $SE = 0.5311$, $z = -3.172$, $p = .0042$) less accurate than the monolinguals. The early and late bilinguals did not differ in their responses in the direct evidential condition ($\beta = 0.212$, $SE = 0.5005$, $z = 0.424$, $p = .905$). For participants' responses in the indirect evidential condition, no within or between group differences were observed (all $ps > .346$).

Table 5.2. *Mean proportion of accuracy, standard error rates (SE), and response times (RTs) of click responses*

	Monolingual	Late bilingual	Early bilingual
Accuracy			
Direct evidential	.89 (.02)	.67 (.03)	.63 (.03)
Indirect evidential	.89 (.02)	.90 (.02)	.85 (.03)
Future tense (distractor)	.93 (.01)	.90 (.01)	.88 (.02)
Response times			
Direct evidential	2214.7	2707.4	2716.5
Indirect evidential	2262.3	2339.7	2494.3

With regard to RTs, the model outputs shown in Table 5.3 revealed significant effects of group but not of condition. The negative estimate values of the group effects confirm that both late and early bilingual groups were slower in their responses than monolinguals irrespective of condition. Since the interactions between group and condition were also significant, post-hoc analyses were performed. Both the late ($\beta = 372.10$, $SE = 116.10$, $z = -3.204$, $p = .001$) and early bilinguals ($\beta = 332.90$, $SE = 150.0$, $z = -2.22$, $p = .026$) showed longer RTs to the direct evidential condition than to the indirect evidential condition, whereas no significant between-condition difference was seen in the monolinguals ($\beta = -29.31$, $SE = 100.30$, $z = -0.292$, $p = .77$). Within the responses in the direct evidential condition, group contrasts proved significance. Both the early ($\beta = -475.26$, $SE = 156.45$, $z = -3.038$, $p < .01$) and the late bilinguals ($\beta = -401.01$, $SE =$

150.37, $z = -2.667$, $p = .020$) responded slower than the monolinguals, whereas late bilinguals did not differ from the early bilinguals ($\beta = -74.25$, $SE = 168.33$, $z = -0.441$, $p = .77$). Within the responses in the indirect evidential condition, by contrast, no group differences were found (all $ps > .14$).

Table 5.3. *Fixed effects from the generalized linear mixed-effects regression models performed on accuracy of clicks and linear mixed-effects regression model performed on response times*

Fixed effect	Accuracy of clicks			Response times (RTs) of clicks		
	Estimate	SE	Z-value	Estimate	SE	t-value
Intercept	2.472	0.353	6.994	2282.28	200.04	11.409
Condition (Indirect Evidential)	0.056	0.310	0.182	-25.08	107.34	-0.234
Group (Late bilingual)	-1.737	0.407	-4.262	525.21	268.52	1.956
Group (Early bilingual)	-1.531	0.403	-3.798	554.36	274.24	2.021
Condition x Group (Late bilingual)	1.393	0.426	3.266	-420.22	160.05	-2.626
Condition x Group (Early bilingual)	1.762	0.443	3.977	-349.25	169.03	-2.066
	Formula: accuracy ~ Condition * Group + (1 subject_no) + (1 item_no)			Formula: RTs ~ Condition * Group + (1 item_no) + (1 subject_no)		

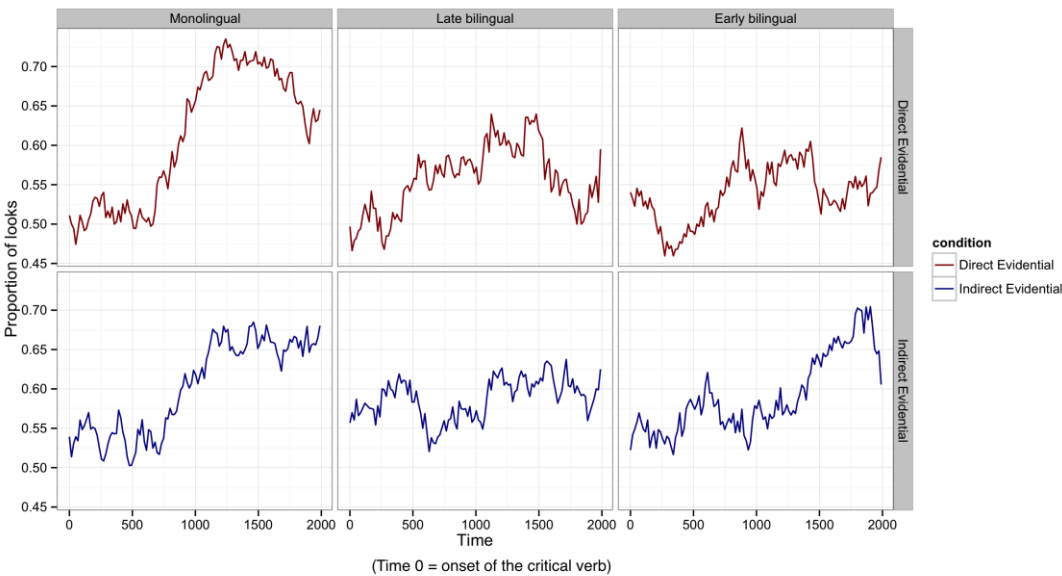
* $p < .05$, ** $p < .01$, *** $p < .001$

5.3.2. Proportions of looks

Figure 5.2 illustrates the moment-by-moment changes in participants' proportions of looks towards the target picture for the direct and indirect evidential conditions during the entire 2000 ms time window, and Figure 5.3 shows the mean proportions of looks in the main and later time windows, respectively. Figure 5.2 indicates that the proportions of looks to the target picture were around 50% (i.e. participants gazed on both the target and context photographs with equal likelihood) at the beginning of the time window for all groups, which confirms that participants did not visually prefer one photograph over the other before they heard the critical verb form. As we mentioned above, any fixation changes prior to 200 ms from verb onset cannot be attributed to the critical stimulus.

Visual inspection of the eye-movement data indicated that during the initial 200–1000 ms after verb onset, both bilingual groups' eye movements tended to oscillate between the target and context pictures, and that a more stable increase in looks to the target picture only emerged after about 1000 ms (see Figure 5.2). The monolinguals, however, showed more stable eye-movement patterns, with looks to the target pictures starting to increase rather steeply from about 600 ms onwards in both the direct and the indirect evidential conditions. The monolingual group's proportion of looks to the target picture reached a peak at around 1200 ms. After 1200 ms, the monolinguals started turning their gaze to the context picture, where the actions were shown to be in progress, in the direct evidential condition. They kept fixating the target photo during the processing of indirect evidentials in the same time window. Therefore, on the basis of this visual inspection, two time windows were chosen for the statistical analyses: (i) the 'main' time window (200–2000 ms), and (ii) a 'late' time window (1200–2000 ms); see Figure 5.3.

Figure 5.2. *Mean proportions of target fixations per participant group and condition for the 2000 ms time window from the onset of the critical verb. The y-axis shows participants' mean fixation proportions for each of the two evidentiality conditions.*



The fixed effects of the mixed-effects logistic regression models built on the proportion of looks data from the main and late time windows are shown in Table 5.4. Since proportion of looks data do not display a linear relationship with time, in addition to linear time, quadratic and cubic time variables were included in the models so that fixation changes over time can be best captured. Outcomes from the model for the main time window showed significant effects of group, with both early and late bilinguals fixating less frequently on the target picture within the main time window compared to the monolinguals. Significant interactions between condition and group were found which indicate between-group differences in participants' eye-movement patterns across the two experimental conditions.

Table 5.4. *Fixed effects from the mixed-effect logistic regression model performed on the **proportion of looks** data in the main time window (200 – 2000 ms) and late time window (1200-2000 ms).*

Fixed effect	Main time window (200 – 2000 ms)			Late time window (1200 – 2000 ms)				
	Estimate	SE	t-value	p-value	Estimate	SE	t-value	p-value
Intercept	5.674	1.092	5.198	< .001***	-4.241	8.824	-0.481	.631
Linear time	-1.012	1.088	-0.001	.999	2.123	7.795	0.027	.978
Quadratic time	2.451	2.800	8.753	< .001***	-1.320	1.053	-1.253	.210
Cubic time	-9.140	9.202	-9.933	< .001***	2.648	2.193	1.207	.227
Condition (Indirect evidential)	-4.365	4.764	-0.916	.360	-2.148	7.260	-2.958	.003***
Group (Early bilingual)	-7.072	2.459	-2.876	.004**	-1.252	3.081	-4.063	< .001***
Group (Late bilingual)	-5.331	2.426	-2.197	.028*	-1.023	3.041	-3.364	.001***
Condition x Group (Early bilingual)	5.432	6.944	7.823	< .001***	1.018	1.060	9.601	< .001***
Condition x Group (Late bilingual)	3.246	6.883	4.716	< .001***	5.260	1.051	5.003	< .001***
Formula: PropLook ~ Linear time + Quadratic time + Cubic time + Condition * Group + (1 + Linear time participants) + (1 + Linear time items)								

* p < .05, ** p < .01, *** p < .001

* $p < .05$, ** $p < .01$, *** $p < .001$

Within the main time window, fixations on the target picture were found to be reduced in the direct evidential condition in both the early ($\beta = 0.0518$, $SE = 0.0052$, $z = 9.857$, $p < .0001$) and late bilinguals ($\beta = 0.0253$, $SE = 0.0051$, $z = 4.911$, $p < .0001$) in comparison to the number of target fixations in the indirect evidential condition. The monolingual group showed no difference between the two evidential conditions ($\beta = -0.0046$, $SE = 0.005$, $z = -0.919$, $p = .35$), as was confirmed by Tukey tests.

The early bilinguals fixated less on the target picture than the monolinguals in the direct evidential condition ($\beta = -0.09448$, $SE = 0.03616$, $z = -2.613$, $p = .024$), while the late bilinguals differed only marginally from the monolinguals here ($\beta = -0.07704$, $SE = 0.03554$, $z = -2.168$, $p = .077$). The late and early bilinguals did not differ from each other in the direct evidential condition ($\beta = 0.01744$, $SE = 0.03617$, $z = 0.482$, $p = .87$), however. For the indirect evidential condition, no between-group differences were found (all $ps > .67$).

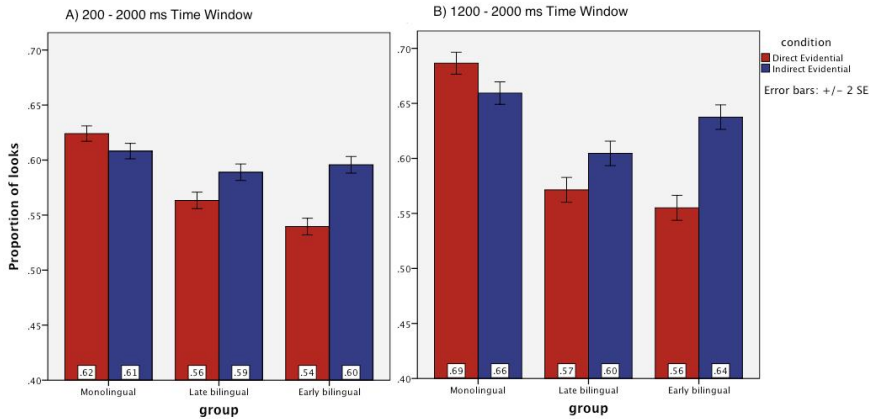


Figure 5.3. Mean proportions of target fixations in three groups of participants during their processing of direct and indirect evidentials in two different time windows: (A) 200–2000 ms and (B) 1200–2000 ms after verb onset.

For the late time window (see Table 5.4), the model outputs showed effects of condition, group, as well as interactions between these two factors. To investigate the nature of these differences, post-hoc analyses were performed. During their processing of direct evidentials, both late ($\beta = -0.11413$, $SE = 0.04053$, $z = -2.816$, $p = .013$) and early bilinguals ($\beta = -0.12507$, $SE = 0.04115$, $z = -3.040$, $p = .006$) looked less frequently towards the target picture than the monolinguals did. Again, no significant between group differences were found during participants' processing the indirect evidentials (all $ps > .44$).

Within-group comparisons revealed that both the early ($\beta = 0.077061$, $SE = 0.0077$, $z = 9.98$, $p < .0001$) and the late bilinguals ($\beta = 0.034811$, $SE = 0.0075$, $z = 4.599$, $p < .0001$) fixated more frequently on the target picture in the indirect than in the direct evidential condition during the late time window. The monolinguals showed the opposite pattern: they looked at the target picture slightly more frequently in the direct than the indirect condition ($\beta = -0.015209$, $SE = 0.0072$, $z = -2.017$, $p = .035$).

Notwithstanding the monolingual participants' overall higher number of fixations on the target picture in the direct evidential condition in the late time window, they tended to shift their gaze towards the context photo from about 1200 ms in the direct evidential condition whereas they kept fixating on the target photo in the indirect evidential condition (see Figure 5.3).

To further examine these eye-movement changes over time, we ran the model again on the monolingual eye-movement data from the late time window with fixed effects of linear time and condition. The model output showed a significant effect of linear time ($\beta = -1.243$, $SE = 2.094$, $t = -5.937$, $p < .001$), condition ($\beta = -1.954$, $SE = 4.80$, $t = -4.071$, $p < .001$), and an interaction between the two factors ($\beta = 1.128$, $SE = 2.966$, $t = 3.804$, $p < .001$). These results confirm that the monolinguals' fixation changes over time within the late time window were different in the direct and indirect evidential conditions.⁴⁷

⁴⁷ Participants' eye-movement changes over time in the late time window also showed different group characteristics within each condition. In the direct

5.3.3. Summary of results

Both the late and the early bilinguals were slower and less accurate than the monolinguals in their responses in the direct evidential condition, whereas they patterned with the monolinguals in the indirect evidential condition. Furthermore, within the response data there were interactions with group, showing that both the late and early bilinguals responded less accurately to the direct than to the indirect evidential condition, while the monolinguals showed no difference between these two conditions. A similar contrast was found in response latencies.

These behavioral results were reflected in the proportion of looks data. Bilinguals were less likely to look at the target picture in the direct compared to the indirect evidential condition in both the main and the late time windows. In the late time window (i.e. from 1200 ms onwards), the monolinguals shifted their gaze towards the context picture during their processing of direct evidentials, whilst the bilinguals' eye-movements tended to oscillate more between the target and context photos.

evidential condition, there were effects of linear time ($\beta = -1.053$, $SE = 1.287$, $t = -8.181$, $p < .001$), and of group ($\beta = -6.760$, $SE = 2.542$, $t = -2.659$, $p < .01$). In the indirect evidential condition, by contrast, there was an effect of linear time ($\beta = 3.844$, $SE = 1.259$, $t = 3.054$, $p < .001$) but not of group ($\beta = -2.731$, $SE = 13.317$, $t = -0.823$, $p = .41$). Eye-movements changed over time in both condition, as linear time was significant in both conditions. However, there was an effect of group in the direct evidential (but not in the indirect evidential) condition suggesting that the moment-by-moment eye-movements changes in the late time-window are different for individual groups in the direct evidential condition, but similar in the indirect evidential condition.

5.4. Discussion

The results reported add to our understanding of how evidential morphology is processed and linked to the type of evidence available by both mono- and bilingual Turkish speakers. Our first research question was whether bilinguals differ from Turkish monolinguals in processing evidentiality. The second question was whether monolingual, late and/or early bilingual Turkish speakers differ in their processing of direct vs. indirect evidentials.

The answer to the first question is clearly positive, as early and late bilinguals were found to differ from the monolinguals in their end-of-trial responses and eye-movement patterns. Both late and early bilinguals responded less accurately and looked less often to the target picture when processing direct evidentials compared to the monolinguals. Regarding our second research question, we observed an interesting asymmetry between the direct and indirect evidential conditions in the two bilingual groups that was absent in the monolingual group. Both early and late bilinguals showed greater problems processing direct compared to indirect evidentiality. This asymmetry was reflected in reduced response accuracy, longer response latencies, and in a lower proportion of looks to the target picture, in the direct compared to the indirect evidential condition. No statistical between-group differences were found for early vs. late bilinguals, indicating that the onset of bilingualism did not affect the way they processed evidentiality.

How can the observed pattern of results be accounted for? Previous studies have shown that bilinguality may affect the way people use or process their native language, with bilinguals – in particular, heritage speakers – often performing differently from monolinguals on linguistic tasks. The age of bilingualism onset has been argued to be an important factor: Whilst non-target like performance in late bilinguals is often attributed to first language attrition, non-target like performance in early bilinguals has been associated with incomplete acquisition. In first language attrition, individuals who initially acquired their native language fully may lose certain properties of that language later in life, possibly influenced by properties of a second language. In incomplete acquisition, by contrast, early bilinguals (or heritage speaker) experience disrupted

acquisition processes, as a result of which certain properties of their native language are never properly acquired.

In Turkish child language acquisition, the indirect evidential is acquired after the direct evidential; it is conceivable that our early bilinguals did not fully acquire the correct use of indirect evidentials as compared to the late bilinguals. Incomplete acquisition in early bilinguals has also been associated with more severe outcomes in comparison to attrition in late bilinguals (Montrul, 2002, 2008). This is not what we found, however. Both bilingual groups were at the monolingual level in processing indirect evidentiality but performed worse than the monolinguals in the direct evidential condition. We did not find any differences between early and late bilinguals' responses in the direct evidential condition, which means that both bilingual groups were equally affected in their processing of direct evidentiality in comparison to the monolinguals. Our results, thus, do not indicate that an earlier onset to bilingualism results in more severe effects than a later onset of bilingualism.

We believe that the late bilinguals in our study were affected by a form of attrition. However, on the basis of the current data, for the early bilinguals it is impossible to precisely tease apart effects of attrition from those of incomplete acquisition. Studies on monolingual children's acquisition of evidential morphology are still scarce. These studies suggest that by the age of six, the conceptual development linked to the use of indirect evidential forms is not yet fully complete (e.g. Öztürk and Papafragou, 2007, 2008). It is thus unclear at which age the development of the evidential system finalizes. The fact that both bilingual groups showed reduced sensitivity to direct evidentials but were at the monolingual level in their processing of indirect evidentials indicates that the representation and/or pragmatic function of the direct evidential morpheme differs between mono- and bilingual Turkish speakers. This suggests that the underlying reason for the observed between-group differences is not related to the age at which the bilinguals' acquired German but to the linguistic properties of evidentiality.

Recall that Turkish indirect evidentials are assumed to have modal properties unlike direct evidentials, and that the former are thought to be

semantically more complex than the latter. Turkish linguists also agree that the direct evidential is the ‘unmarked’ evidential form (e.g., Aksu-Koç, 1988, 2000; Johanson, 2006; Sezer, 2001), while the indirect evidential is the more marked term in its semantics. Given Montrul’s (2009) finding of Mood distinctions being more strongly eroded than non-modal inflectional distinctions in Spanish heritage speakers, we expected bilinguals’ sensitivity to indirect evidential markers to be more reduced than their sensitivity to direct evidential markers. Difficulty with indirect evidentials is also what the Interface Hypothesis predicts. According to this hypothesis, bilinguals tend to have problems with integrating information from multiple linguistic levels at the syntax-discourse interface and thus should show more difficulty processing marked compared to unmarked forms (e.g. Sorace and Serratrice, 2009). However, both early and late bilinguals were more accurate and quicker to respond to the more marked term (the indirect evidential) here, whose use is licensed only by the availability of a specific type of evidence, than to the less marked term (the direct evidential) in the current study.

Alternatively, we may be able to account for our findings by assuming that, even though Turkish heritage speakers are aware of the semantic and pragmatic properties of indirect evidentials, the direct evidential morpheme -DI has become the default form for referring to past events regardless of information source. That is to say that the bilingual participants take the direct evidential to be a past tense marker without any specific evidential content, whilst they retained the indirect evidential as an evidential form associated with reporting non-witnessed events. This hypothesis broadly fits with Arslan et al.’s (submitted) finding that early bilingual speakers of Turkish were largely insensitive to mismatches between evidential verb forms and evidential contexts but had retained sensitivity to incorrect tense forms. Although the early bilinguals examined by Arslan et al. (submitted) seemed unable to identify information source violations for either of the two evidential forms, Arslan and Bastiaanse (2014b) found an asymmetrical substitution error pattern. The early bilingual speakers of Turkish mistakenly produced direct evidential forms in contexts where an indirect evidential would normally be required. This indicates that the early bilinguals ignored the evidential content of direct evidential forms, using these forms to refer to the past irrespective of

whether or not its use was licensed by the type of evidence available. This is also supported by the current findings. When given a visual depiction of directly witnessed evidence for an event, bilingual speakers of Turkish have more problems processing direct evidential forms than monolinguals, whereas they are no different from monolinguals in their processing of indirect evidentials accompanied by a visual depiction of indirect (inferential) evidence.

Recall that one idea behind the conceptual design of this study was to reveal whether and when speakers of an evidential language consider the evidence during processing grammatical evidentiality. That is, we were also interested in whether the speakers were aware of the evidential implications signaled by the verbal forms. Both the behavioral and eye-movements data point in the same direction: both late and early bilinguals fixated less frequently on the target picture in the direct than in the indirect evidential condition, whereas the monolinguals showed no difference between these two conditions in the main time window. Fewer looks to the target picture in the direct evidential condition means that the bilingual participants fixated more often on the context picture in the direct than in the indirect evidential condition in both the main and late time windows. They also clicked on the context picture more frequently in the direct evidential condition, as shown by their reduced response accuracy. This was not what the monolinguals did. In the late time window, although the monolinguals tended to look at the target picture slightly more often in the direct evidential than the indirect evidential condition, they were equally able to choose the target picture in both conditions. This indicates that the bilinguals were less likely to recognize that the context pictures merely provided a form of evidence, and more likely to mistake the context picture for the target picture, in comparison to the monolinguals.

The time course of participants' eye-movements during processing direct evidentials also differed between the monolingual and bilingual Turkish speakers. The monolinguals shifted their gaze towards the context picture, where the action was shown to be in progress, in the late time window (from about 1200 ms) while processing direct evidentials. This suggests that increased looks towards the context picture allowed the monolinguals to verify that the action could indeed be 'witnessed' directly,

compatible with the use of a direct evidential form. This shift was less prominent in the two bilingual groups, although their fixations also changed over time in the late time window due to larger oscillations between the two pictures (see Figure 5.3), indicating that the bilinguals felt less of a need to ‘witness’ the action, and thus, to verify whether the use of a direct evidential was warranted. This suggests that the direct evidential has been subject to semantic or pragmatic ‘bleaching’ in Turkish heritage grammars, making it appropriate for use in both ‘witnessed’ and ‘non-witnessed’ types of evidential contexts. Examples of a restructuring of grammatical systems in bilingual speakers of minority languages (i.e. heritage speakers) are not in fact uncommon. Polinsky (2006), for instance, reports simplifications in the gender and aspect systems of Russian heritage speakers, and Kim et al. (2009) observed a simplification of the pronominal system in Korean heritage speakers. However, whether or not the apparent erosion of evidentiality distinctions in Turkish heritage speakers is triggered by prolonged exposure to the majority language of our bilingual participants cannot be determined in the absence of a bilingual comparison group whose L2 is typologically different from German (and Dutch).

To conclude, our results show that both early and late Turkish/German bilinguals differed from Turkish monolinguals in their processing of direct (but not indirect) evidentiality. These data do not support the Regression Hypothesis or the Interface Hypothesis. We have argued that our findings can be accounted for by assuming that the bilinguals take the direct evidential to be the ‘unmarked’ default form for referring to past events, in line with what has previously been reported by Arslan and Bastiaanse (2014b) and Arslan et al. (submitted). Taken together, our findings from the production, off-line comprehension and online processing of evidentiality by Turkish-German and Turkish-Dutch bilinguals provide converging evidence suggesting that the grammar of evidentiality in these bilinguals has simplified at the representational level. The bilinguals under study are, however, aware that the use of indirect evidential forms is linked to a particular type of evidence, as both our behavioral and eye-movement data suggest that the early and late bilinguals interact with the indirect evidence in a similar way as the monolinguals.

CHAPTER 6

6. General discussion

This dissertation reported the results from four experimental studies on the neurolinguistic and psycholinguistic aspects of evidential verb forms in Turkish. In the neurolinguistic aspects, pathological deterioration of the evidential morphology in agrammatic patients was addressed. In the psycholinguistic aspects, online processing of evidential forms was investigated in heritage bilingual speakers and compared to monolingual speakers. Both of these perspectives have shown that evidentiality is a vulnerable domain: it is affected in agrammatic speakers and attrited in heritage and late bilingual speakers of Turkish. In this chapter, the findings as well as their implications will be discussed.

6.1. Questions addressed in this dissertation

With the studies of this dissertation, an effort has been made to understand the cognitive underpinnings of evidentiality in Turkish with regard to its deterioration in individuals with aphasia and in heritage speakers of Turkish. Aphasia and attrition are obviously not ‘a priori’ similar forms of language loss. However, the evidentials share similar ‘fates’ when it comes to their impairments in aphasia and the way they attrite in heritage speakers and late bilinguals.

The following four main research questions were addressed in the four studies presented in this dissertation:

- 1) Are Turkish agrammatic speakers able to produce the evidential verb forms that are linked to the respective information sources; are they able to identify the information source perspectives that the evidential verbs map onto?
- 2) Are the uses of the evidential verb forms affected compared to other verb forms in Turkish agrammatic speakers’ narrative speech production?
- 3) To what extent is Turkish heritage speakers’ processing of the evidential verb forms affected by incomplete acquisition or attrition? Do the heritage speakers retain a monolingual-like sensitivity to sentential contexts where evidential forms are violated?
- 4) How do Turkish heritage speakers, as compared to late bilinguals and monolinguals, interact with forms of visual evidence presented in a virtual visual-world setting while listening to sentences with evidential forms, consistent with the given visual stimuli?

The following sections provide the main conclusions drawn from those studies as well as directions for future research.

6.2. Major conclusions

6.2.1. Neurolinguistic aspects of evidentiality

A significant body of research has shown that agrammatic speakers have problems with verb forms that refer to the past (Abuom & Bastiaanse, 2013; Bastiaanse et al., 2011; Bos & Bastiaanse, 2014; Bos et al., 2014; Martínez-Ferreiro & Bastiaanse, 2013; Rofes et al., 2014; Simonsen & Lind, 2002; Stavrakaki & Kouvava, 2003). The Past Discourse Linking Hypothesis (PADILIH) accounts for the difficulty of referring to the past in agrammatic aphasia. The first two studies reported in this dissertation (Chapters 2 and 3) addressed this issue.

(1) Production of evidential forms is impaired in an opposing direction to impairments in source attribution in Turkish agrammatic aphasia

Our first research question asked whether Turkish agrammatic speakers are able to produce the evidential verb forms in sentences that are linked to different information sources. Furthermore, it was asked whether the agrammatic speakers are able to identify the information-source perspectives that the evidential verbs map onto.

These questions were explored in Chapter 2. Consistent with the predictions of the PADILIH, Turkish agrammatic speakers' production of sentences requiring a direct evidential form was impaired, whereas the production of the indirect evidential forms was relatively spared. Selection of an indirect evidential over the direct one is determined by the availability of indirect evidence. In both the inference and reported contexts, when the speaker obtains the information on an event, the event has already occurred, and hence, for the use of an indirect evidential form the actual event time is irrelevant. The direct evidential form, however, requires discourse linking, as its use is linked to a directly witnessed past event. It is particularly hard for agrammatic speakers to retrieve and inflect a verb that is licensed by direct information.

Our second question was whether the evidential verb forms are affected with respect to other verb forms in Turkish agrammatic speakers' narrative-speech production.

This question was addressed in Chapter 3. Our findings showed that Turkish agrammatic speakers exhibited reduced normal number of verbs, yet the diversity of these verbs was reduced. The agrammatic speakers' production of finite verbs was intact. However, for the direct evidentials, there were individual differences among the agrammatic speakers as reflected in a trade-off pattern between verb inflection for the direct evidential and verb diversity. These data are compatible with Bastiaanse's (2013) claim. That is, retrieving the name of an event and inflecting it for the time frame in which the event takes place is arduous for agrammatic speakers, at least for the direct evidentials, which was found to be the most difficult for agrammatic speakers to produce on a sentence-completion task, as shown in Chapter 2.

The results from both Chapters 2 and 3 suggest the agrammatic speakers have particular problems with the direct evidential form. Recall that the findings from the source-identification task presented in Chapter 2 showed that recognizing indirect information (e.g., inference and report) is more difficult for agrammatic speakers than directly witnessed information sources. In other words, the agrammatic speakers are aware that the direct evidential form used in sentential contexts is associated with information they perceived themselves. Therefore, the agrammatic speaker's problems with producing direct evidential forms cannot be explained on the grounds of impairments in discriminating information sources. The impairment in the linguistic form (e.g., direct evidential) does not correspond to the impairment in the information-source perspective that underlies the form (e.g., direct witnessing). This is consistent with the preliminary data in Arslan and Bastiaanse (2014a) who, using a source-memory task, showed task that Turkish-speaking patients with aphasia are better in attributing seen objects to their names than they do so for heard objects (i.e., based on someone else's report).

But why do the agrammatic speakers have problems with verbs conveying the speaker's direct information, although they were able to

recognize that the events presented to them had been visually witnessed? Obviously, Turkish agrammatic speakers have difficulties in referring to the past, as the PADILIH predicts, and the form that conveys the speaker's direct information is the most difficult for them. However, there is another possibility to be addressed in future research since spared source recognition for directly witnessed events is not what the PADILIH expects. This possibility is that brain lesions that result in agrammatic aphasia disrupt the neural network that is responsible for representing events described by evidentials and their information sources in a dissociative way. Such dissociations are not in fact rare in neuropsychological studies. For instance, Janowsky et al. (1989) found dissociations between remembering an item and its source in patients with frontal-lobe dysfunctions. The authors reported that their patients were able to remember the events that had been presented to them yet not to remember the source for these events; the patients who mistook the events remembered the sources for them correctly. Future research can show to what extent agrammatic speakers of Turkish retain memories for information sources of events that are presented appropriately for the uses of direct and indirect evidential forms.

The aphasia studies have shown how evidential inflections are affected in agrammatic aphasia. It was one of the questions of this dissertation to demonstrate how the evidential forms are affected in heritage bilingualism. The next section provides our conclusions from the studies that were administered to heritage speakers of Turkish.

6.2.2. Psycholinguistic aspects of evidentiality

Previous work has shown that heritage speakers (i.e., early bilingual speakers of minority languages) have compelling difficulties with the verb-inflection morphology of their first language (Albirini et al., 2013; Albirini et al., 2011; Anderson, 1999, 2001; Bolonyai, 2002, 2007; Montrul, 2002, 2008, 2009; Montrul et al., 2012; Polinsky, 2006; Rothman, 2007; Silva-Corvalán, 1994). Some of these studies attribute heritage speakers' difficulties with inflectional morphology to the vulnerability of the

linguistic architecture. In particular, integrating information from multiple linguistic levels (e.g., syntax–pragmatic interface) proved to be affected in language attrition (Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009) and in heritage speakers' first language performances (Montrul, 2009). This is captured by the Interface Hypothesis (see Sorace, 2000, 2011). In the studies reported in Chapters 4 and 5, we tested these particular claims.

(2) Evidentiality is a vulnerable domain in Turkish heritage speakers

Our third question was whether Turkish heritage speakers' processing of evidential verb forms is affected by incomplete acquisition or attrition. This question was explored in the study reported in Chapter 4. The rationale behind this study was to unveil whether the Turkish heritage speakers retain a monolingual-like sensitivity to sentential contexts where evidential forms are violated.

Our findings demonstrated that the Turkish heritage speakers performed less accurately and more slowly in responding to evidentiality violations than in time-reference violations, and that they did not differ in their responses to the violations of both evidential forms. This is in part compatible with the Interface Hypothesis. We have argued that the evidential morphology is relevant to the syntax-pragmatics interface, as the morphological form has to be integrated with domains of semantics and pragmatics. Therefore, the heritage speakers were insensitive to violations of both evidential forms. Recall that the time-reference violations were constructed in participles positioned in relative clauses, and thus, syntactic features license the uses of these participles. This explains why the time-reference violations were not as difficult as the evidentiality violations.

Note that Sorace's claims on 'interface vulnerability' are not restricted to linguistic interfaces, but also covers interfaces between syntax and other cognitive domains. This implies that language structures that require processing at the interface of syntax and other cognitive domains are harder to acquire during bilinguals' developmental stages than structures requiring mere 'syntactic computation' (see also Sorace (2011)). This, of

course, raises the question whether there is a language structure in Turkish that only requires syntactic licensing. As mentioned above, our sentence stimuli used to test processing of time reference contained participle forms in relative clauses that syntactic features, assumedly, govern. However, does this mean semantic processing is not involved at all? The participle forms refer to past and future time-frames. Although, according to the claims of Turkish linguists, time reference of participle forms are bound by the matrix-clause verbs (at least, when they align in the same time frame), one cannot ignore the involvement of semantic and pragmatic contents here. Also see Montrul (2011) for arguments on how language structures may actually be relevant to different interfaces depending on their uses in differential contexts. Therefore, it remains unclear whether Turkish heritage speakers perform worse on evidentiality compared to time-reference sentences because evidentiality is relevant to syntax-pragmatics interface or because its use requires other cognitive domains (i.e., source memory). Thus, it cannot be concluded that our data support or falsify the Interface Hypothesis.

(3) Turkish heritage speakers do not interact with the evidence as monolinguals do

The final question was how Turkish heritage speakers, as compared to late bilinguals and monolinguals, process with forms of visual evidence presented in a virtual visual-world setting during listening sentences with evidential forms consistent with the given visual stimuli. This question was explored in Chapter 5. The rationale behind the study was to reveal how heritage speakers interact with evidence in the real world while they processed the evidential morpheme. The most viable way to test this interaction was to design an eye-movement monitoring experiment using a virtual visual-world paradigm.

Our findings showed that both late and early bilinguals (i.e., heritage speakers) responded less accurately in the direct-evidential condition as compared to the monolinguals. The bilingual participants' responses to the indirect-evidential condition, however, were similar in both accuracy and RTs to those of the monolinguals. Both late and early bilinguals responded

less accurately to the direct- than to the indirect-evidential condition, while the monolinguals showed no difference between these two conditions. The proportion of looks data showed a similar difference between the bilingual and monolingual participants' looks at the target in the direct compared to the indirect evidential condition.

There were two main conclusions drawn from these data. The first one is that both early and late bilinguals are affected by a form of attrition rather than by incomplete acquisition. Montrul (2008) argued that in heritage speakers, incomplete acquisition (or early childhood attrition) results in more severe difficulties than attrition in late bilinguals. Our findings are not consistent with this observation. However, the extent to which erosion in evidential morphology in bilingual Turkish speakers caused by attrition or by incomplete acquisition cannot yet be demonstrated. First, it is unclear when monolingual children's acquisition of evidential system is complete. Second, to test whether attrition or incomplete acquisition has differential outcomes on the erosion of evidential morphology, longitudinal studies have to be conducted on both heritage and late bilingual speakers.

The second main conclusion from Chapter 5 was that the eye-movement data showed that the direct evidential is more affected in Turkish heritage grammars. The Interface Hypothesis predicted the opposite. If involvement of cognitive domains adds to difficulty acquiring certain structures in bilingualism (or makes their loss possible), the indirect evidential should have been more eroded. One reason for this is 'complexity': the indirect evidential form is rather complex in its semantics, as it marks reported and inferred events that the speaker knows indirectly. It is conceivable that inferential reasoning (as well as representing and integrating knowledge of other speakers) develops at later stages of children's language acquisition compared to the direct perception of events (e.g., Aksu Koç, 2009; Öztürk & Papafragou, 2007, 2008). Another reason why the Interface Hypothesis predicted erosion of the indirect evidential is markedness. As Sorace and Serratrice (2009) claimed that the marked forms may be prone to processing limitations in bilinguals compared to the default forms. If this is true, the indirect evidential should have been affected more than its direct counterpart. In brief, the data from both experiments do not

support the Interface Hypothesis with regard to the erosion of evidential morphology.

One possibility that needs to be tested in future research is whether or not evidentiality erodes easily under incomplete acquisition and attrition due to the transfer effects from the dominant majority language. In the studies reported in this dissertation, the bilingual individuals spoke Dutch or German as their dominant second language, languages that do not have an evidential paradigm in their grammar. The idea fits well to the eye-tracking data, which indicated that both heritage and late-bilingual speakers were less attentive to the direct-evidential condition as compared to monolingual Turkish speakers. According to the claim made here, bilingual speakers of two languages that both have obligatory grammatical evidentiality should show no effects of language loss in the semantic and pragmatic content of the evidential forms.

Appendix

A. Appendices from Chapter 2

Appendix A1. *Scores of agrammatic participants on the relevant subtests of the Aphasia Language Assessment Test (ADD). The raw scores are given in exact numbers of correct items and percentages in brackets. Maximum scores are given for each subtest in respective titles.*

	Speech fluency (Max=32)	Auditory comprehension (Max=66)	Repetition (Max=20)	Naming (Max=44)	Therapist judgment
A1	12 (%38)	39 (%59)	2 (%10)	12 (%27)	Broca's Aphasia (non-fluent)
A2	14 (%44)	52 (%79)	12 (%60)	27 (%61)	Broca's Aphasia (non-fluent)
A3	12 (%38)	60 (%91)	12 (%60)	24 (%54)	Broca's Aphasia (non-fluent)
A4	4 (%13)	32 (%48)	3 (%15)	12 (%27)	Broca's Aphasia (non-fluent)
A5	8 (%25)	34 (%51)	6 (%30)	16 (%36)	Broca's Aphasia (non-fluent)
A6	6 (%19)	64 (%97)	12 (%60)	26 (%59)	Broca's Aphasia (non-fluent)
A7	10 (%31)	58 (%88)	12 (%60)	27 (%61)	Broca's Aphasia (non-fluent)

Appendix A2. *List of experimental sentence contexts used in the production and source identification tasks. The verbs are given at sentence final position and the inflections are left out.*

<i>Direct perception evidential –DI</i>	<i>Inferential evidential –mİş</i>	<i>Reportative evidential –(İ)mİş</i>
Kadın resm-i boya... <i>Woman-nom picture-acc paint...</i>	Kadın kalem-i aç... <i>woman-nom pencil-acc sharpen...</i>	Adam çorap giy... <i>man-nom socks-nom wear...</i>
Kadın su iç.. <i>Woman-nom water-nom drink...</i>	Kadın şekil çiz... <i>woman-nom shape-nom draw...</i>	Adam kibrit-i yak... <i>man-nom match-acc burn...</i>
Kadın elbise-(y)I katla... <i>Woman-nom cloth-acc fold...</i>	Adam yük-ü it... <i>man-nom load-acc push...</i>	Çocuk dişler-i fırçala... <i>kid-nom teeth-acc brush...</i>
Kadın kalem-i kır... <i>Woman-nom pen-acc break...</i>	Kadın örgü ör... <i>woman-nom stuff-nom knit...</i>	Çocuk gol at... <i>kid-nom goal-nom score...</i>
Kadın ekmek kes... <i>Woman-nom bread-nom cut...</i>	Kadın giysi-yi ütüle... <i>woman-nom blouse-acc iron...</i>	Kadın araba al... <i>woman-nom car-nom buy...</i>
Kadın süt koy... <i>Woman-nom milk-nom pour...</i>	Adam portakal ye... <i>man-nom orange-nom eat...</i>	Adam televizyon izle... <i>man-nom TV-nom watch...</i>
Kadın masa-(y)ı sil... <i>woman-nom table-acc clean...</i>	Adam kağıd-ı yapıştır... <i>man-nom paper-acc stick...</i>	Kadın ceket-i çıkar... <i>woman-nom jacket-acc take off...</i>
Kadın çiçekler-i sula... <i>woman-nom flowers-acc water...</i>	Kadın çöpler-i süpür... <i>woman-nom waste-acc sweep...</i>	Kız gözlüğü tak... <i>girl-nom glasses-acc put on...</i>
Kadın elma soydu... <i>woman-nom apple-nom peel...</i>	Adam klasör-ü doldur... <i>man-nom folder-acc fill...</i>	Kadın çorba-(y)ı yap... <i>woman-nom soup-acc make...</i>
Kadın bulaşıkları yıka... <i>woman-nom dishes-acc wash...</i>	Kadın kalem-i aç... <i>woman-nom pencil-acc sharpen...</i>	Kadın fotoğraf çek... <i>woman-nom photo-nom take...</i>

Abbreviations used in this table: nom= nominative, acc= accusative.

Appendix A3. *Individual numbers of correct items of Agrammatic and NBD speakers on Production and Source Identification Tasks. The scores are given in exact numbers of correctly produced/identified items. Max=10 each condition.*

Production				Source Identification		
	Direct perception evidential	Inferential evidential	Reportative evidential	Direct perception	Inferential	Reportative
Agrammatic						
A1	0	9	10	8	1	3
A2	1	10	6	5	4	3
A3	8	4	9	7	4	4
A4	2	9	8	8	5	2
A5	0	10	10	6	0	1
A6	4	7	5	10	0	0
A7	0	9	10	10	2	6
NBD Control						
C1	10	10	10	7	6	8
C2	10	10	10	10	9	10
C3	10	10	10	9	8	10
C4	10	10	10	10	6	7
C5	10	10	10	6	7	4
C6	10	10	10	9	10	10
C7	10	10	10	8	7	7

B. Appendices from Chapter 3

Appendix B1. *Demographic details of the agrammatic (A) and non-brain-damaged (NBD) speakers (mpo = months post-onset; education is in years).*

Participant	age	gender	education	mpo	etiology
A1	68	m	12	1	left-CVA
A2	74	m	5	5	left-CVA
A3	43	f	5	4	left-CVA
A4	44	m	5	14	left-CVA
A5	60	m	5	4	left-CVA
A6	74	m	5	8	left-CVA
A7	64	f	8	10	left-CVA
A8	43	f	8	5	left-CVA
A9	58	m	5	22	left-CVA
A10	58	f	8	6	left-CVA
NBD1	67	m	>12		
NBD2	53	m	12		
NBD3	37	f	11		
NBD4	41	m	12		
NBD5	60	m	8		
NBD6	60	m	12		
NBD7	39	m	10		
NBD8	43	m	8		
NBD9	58	m	8		
NBD10	59	f	8		

Appendix B2. *General measures for each participant. MLU= Mean Length of Utterances; speech rate = word per minute.*

Participant	MLU	speech rate	# utterances	# correct utterances	# embeddings	
					with finite verbs	with non- finite verbs
A1	2.94	30	69	28	3	8
A2	2.85	48	68	52	4	6
A3	3.22	60	62	45	2	10
A4	2.56	29	75	46	1	11
A5	1.49	21	133	21	0	0
A6	2.40	25	82	41	1	2
A7	2.98	32	67	40	0	4
A8	2.17	30	89	33	0	0
A9	2.32	34	85	46	0	9
A10	2.27	28	89	18	0	6
NBD1	7.14	78	28	26	5	19
NBD2	5.71	76	34	22	0	21
NBD3	4.54	78	45	44	2	11
NBD4	5.88	74	31	30	0	18
NBD5	4.54	111	44	41	2	3
NBD6	4.65	75	43	41	3	5
NBD7	3.84	67	51	50	2	9
NBD8	5.00	102	40	39	0	5
NBD9	5.40	91	37	33	1	9
NBD10	3.92	76	47	47	3	11

Appendix B3. *The number of lexical verbs (verb tokens), the diversity (verb TTR) and the number of verbs per utterances for each of the participants.*

Participant	verb tokens	verb TTR	verbs per utterance
A1	45	0.53	0.66
A2	60	0.41	0.86
A3	54	0.53	0.87
A4	60	0.45	0.77
A5	26	0.69	0.19
A6	29	0.68	0.35
A7	50	0.46	0.75
A8	39	0.48	0.42
A9	60	0.16	0.70
A10	46	0.52	0.52
NBD1	50	0.58	1.79
NBD2	36	0.66	1.03
NBD3	50	0.52	1.14
NBD4	50	0.62	1.47
NBD5	38	0.60	0.86
NBD6	51	0.62	1.19
NBD7	53	0.60	1.02
NBD8	41	0.68	1.03
NBD9	45	0.73	1.22
NBD10	49	0.61	0.96

Appendix B4. *Number and proportion of finite verbs and number of participles for each participant.*

Participant	# finite verbs	Prop. finite verbs	# non-finite verbs		
			infinitives	participles	gerunds
A1	35	0.81	2	1	5
A2	59	0.91	1	1	4
A3	46	0.82	4	2	4
A4	48	0.81	6	4	1
A5	27	1.00	0	0	0
A6	34	0.94	0	0	2
A7	48	0.92	2	0	2
A8	44	1.00	0	0	0
A9	52	0.85	9	0	0
A10	35	0.65	15	3	1
NBD1	36	0.65	8	10	1
NBD2	20	0.49	5	12	4
NBD3	47	0.81	7	2	2
NBD4	34	0.65	10	5	3
NBD5	50	0.96	1	0	1
NBD6	47	0.90	3	2	0
NBD7	51	0.85	3	2	4
NBD8	44	0.90	0	3	2
NBD9	37	0.80	0	6	3
NBD10	46	0.81	6	4	1

Appendix B5. *Number and type token ratios (TTR) of the three most frequent finite verb forms: direct evidentials, indirect evidentials and present progressive.*

participant	direct evidential		indirect evidential		present progressive	
	number	TTR	number	TTR	number	TTR
A1	16	0.75	11	0.73	27	1.00
A2	41	0.66	5	0.60	46	0.56
A3	25	0.80	4	0.75	29	0.85
A4	21	0.67	4	0.75	25	0.54
A5	6	0.67	6	0.33	12	0.89
A6	12	0.92	2	1.00	14	0.67
A7	25	0.68	3	0.67	28	0.55
A8	8	0.88	4	1.00	12	0.42
A9	35	0.43	0	0.00	35	0.75
A10	16	0.75	1	1.00	17	0.83
NBD1	10	0.60	6	1.00	16	1.00
NBD2	2	1.00	0	0.00	2	0.80
NBD3	13	0.85	4	0.75	17	0.59
NBD4	20	0.90	1	1.00	21	1.00
NBD5	22	0.90	7	1.00	29	1.00
NBD6	25	0.84	2	1.00	27	0.73
NBD7	4	1.00	7	0.86	11	0.81
NBD8	16	0.75	2	1.00	18	0.65
NBD9	12	1.00	4	1.00	16	1.00

C. Appendices from Chapter 4

Appendix C1. Turkish heritage speakers' responses to the bilingualism questionnaire

<i>First contact to</i>	Turkish	Dutch			
Exposed before school age?	95%	91%			
First learned through social interaction	90%	0%			
First learned in a classroom through formal instruction	9%	100%			
<i>Dominant language in interaction with</i>					
Mother	90%	4%			
Father	81%	14%			
Siblings / partners	43%	52%			
<i>Dominant language in following circumstances</i>					
Counting numbers	24%	76%			
Arithmetic operations	10%	90%			
Having a dream	57%	43%			
Express anger or happiness	48%	52%			
Express names of dates, days, months	14%	86%			
	1-3	3-7	7-14	14 +	
<i>Age of first contact to Turkish</i>					
Being read	38%	43%	19%	0%	
Writing	19%	43%	37%	4%	
Listening	91%	5%	5%	0%	
<i>Age of first contact to Dutch</i>					
Being read	24%	67%	9,5%	0%	
Writing	9,5%	67%	24%	0%	
Listening	67%	29%	5%	0%	
<i>How much of your communication during the day occurs in...?</i>					
	<10 %	25 %	50 %	75 %	>90 %
Dutch	0%	10%	62%	24%	5%
Turkish	10%	29%	48%	14%	0%
<i>How many hours during the day do you spend listening to...?</i>					
	<1	1-3	3-5	5-7	>7
Dutch	33%	62%	5%	0%	0%
Turkish	57%	19%	24%	0%	0%

Cont. from previous page

How many hours in a day do you spend reading in...?

	<1	1-3	3-5	5-7	>7
<i>Dutch</i>	29%	33%	14%	5%	19%
<i>Turkish</i>	86%	14%	0%	0%	0%

Appendix C2. *Turkish heritage sparkers' self-ratings of language abilities in Turkish and Dutch = percent participants per language proficiency level.*

	Poor	Intermediate	Functional	Good	Advanced
<i>Turkish</i>					
Reading	0%	29%	29%	38%	5%
Comprehension					
Listening	0%	9,5%	5%	24%	62%
Comprehension					
Writing Output	9,5%	9,5%	38%	38%	5%
Speaking Output	5%	9,5%	5%	9,5%	67%
<i>Dutch</i>					
Reading	0%	0%	0%	14%	86%
Comprehension					
Listening	0%	0%	0%	14%	86%
Comprehension					
Writing Output	0%	0%	0%	14%	86%
Speaking Output	0%	0%	0%	9,5%	90,5%

Appendix C3. List of verb phrases used to construct the evidentiality sentences. English translations are given below each verb phrase in italics.

<i>Verb phrases</i>	<i>Verb phrases (continued)</i>
1 Yemeği yemek <i>To eat the food</i>	16 Yemeği dökmek <i>To spill the food</i>
2 Evi kiralamak <i>To rent the house</i>	17 Evi boyamak <i>To paint the house</i>
3 Bardağı kırmak <i>To break the glass</i>	18 Bardağı doldurmak <i>To fill the glass</i>
4 Elbiseyi ütlemek <i>To iron the dress</i>	19 Elbiseyi katlamak <i>To fold the dress</i>
5 Halıyı süpürmek <i>To sweep the carpet</i>	20 Halıyı silmek <i>To whisk the carpet</i>
6 Balonu şişirmek <i>To inflate the balloon</i>	21 Balonu patlatmak <i>To blow up the balloon</i>
7 Kapıyı kilitlemek <i>To lock the door</i>	22 Kapıyı açmak <i>To open the door</i>
8 Sütü içmek <i>To drink the milk</i>	23 Sütü ısıtmak <i>To warm the milk</i>
9 Çiçekleri sulamak <i>To water the flowers</i>	24 Çiçekleri budamak <i>To prune the flowers</i>
1 Arabayı yıkamak <i>To wash the car</i>	25 Arabayı satmak <i>To sell the car</i>
1 Domatesi doğramak <i>To chop the tomatoes</i>	26 Domatesi toplamak <i>To pick the tomatoes</i>
1 Resmi yırtmak <i>To tear the picture</i>	27 Resmi çizmek <i>To draw a picture</i>
1 Eşyayı taşımak <i>To move the property</i>	28 Eşyayı saklamak <i>To hide the property</i>
1 Gazeteyi yakmak <i>To burn the newspaper</i>	29 Gazeteyi okumak <i>To read the newspaper</i>
1 Mektubu yazmak <i>To write the letter</i>	30 Mektubu gönderdi <i>To send the letter</i>

Appendix C4. *List of verb phrases used to construct the time reference sentence. English translations are given below each verb phrase in italics.*

<i>Verb phrases</i>		<i>Verb phrases (continued)</i>	
1	Yemeği pişirmek <i>To cook the food</i>	11	Soru sormak <i>To ask a question</i>
2	Oyuncağı bozmak <i>To break the toy down</i>	12	Çatalı saplamak <i>To stab the fork</i>
3	Çiçeği almak <i>To buy the flowers</i>	13	Çayı kaynatmak <i>To boil the tea</i>
4	Sofrayı hazırlamak <i>To prepare the dinner table</i>	14	Fotoğrafi çekmek <i>To take the fotograph</i>
5	Kazağı örmek <i>To knit the sweatshirt</i>	15	Özür dilemek <i>To beg pardon</i>
6	Cevizi kırmak <i>To break the walnuts</i>	16	Telefon etmek <i>To make a phone call</i>
7	Kahveyi ısmarlamak <i>To order the coffee</i>	17	Altını takmak <i>To pin the gold (on somebody)</i>
8	Tokatı atmak <i>To slap a smack</i>	18	Para vermek <i>To give away money</i>
9	Keki yapmak <i>To make the cake</i>	19	Laf sokmak <i>To speak with sarcasm</i>
10	Gitarı çalmak <i>To play the guitar</i>	20	Resimi göstermek <i>To show the picture</i>

References

- Aarssen, J. (2001). Development of temporal relations in narratives by Turkish-Dutch bilingual children. In L. T. Verhoeven & S. Stromqvist (Eds.), *Narrative development in a multilingual context*. (pp. 209-231). Amsterdam: Benjamins.
- Abuom, T. O., & Bastiaanse, R. (2012). Characteristics of Swahili–English bilingual agrammatic spontaneous speech and the consequences for understanding agrammatic aphasia. *Journal of Neurolinguistics*, 25(4), 276-293.
- Abuom, T. O., & Bastiaanse, R. (2013). Production and comprehension of reference of time in Swahili–English bilingual agrammatic speakers. *Aphasiology*, 27(2), 157-177.
- Abuom, T. O., Obler, L. K., & Bastiaanse, R. (2011). Using Swahili and English to test explanations of agrammatism. *Aphasiology*, 25(5), 559-575.
- Aikhenvald, A. Y. (2003). Evidentiality in typological perspective. In A. Y. Aikhenvald & R. M. W. Dixon (Eds.), *Studies in evidentiality* (pp. 1-32). Amsterdam: John Benjamins.
- Aikhenvald, A. Y. (2004). *Evidentiality*. Oxford: Oxford University Press.
- Aikhenvald, A. Y. (2007). Information source and evidentiality: what can we conclude? *Italian Journal of Linguistics/Rivista di Linguistica*, 19(1), 209-227.
- Aikhenvald, A. Y. (2014). The grammar of knowledge: a cross-linguistic view of evidentials and the expression of information source. In A. Y. Aikhenvald & R. M. W. Dixon (Eds.), *The Grammar of Knowledge: A Cross-Linguistic Typology* (Vol. 7, pp. 1-51). Oxford: Oxford University Press.
- Akıncı, M. (2003). Temporal anchoring of texts in Turkish of first and second generation Turkish immigrants in France. In A. S. Özsoy, D. Akar, M. Nakipoglu-Demiralp, E. Erguvanlı-Taylan & A. Aksu-Koç (Eds.), *Studies in Turkish linguistics* (pp. 289 - 297): Boğaziçi University Press.
- Aksu Koç, A. (2009). Evidentials: An interface between linguistic and conceptual development. In J. Guo, E. Lieven, N. Budwig, S. Ervin-Tripp, K. Nakamura & Ş. Özçalışkan (Eds.), *Crosslinguistic approaches to the psychology of language: Research in the tradition of Dan Isaac Slobin* (pp. 531-542). New York: Psychology Press.
- Aksu-Koç, A. (1988). *The acquisition of aspect and modality: The case of past reference in Turkish*. Cambridge: Cambridge University Press.

- Aksu-Koç, A. (1994). Development of linguistic forms: Turkish. In R. A. Berman & D. I. Slobin (Eds.), *Relating events in narrative: A crosslinguistic developmental study*. (pp. 329-385). Hillsdale, NJ: Erlbaum.
- Aksu-Koç, A. (2000). Some aspects of the acquisition of evidential in Turkish. In L. Johanson & B. Utas (Eds.), *Evidentials: Turkic, Iranian and neighbouring languages*. (pp. 15-28). Berlin: Walter de Gruyter.
- Aksu-Koç, A. (2014). *Acquisition of modality in Turkish*. Paper presented at the 17th International Conference on Turkish Linguistics, University of Rouen, France.
- Aksu-Koç, A., & Slobin, D. I. (1986). A psychological account of the development and use of evidentials in Turkish. In C. Wallace & J. Nichols (Eds.), *Evidentiality. The linguistic coding of epistemology*. (pp. 159-167). New Jersey: Ablex Publishing Corporation.
- Aksu-Koç, A., Terziyan, T., & Taylan, E. E. (2014). Input offers and child uptakes: Acquiring mood and modal morphology in Turkish. *Language, Interaction and Acquisition/Langage, Interaction et Acquisition*, 5(1), 62-81.
- Aksu - Koç, A., Ögel - Balaban, H., & Alp, İ. E. (2009). Evidentials and source knowledge in Turkish. In S. A. Fitneva & T. Matsui (Eds.), *Evidentiality: A window into language and cognitive development, New directions for child and adolescent development* (pp. 13-28). San Francisco: Jossey-Bass.
- Albirini, A., & Benmamoun, E. (2014). Aspects of second-language transfer in the oral production of Egyptian and Palestinian heritage speakers. *International Journal of Bilingualism*, 18(3), 244-273.
- Albirini, A., Benmamoun, E., & Chakrani, B. (2013). Gender and number agreement in the oral production of Arabic Heritage speakers. *Bilingualism: Language and Cognition*, 16(01), 1-18.
- Albirini, A., Benmamoun, E., & Saadah, E. (2011). Grammatical features of Egyptian and Palestinian Arabic heritage speakers' oral production. *Studies in Second Language Acquisition*, 33(02), 273-303.
- Anderson, R. T. (1999). Loss of gender agreement in L1 attrition: Preliminary results. *Bilingual Research Journal*, 23(4), 389-408.
- Anderson, R. T. (2001). Lexical morphology and verb use in child first language loss: A preliminary case study investigation. *International Journal of Bilingualism*, 5(4), 377-401.
- Anjarningsih, H. Y., & Bastiaanse, R. (2011). Verbs and time reference in standard Indonesian agrammatic speech. *Aphasiology*, 25(12), 1562-1578.

- Anjarningsih, H. Y., Haryadi-Soebadi, R., Gofir, A., & Bastiaanse, R. (2012). Characterising agrammatism in Standard Indonesian. *Aphasiology*, 26(6), 757-784.
- Armstrong, E. (2000). Aphasic discourse analysis: The story so far. *Aphasiology*, 14(9), 875-892.
- Arslan, S., & Bastiaanse, R. (2014a). *Source memory impairments in aphasic and healthy aging Turkish speakers*. Paper presented at the 15th Science of Aphasia Conference, Ospedale San Camillo, Venice, Italy.
- Arslan, S., & Bastiaanse, R. (2014b). *Tense/aspect and Evidentiality in narrative speech of Turkish-Dutch bilingual speakers*. Paper presented at the 17th International conference on Turkish linguistics, University of Rouen, France.
- Arslan, S., de Kok, D., & Bastiaanse, R. (in press). Processing grammatical evidentiality and time reference in Turkish heritage and monolingual speakers. *Bilingualism: Language and Cognition*.
- Avrutin, S. (2000). Comprehension of discourse-linked and non-discourse-linked questions by children and Broca's aphasics. In Y. Grodzinsky, L. P. Shapiro & D. Swinney (Eds.), *Language and the brain: Representation and processing* (pp. 295-313). New York: Academic Press.
- Avrutin, S. (2006). Weak syntax. In Y. Grodzinsky & K. Amunts (Eds.), *Broca's Region* (pp. 49-62). Oxford: Oxford University Press.
- Aydin, Ö. (2007). The comprehension of Turkish relative clauses in second language acquisition and agrammatism. *Applied Psycholinguistics*, 28(02), 295-315.
- Baayen, R. H. (2008). *Analyzing linguistic data*. Cambridge: Cambridge University Press.
- Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, 59(4), 390-412.
- Badecker, W., & Caramazza, A. (1986). A final brief in the case against agrammatism: The role of theory in the selection of data. *Cognition*, 24(3), 277-282.
- Banguoğlu, T. (1974). *Türkçenin grameri*. Istanbul: Baha Matbaası.
- Barr, D. J. (2008). Analyzing 'visual world' eyetracking data using multilevel logistic regression. *Journal of Memory and Language*, 59(4), 457-474.
- Bastiaanse, R. (1995). Broca's Aphasia: A Syntactic and/or a Morphological Disorder? A Case Study. *Brain and language*, 48(1), 1-32.

- Bastiaanse, R. (2008). Production of verbs in base position by Dutch agrammatic speakers: Inflection versus finiteness. *Journal of Neurolinguistics*, 21(2), 104-119.
- Bastiaanse, R., Bamyacı, E., Hsu, C.-J., Lee, J., Yarbay-Duman, T., & Thompson, C. K. (2011). Time reference in agrammatic aphasia: A cross-linguistic study. *Journal of Neurolinguistics*, 24(6), 652-673.
- Bastiaanse, R., Hugen, J., Kos, M., & van Zonneveld, R. (2002). Lexical, morphological, and syntactic aspects of verb production in agrammatic aphasics. *Brain and language*, 80(2), 142-159.
- Bastiaanse, R., & Jonkers, R. (1998). Verb retrieval in action naming and spontaneous speech in agrammatic and anomic aphasia. *Aphasiology*, 12(11), 951-969.
- Bastiaanse, R., Jonkers, R., & Thompson, C. K. (2008). Test for assessing reference of time (TART). *University of Groningen, Groningen*.
- Bastiaanse, R., Rispens, J., Ruigendijk, E., Rabadán, O. J., & Thompson, C. K. (2002). Verbs: Some properties and their consequences for agrammatic Broca's aphasia. *Journal of Neurolinguistics*, 15(3-5), 239-264.
- Bastiaanse, R., & van Zonneveld, R. (2005). Sentence production with verbs of alternating transitivity in agrammatic Broca's aphasia. *Journal of Neurolinguistics*, 18(1), 57-66.
- Bastiaanse, R., & van Zonneveld, R. (2006). Comprehension of passives in Broca's aphasia. *Brain and language*, 96(2), 135-142.
- Benmamoun, E., Montrul, S., & Polinsky, M. (2013). Defining an "ideal" heritage speaker: Theoretical and methodological challenges Reply to peer commentaries. *Theoretical Linguistics*, 39(3-4), 259-294.
- Blackwell, A., Bates, E., & Fisher, D. (1996). The time course of grammaticality judgement. *Language and Cognitive Processes*, 11(4), 337-406.
- Blumenfeld, R. S., & Ranganath, C. (2007). Prefrontal cortex and long-term memory encoding: an integrative review of findings from neuropsychology and neuroimaging. *The Neuroscientist*, 13(3), 280-291.
- Boas, F. (1938). Language. In F. Boas (Ed.), *General Antropology* (pp. 124-145). New York: D. C. Heath Company.
- Bolonyai, A. (2002). Case systems in contact: Syntactic and lexical case in bilingual child language. *Southwest journal of linguistics*, 21(2), 1.
- Bolonyai, A. (2007). (In) vulnerable agreement in incomplete bilingual L1 learners. *International Journal of Bilingualism*, 11(1), 3-23.
- Bos, L. S., & Bastiaanse, R. (2014). Time reference decoupled from tense in agrammatic and fluent aphasia. *Aphasiology*, 28(5), 533-553.

- Bos, L. S., Dragoy, O., Avrutin, S., Iskra, E., & Bastiaanse, R. (2014). Understanding discourse-linked elements in aphasia: A threefold study in Russian. *Neuropsychologia*, 57, 20-28.
- Boye, K. (2010). Semantic maps and the identification of cross-linguistic generic categories: Evidentiality and its relation to epistemic modality. *Linguistic Discovery*, 8(1), 4-22.
- Burchert, F., Swoboda-Moll, M., & De Bleser, R. (2005). Tense and agreement dissociations in German agrammatic speakers: Underspecification vs. hierarchy. *Brain and language*, 94(2), 188-199.
- Cabeza, R., Mangels, J., Nyberg, L., Habib, R., Houle, S., McIntosh, A. R., & Tulving, E. (1997). Brain regions differentially involved in remembering what and when: a PET study. *Neuron*, 19(4), 863-870.
- Chafe, W., & Nichols, J. (1986). *Evidentiality: The linguistic coding of epistemology*. New Jersey: Ablex Publishing.
- Cinque, G. (2001). A note on mood, modality, tense and aspect affixes in Turkish. In E. Erguvanli-Taylan (Ed.), *The Verb in Turkish* (Vol. 44, pp. 47-59). Amsterdam: John Benjamins.
- Clahsen, H., & Ali, M. (2009). Formal features in aphasia: tense, agreement, and mood in English agrammatism. *Journal of Neurolinguistics*, 22(5), 436-450.
- Comrie, B. (1976). *Aspect*. Cambridge: Cambridge University Press.
- Cook, V. J. (2003). *Effects of the Second Language on the First*. Clevedon: Multilingual matters.
- Cornillie, B. (2009). Evidentiality and epistemic modality: On the close relationship between two different categories. *Functions of language*, 16(1), 44-62.
- Crepaldi, D., Inghinoli, C., Verga, R., Contardi, A., Semenza, C., & Luzzatti, C. (2011). On nouns, verbs, lexemes, and lemmas: Evidence from the spontaneous speech of seven aphasic patients. *Aphasiology*, 25(1), 71-92.
- Csató, E. A. (2000). Turkish mis-and imis-items. Dimensions of a functional analysis. In L. Johanson & B. Utas (Eds.), *Evidentials: Turkic, Iranian and neighbouring languages* (pp. 29-46). Berlin: Mouton de Gruyter.
- Curnow, T. J. (2002). Types of interaction between evidentials and first-person subjects. *Anthropological Linguistics*, 44(2), 178-196.
- De Bot, K., & Gorter, D. (2005). A European perspective on heritage languages. *Modern Language Journal*, 89(4), 612-616.
- De Bot, K., & Weltens, B. (1991). Recapitulation, regression, and language loss. In H. W. Seliger & R. M. Vago (Eds.), *First language attrition* (pp. 31-51). Cambridge: Cambridge University Press.

- De Haan, F. (1999). Evidentiality and epistemic modality: Setting boundaries. *Southwest journal of linguistics*, 18(1), 83-101.
- De Haan, F. (2005). Encoding speaker perspective: Evidentials. In Z. Frajzyngier, A. Hodges & D. S. Rood (Eds.), *Linguistic Diversity and Language Theories*. (pp. 379-397). Amsterdam: John Benjamins.
- de Villiers, J., & Garfield, J. (2009). Evidentiality and Narrative. *Journal of Consciousness Studies*, 16(6-8), 6-8.
- DeLancey, S. (2001). The mirative and evidentiality. *Journal of Pragmatics*, 33(3), 369-382.
- Dobbins, I. G., & Han, S. (2006). Cue-versus probe-dependent prefrontal cortex activity during contextual remembering. *Journal of cognitive neuroscience*, 18(9), 1439-1452.
- Dodson, C. S., Holland, P. W., & Shimamura, A. P. (1998). On the recollection of specific-and partial-source information. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24(5), 1121.
- Doğruöz, A., & Backus, A. (2009). Innovative constructions in Dutch Turkish: An assessment of ongoing contact-induced change. *Bilingualism: Language and Cognition*, 12(01), 41-63.
- Dragoy, O., & Bastiaanse, R. (2013). Aspects of time: Time reference and aspect production in Russian aphasic speakers. *Journal of Neurolinguistics*, 26(1), 113-128.
- Dragoy, O., Stowe, L. A., Bos, L. S., & Bastiaanse, R. (2012). From time to time: Processing time reference violations in Dutch. *Journal of Memory and Language*, 66(1), 307-325.
- Ekmekçi, Ö. (1990). *Acquisition of relativization in Turkish*. Paper presented at the Fifth international conference on Turkish linguistics, London University, England.
- Enç, M. (1987). Anchoring conditions for tense. *Linguistic inquiry*, 633-657.
- Enç, M. (2004). Rethinking past tense. In J. Guéron & A. Lecarme (Eds.), *The syntax of time* (pp. 203-215). Cambridge, MA: MIT Press.
- Erguvanlı-Taylan, E. (1993). Türkçe'de -DIK ekinin yantümcelerdeki işlevi üzerine. *Dilbilim Araştırmaları Dergisi*, 161-171.
- Erguvanlı-Taylan, E. (1994). Yantümcelerde tamlayan ekinin işlevi üzerine. *Dilbilim Araştırmaları Dergisi*, 31-41.
- Erguvanlı-Taylan, E. (1997). The Relationship between Aspect, Tense and Modality in Turkish : the Morpheme -DI. In D. Zeyrek & Ş. Ruhi (Eds.), *XI. Dilbilim Kurultayı Bildirileri* (pp. 1-13). Ankara: Middle East Technical University Press.

- Erguvanlı-Taylan, E. (2001). On the relation between temporal/aspectual adverbs and the verb form in Turkish. In E. Erguvanlı-Taylan (Ed.), *The verb in Turkish* (Vol. 44, pp. 97-129): John Benjamins.
- Erguvanlı-Taylan, E. (2014). *A Modality Map of Turkish*. Paper presented at the 17th International Conference on Turkish Linguistics, University of Rouen.
- Faller, M. T. (2002). *Semantics and pragmatics of evidentials in Cuzco Quechua*. (PhD Thesis), Stanford University.
- Faroqi-Shah, Y., & Dickey, M. W. (2009). On-line processing of tense and temporality in agrammatic aphasia. *Brain and language*, 108(2), 97-111.
- Faroqi-Shah, Y., & Thompson, C. K. (2004). Semantic, lexical, and phonological influences on the production of verb inflections in agrammatic aphasia. *Brain and language*, 89(3), 484-498.
- Faroqi-Shah, Y., & Thompson, C. K. (2007). Verb inflections in agrammatic aphasia: Encoding of tense features. *Journal of Memory and Language*, 56(1), 129-151.
- Floyd, R. (1999). *The structure of evidential categories in Wanka Quechua*: Summer Institute of Linguistics.
- Friedman, V. (1978). On the semantic and morphological influence of Turkish on Balkan Slavic. In D. Farkas, W. M. Jacobsen & K. W. Todrys (Eds.), *Papers from the fourteenth regional meeting of Chicago Linguistic Society* (pp. 108-118). Chicago, IL.: Chicago Linguistic Society.
- Friedman, V. (1986). Evidentiality in the Balkans: Bulgarian, Macedonian, and Albanian. In W. Chafe & J. Nichols (Eds.), *Evidentiality: the linguistic coding of epistemology* (pp. 168-187). New Jersey: Ablex Publishing.
- Friedman, V. (2003). Evidentiality in the Balkans with special attention to Macedonian and Albanian. In A. Y. Aikhenvald & R. M. W. Dixon (Eds.), *Studies in evidentiality* (pp. 189-218). Amsterdam: John Benjamins.
- Friedman, V. (2004). The typology of Balkan evidentiality and areal linguistics. In O. M. Tomić (Ed.), *Balkan syntax and semantics* (pp. 101-134). Amsterdam: John Benjamins.
- Friedmann, N. a., & Grodzinsky, Y. (1997). Tense and agreement in agrammatic production: Pruning the syntactic tree. *Brain and language*, 56(3), 397-425.
- Gavarró, A., & Martínez-Ferreiro, S. (2007). Tense and Agreement Impairment in Ibero-Romance. *Journal of psycholinguistic research*, 36(1), 25-46.

- Givón, T. (1982). Evidentiality and epistemic space. *Studies in language*, 6(1), 23-49.
- Glisky, E. L., Polster, M. R., & Routhieaux, B. C. (1995). Double dissociation between item and source memory. *Neuropsychology*, 9(2), 229.
- Goodglass, H., & Kaplan, E. (1972). *The assessment of aphasia and related disorders*. Philadelphia: Lea & Febiger.
- Goral, M. (2011). *Treatment of grammatical disorders in bilingual aphasia*. Paper presented at the Science of Aphasia XII, Barcelona.
- Grodzinsky, Y. (1991). There is an entity called agrammatic aphasia. *Brain and language*, 41(4), 555-564.
- Grodzinsky, Y. (2000). The neurology of syntax: Language use without Broca's area. *Behavioral and brain sciences*, 23(01), 1-21.
- Gül, D. (2009). *Semantics of Turkish evidential-(I) mlş*. Paper presented at the the 14th International Conference on Turkish Linguistics.
- Gürel, A. (2004). Selectivity in L2-induced L1 attrition: a psycholinguistic account. *Journal of Neurolinguistics*, 17(1), 53-78.
- Gürel, A., & Yilmaz, G. (2011). Restructuring in the L1 Turkish grammar: Effects of L2 English and L2 Dutch. *Language, Interaction and Acquisition/Langage, Interaction et Acquisition*, 2(2), 221-250.
- Hankamer, J., & Knecht, L. (1976). The role of the subject/non-subject distinction in determining the choice of relative clause participle in Turkish. *Harvard studies in syntax and semantics*, 2, 197-219.
- Jakobson, R. (1941). *Kindersprache, Aphasie, und allgemeine Lautgesetze*. Uppsala: Almqvist & Wiksell.
- Jakobson, R. (1957). *Shifters, verbal categories and the Russian verb*. The Hague: Mouton.
- Janowsky, J. S., Shimamura, A. P., & Squire, L. R. (1989). Source memory impairment in patients with frontal lobe lesions. *Neuropsychologia*, 27(8), 1043-1056.
- Johanson, L. (1971). *Aspekt im Türkischen*. Uppsala: Almqvist & Wiksell.
- Johanson, L. (2000). Turkic indirectives. In L. Johanson & B. Utas (Eds.), *Evidentials: Turkic, Iranian and Neighbouring Languages* (pp. 61-88). Berlin: Mouton de Gruyter.
- Johanson, L. (2003). Evidentiality in Turkic. In A. Y. Aikhenvald & R. M. W. Dixon (Eds.), *Studies in evidentiality* (pp. 273-290). Amsterdam: John Benjamins.
- Johanson, L. (2006). Indirective sentence types. *Turkic Languages*, 10, 73-89.
- Johanson, L., & Utas, B. (2000). *Evidentials: Turkic, Iranian and neighbouring languages*. Berlin: Walter de Gruyter.

- Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological bulletin*, 114(1), 3-28.
- Jonkers, R., & de Bruin, A. (2009). Tense processing in Broca's and Wernicke's aphasia. *Aphasiology*, 23(10), 1252-1265.
- Joseph, B. D. (2003). Summation, questions, prospects. In A. Y. Aikhenvald & R. M. W. Dixon (Eds.), *Studies in evidentiality* (Vol. 54, pp. 307-327). Amsterdam: John Benjamins.
- Keijzer, M. (2010). The regression hypothesis as a framework for first language attrition. *Bilingualism: Language and Cognition*, 13(01), 9-18.
- Kim, J.-H., Montrul, S., & Yoon, J. (2009). Binding interpretations of anaphors by Korean heritage speakers. *Language Acquisition*, 16(1), 3-35.
- Kolk, H., & Heeschen, C. (1992). Agrammatism, paragrammatism and the management of language. *Language and Cognitive Processes*, 7(2), 89-129.
- Köpke, B. (2004). Neurolinguistic aspects of attrition. *Journal of Neurolinguistics*, 17(1), 3-30.
- Köpke, B., Schmid, M., Keijzer, M., & Dostert, S. (2007). *Language attrition: Theoretical perspectives*. Amsterdam: John Benjamins Publishing.
- Köpke, B., & Schmid, M. S. (2004). Language attrition: The next phase. In M. Schmid, B. Köpke, M. Keijzer & L. Weilemar (Eds.), *First language attrition: Interdisciplinary perspectives on methodological issues* (Vol. 28, pp. 1 - 46). Amsterdam: John Benjamins Publishing Company.
- Kornfilt, J. (1997a). On the syntax and morphology of relative clauses in Turkish *Dilbilim Araştırmaları Dergisi*, 24-51.
- Kornfilt, J. (1997b). *Turkish*. London: Routledge.
- Kural, M. (1994). Yantümcelerde çekim ekleri. *Dilbilim Araştırmaları Dergisi*, 80-110.
- Lazard, G. (2001). On the grammaticalization of evidentiality. *Journal of Pragmatics*, 33(3), 359-367.
- Lewis, G. L. (1967). *Turkish grammar*. Oxford: Clarendon Press.
- Li, P., Sepanski, S., & Zhao, X. (2006). Language history questionnaire: A Web-based interface for bilingual research. *Behavior Research Methods*, 38(2), 202-210.
- Lundstrom, B. N., Ingvar, M., & Petersson, K. M. (2005). The role of precuneus and left inferior frontal cortex during source memory episodic retrieval. *NeuroImage*, 27(4), 824-834.
- Mangels, J. A. (1997). Strategic processing and memory for temporal order in patients with frontal lobe lesions. *Neuropsychology*, 11(2), 207.

- Martínez-Ferreiro, S., & Bastiaanse, R. (2013). Time reference in Spanish and Catalan non-fluent aphasia. *Lingua*, 137, 88-105.
- Maviş, İ. (2007). Perspectives on public awareness of stroke and aphasia among Turkish patients in a neurology unit. *Clinical linguistics & phonetics*, 21(1), 55-70.
- Maviş, İ., & Toğram, B. (2009). Afazi Dil Değerlendirme Testi (ADD) kullanım yönergesi. *Ankara: Detay Yayınları*.
- Menn, L., & Obler, L. K. (1990). *Agrammatic Aphasia*. Amsterdam: John Benjamins.
- Miceli, G., Mazzucchi, A., Menn, L., & Goodglass, H. (1983). Contrasting cases of Italian agrammatic aphasia without comprehension disorder. *Brain and language*, 19(1), 65-97.
- Miceli, G., Silveri, M. C., Romani, C., & Caramazza, A. (1989). Variation in the pattern of omissions and substitutions of grammatical morphemes in the spontaneous speech of so-called agrammatic patients. *Brain and language*, 36(3), 447-492.
- Mitchell, K. J., & Johnson, M. K. (2000). Source monitoring: Attributing mental experiences. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory*. (pp. 179-195). New York: Oxford University Press.
- Mitchell, K. J., & Johnson, M. K. (2009). Source monitoring 15 years later: What have we learned from fMRI about the neural mechanisms of source memory? *Psychological bulletin*, 135(4), 638-677.
- Mitchell, K. J., Johnson, M. K., Raye, C. L., & Greene, E. J. (2004). Prefrontal cortex activity associated with source monitoring in a working memory task. *Journal of cognitive neuroscience*, 16(6), 921-934.
- Montrul, S. A. (2002). Incomplete acquisition and attrition of Spanish tense/aspect distinctions in adults bilinguals. *Bilingualism: Language and cognition*, 5(1), 39-68.
- Montrul, S. A. (2008). *Incomplete acquisition in bilingualism: Re-examining the age factor*. Amsterdam: John Benjamins Publishing.
- Montrul, S. A. (2009). Knowledge of tense-aspect and mood in Spanish heritage speakers. *International Journal of Bilingualism*, 13(2), 239-269.
- Montrul, S. A. (2010). Dominant language transfer in adult second language learners and heritage speakers. *Second Language Research*, 26(3), 293-327.
- Montrul, S. A. (2011). Multiple interfaces and incomplete acquisition. *Lingua*, 121(4), 591-604.

- Montrul, S. A., Bhatt, R. M., & Bhatia, A. (2012). Erosion of case and agreement in Hindi heritage speakers. *Linguistic Approaches to Bilingualism*, 2(2), 141-176.
- Mushin, I. (2000). Evidentiality and deixis in narrative retelling. *Journal of Pragmatics*, 32(7), 927-957.
- Muysken, P. (1995). Focus in Quechua. In K. Kiss (Ed.), *Discourse configurational Languages* (pp. 375–393). New York: Oxford University Press.
- Nanousi, V., Masterson, J., Druks, J., & Atkinson, M. (2006). Interpretable vs. uninterpretable features: Evidence from six Greek-speaking agrammatic patients. *Journal of Neurolinguistics*, 19(3), 209-238.
- Olness, G. S. (2006). Genre, verb, and coherence in picture - elicited discourse of adults with aphasia. *Aphasiology*, 20(02-04), 175-187.
- Özge, D., Marinis, T., & Zeyrek, D. (2010). *Production of relative clauses in monolingual Turkish children*. Paper presented at the 34th Annual Boston University Conference on Language Development, Boston University.
- Öztürk, Ö., & Papafragou, A. (2007). *Children's acquisition of evidentiality*. Paper presented at the Proceedings from the the 31st Annual Boston University Conference on Language Development, Boston University.
- Öztürk, Ö., & Papafragou, A. (2008). *Acquisition of evidentiality and source monitoring*. Paper presented at the Proceedings from the the 32nd Annual Boston University Conference on Language Development, Boston University.
- Palmer, F. R. (1986). *Mood and modality*. Cambridge: Cambridge University Press.
- Papafragou, A., Li, P., Choi, Y., & Han, C.-h. (2007). Evidentiality in language and cognition. *Cognition*, 103(2), 253-299.
- Pavlenko, A. (2004). L2 influence and L1 attrition in adult bilingualism. In M. Schmid, B. Köpke, M. Keijzer & L. Weilemar (Eds.), *First language attrition: Interdisciplinary perspectives on methodological issues* (pp. 47-59). Amsterdam: John Benjamins Publishing.
- Plungian, V. A. (2001). The place of evidentiality within the universal grammatical space. *Journal of Pragmatics*, 33(3), 349-357.
- Plungian, V. A. (2010). Types of verbal evidentiality marking: an overview. In E. Smirnova & G. Diewald (Eds.), *Linguistic realization of evidentiality in European languages*. (pp. 15-58). Berlin: Walter de Gruyter.
- Polinsky, M. (2006). Incomplete acquisition: American Russian. *Journal of Slavic Linguistics*, 14(2), 191-262.

- Polinsky, M. (2008). Heritage Language Narratives. In D. Brinton, O. Kagan & S. Bauckus (Eds.), *Heritage languages: A new field emerging*. New York: Routledge.
- Polinsky, M. (2011). Reanalysis in adult heritage language. *Studies in Second Language Acquisition*, 33(02), 305-328.
- R-Core-Team. (2012). R: A Language and Environment for Statistical Computing. Vienna, Austria: <http://www.r-project.org/>.
- Rayner, K., Slowiaczek, M. L., Clifton, C., & Bertera, J. H. (1983). Latency of sequential eye movements: Implications for reading. *Journal of Experimental Psychology: Human Perception and Performance*, 9(6), 912.
- Reichenbach, H. (1947). *Elements of symbolic logic*. New York: Free Press.
- Richards, B. J., & Malvern, D. D. (1997). *Quantifying lexical diversity in the study of language development*. Reading: University of Reading.
- Rinke, E., & Flores, C. (2014). Morphosyntactic knowledge of clitics by Portuguese heritage bilinguals. *Bilingualism: Language and Cognition*, 17(04), 681-699.
- Rofes, A., Bastiaanse, R., & Martínez-Ferreiro, S. (2014). Conditional and future tense impairment in non-fluent aphasia. *Aphasiology*, 28(1), 99-115.
- Rothman, J. (2007). Heritage speaker competence differences, language change, and input type: Inflected infinitives in Heritage Brazilian Portuguese. *International Journal of Bilingualism*, 11(4), 359-389.
- Saffran, E. M., Berndt, R. S., & Schwartz, M. F. (1989). The quantitative analysis of agrammatic production: Procedure and data. *Brain and language*, 37(3), 440-479.
- San Roque, L., Floyd, S., & Norcliffe, E. (in press). Evidentiality and interrogativity. *Lingua*. doi: <http://dx.doi.org/10.1016/j.lingua.2014.11.003>
- Sekerina, I. A., & Sauermann, A. (in press). Visual attention and quantifier-spreading in heritage Russian bilinguals. *Second Language Research*. doi: 10.1177/0267658314537292
- Seliger, H. W., & Vago, R. M. (1991). *First language attrition*. Cambridge: Cambridge University Press.
- Sezer, E. (2001). Finite inflection in Turkish. In E. Erguvanli-Taylan (Ed.), *The verb in Turkish* (pp. 1-46). Amsterdam: John Benjamins.
- Shimamura, A. P., Janowsky, J. S., & Squire, L. R. (1991). What is the role of frontal lobe damage in memory disorders. In H. S. Levin, H. M. Eisenberg & A. L. Benton (Eds.), *Frontal lobe function and dysfunction* (pp. 173-195). New York: Oxford University Press.

- Silva-Corvalán, C. (1994). *Language Contact and Change: Spanish in Los Angeles*. Oxford: Oxford University Press.
- Simonsen, H. G., & Lind, M. (2002). Past tense expression in a Norwegian man with Broca's aphasia. *Investigations in clinical phonetics and linguistics*, 45-56.
- Slobin, D. I. (1986). The acquisition and use of relative clauses in Turkic and Indo-European languages. In D. I. Slobin & K. Zimmer (Eds.), *Studies in Turkish linguistics* (pp. 273-289). Amsterdam: John Benjamins.
- Slobin, D. I., & Aksu, A. A. (1982). Tense, aspect and modality in the use of the Turkish evidential. In P. J. Hopper (Ed.), *Tense-aspect: Between semantics and pragmatics* (pp. 185-200). Amsterdam: John Benjamins.
- Sorace, A. (2000). Syntactic Optionality in Non-Native Grammars. *Second Language Research*, 16(2), 93-102.
- Sorace, A. (2011). Pinning down the concept of "interface" in bilingualism. *Linguistic Approaches to Bilingualism*, 1(1), 1-33.
- Sorace, A., & Filiaci, F. (2006). Anaphora resolution in near-native speakers of Italian. *Second Language Research*, 22(3), 339-368.
- Sorace, A., & Serratrice, L. (2009). Internal and external interfaces in bilingual language development: Beyond structural overlap. *International Journal of Bilingualism*, 13(2), 195-210.
- Stavrakaki, S., & Kouvava, S. (2003). Functional categories in agrammatism: Evidence from Greek. *Brain and language*, 86(1), 129-141.
- Swick, D., & Knight, R. T. (1999). Contributions of prefrontal cortex to recognition memory: Electrophysiological and behavioral evidence. *Neuropsychology*, 13(2), 155-170.
- Swick, D., Senkfor, A. J., & Van Petten, C. (2006). Source memory retrieval is affected by aging and prefrontal lesions: Behavioral and ERP evidence. *Brain research*, 1107(1), 161.
- Tantucci, V. (2013). Interpersonal evidentiality: The Mandarin V-过 < i> guo</i> construction and other evidential systems beyond the 'source of information'. *Journal of Pragmatics*, 57, 210-230.
- Taylan, E. E. (1984). *The function of word order in Turkish grammar*. Berkeley: University of California Press.
- Thompson, C. K., Choy, J. J., Holland, A., & Cole, R. (2010). Sentactics®: Computer-automated treatment of underlying forms. *Aphasiology*, 24(10), 1242-1266.
- Tosun, S., Vaid, J., & Geraci, L. (2013). Does obligatory linguistic marking of source of evidence affect source memory? A Turkish/English investigation. *Journal of Memory and Language*, 69(2), 121-134.

- Tsimpli, I., Sorace, A., Heycock, C., & Filiaci, F. (2004). First language attrition and syntactic subjects: A study of Greek and Italian near-native speakers of English. *International Journal of Bilingualism*, 8(3), 257-277.
- Ünal, E., & Papafragou, A. (2013). *Linguistic and Conceptual Representations of Inference as a Knowledge Source*. Paper presented at the Proceedings from the 37th Annual Boston University Conference on Language Development, Boston University.
- Underhill, R. (1972). Turkish participles. *Linguistic inquiry*, 3(1), 87-99.
- Underhill, R. (1976). *Turkish grammar*. Cambridge, MA: MIT Press.
- Valdés, G. (2005). Bilingualism, heritage language learners, and SLA research: Opportunities lost or seized? *The Modern Language Journal*, 89(3), 410-426.
- Vermeulen, J., Bastiaanse, R., & Van Wagoningen, B. (1989). Spontaneous speech in aphasia: A correlational study. *Brain and language*, 36(2), 252-274.
- Weber, D. J. (1986). Information perspective, profile, and patterns in Quechua. In W. Chafe & J. Nichols (Eds.), *Evidentiality: the linguistic coding of epistemology* (pp. 137-155). New Jersey: Ablex Publishing.
- Wenzlaff, M., & Clahsen, H. (2004). Tense and agreement in German agrammatism. *Brain and language*, 89(1), 57-68.
- Wenzlaff, M., & Clahsen, H. (2005). Finiteness and verb-second in German agrammatism. *Brain and language*, 92(1), 33-44.
- Wilding, E. L., & Rugg, M. D. (1996). An event-related potential study of recognition memory with and without retrieval of source. *Brain*, 119(3), 889-905.
- Wiley, T. G. (1999). On Defining Heritage Languages and Their Speakers. In J. K. Peyton, D. A. Ranard & S. McGinnis (Eds.), *Heritage languages in America: preserving a national resource* (pp. 29-36). Long Beach, CA: Delta Systems.
- Willett, T. (1988). A cross-linguistic survey of the grammaticization of evidentiality. *Studies in language*, 12(1), 51-97.
- Yağmur, K. (1997). *First language attrition among Turkish speakers in Sydney*. Tilburg: Tilburg University Press.
- Yarbay-Duman, T., Altınok, N., Özgirgin, N., & Bastiaanse, R. (2011). Sentence comprehension in Turkish Broca's aphasia: An integration problem. *Aphasiology*, 25(8), 908-926.
- Yarbay-Duman, T., Aygen, G., & Bastiaanse, R. (2008). The production of Turkish relative clauses in agrammatism: Verb inflection and constituent order. *Brain and language*, 105(3), 149-160.

- Yarbay-Duman, T., Aygen, G., Özgirgin, N., & Bastiaanse, R. (2007). Object scrambling and finiteness in Turkish agrammatic production. *Journal of Neurolinguistics*, 20(4), 306-331.
- Yarbay-Duman, T., & Bastiaanse, R. (2009). Time reference through verb inflection in Turkish agrammatic aphasia. *Brain and language*, 108(1), 30-39.
- Yavas, F. (1980). *On the meaning of the tense and aspect markers in Turkish*. (PhD dissertation), University of Kansas.
- Zagona, K. (2003). Tense and anaphora: Is there a tense-specific theory of coreference? In A. Barss (Ed.), *Anaphora: A reference guide* (pp. 140-171). Oxford: Wiley-Blackwell.

Summary

Turkish grammatically expresses evidentiality, the linguistic encoding of information sources, through verbal morphemes indicating direct (-DI) and indirect (-mİş) evidentiality. This dissertation examines to what extent the evidentiality system in Turkish is vulnerable to differential types of language loss caused either by brain damage (i.e., agrammatic aphasia) or by acquisition of a heritage language in bilinguals. The investigations in this dissertation have extended our understanding of the neurolinguistic and psycholinguistic aspects of evidentiality. In particular, the neurolinguistic aspects relating to how the evidential forms are affected in Turkish speakers with agrammatic aphasia, and the psycholinguistic aspects concerning the processing of evidential forms in the healthy bilingual brain.

Chapter 1 presents a linguistic introduction to the expression of evidentiality in Turkish, and provides a background on its neurolinguistic and psycholinguistic aspects. Regarding the neurolinguistic aspects, individuals with agrammatic aphasia have problems referring to the past as compared to non-past time frames. According to the Past Discourse Linking Hypothesis (PADILIH; Bastiaanse et al., 2011), past time reference is discourse-linked, and, thus, impaired in agrammatic aphasia. That is, verbs which refer to the past are difficult for agrammatic speakers; however, not much has been explored as of yet about past verb forms in Turkish agrammatic speakers.

From a psycholinguistic perspective, heritage language speakers (i.e., early bilingual speakers) whose first language performance tends to be weaker than their second language often exhibit gaps in their knowledge of their first language grammar. Heritage speakers are assumed to have gone through disrupted acquisition processes during childhood, possibly under inadequate input conditions, and thus, in adulthood, some aspects of their first language inflectional morphology are attrited. Most previous studies on heritage speakers have indicated that the incomplete acquisition and attrition patterns in heritage speakers' knowledge of inflectional morphology in their first language are due to the vulnerability of linguistic interfaces (e.g.,

Montrul, 2009). That is, the inflections that relate to the syntax-pragmatics interface are prone to incomplete acquisition and attrition in heritage speakers. This idea is based on the Interface Hypothesis (Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009).

Chapter 2 aims at demonstrating (1) that Turkish agrammatic speakers are able to produce evidential verb forms in sentences that are linked to the respective information sources; (2) that they are able to identify the information source perspectives that the evidential verbs map onto. By using both a sentence production and a source identification task, we showed that Turkish agrammatic speakers performed poorly in producing verbs inflected for direct evidentiality, while the production of verbs used in contexts of inferred and reported events was relatively spared. Our findings from the source identification task, however, showed that indirect information sources (i.e., inference and report) were difficult for the agrammatic speakers to discriminate, while directly witnessed information sources were relatively easy to identify. The production data are consistent with the PADILIH, which suggests that referring to the past is difficult for agrammatic speakers as it requires discourse linking. We argued that the direct evidential is the discourse-linked form within the evidential paradigm, as its use is linked to the speaker's direct witnessing of a past event. Hence, the direct evidential form is hard for agrammatic speakers to produce, although they are aware that the uses of direct evidentiality are linked to visual witnessing.

Chapter 3 addresses the question whether evidential verb forms are affected in comparison to other verb forms in Turkish agrammatic speakers' narrative speech production. The findings from our narrative speech production experiment, including an open-end interview and a story-telling task, showed that Turkish agrammatic speakers' verb diversity was reduced but their use of verb inflections was more or less normal. Nonetheless, their use of direct evidential morphemes was disrupted in the sense that a trade-off pattern between verb inflection for direct evidence and verb diversity was found. Agrammatic speakers who produced a high number of verbs inflected for direct evidentiality employed little diversity in those verbs, while agrammatic speakers who produced a greater diversity of verbs with a direct evidential produced relatively few of these forms. This pattern was

not observed for indirect evidential or present progressive forms. These data are compatible with Bastiaanse's (2013) claim that retrieving the name of an event and inflecting it for the time frame in which the event takes place is arduous for agrammatic speakers.

Chapter 4 aims to unveil the extent to which Turkish heritage speakers' processing of the evidential verb forms is affected by incomplete acquisition or attrition. A sentence-verification task was administered to both heritage and monolingual speakers of Turkish, which required the participants to respond to finite verb evidentiality violations and to time reference violations by non-finite participles. The aim of the experiment was to test whether Turkish heritage speakers were less sensitive to evidentiality violations, a form that relates to the syntax-pragmatics interface, as compared to non-finite participles, uses of which are linked to syntactic knowledge. As predicted by the Interface Hypothesis, the heritage speakers performed less accurately (and had longer RTs) in responding to evidentiality violations compared to time reference violations.

The goal of Chapter 5 is to explain how Turkish heritage speakers, as compared to late bilinguals and monolinguals, process evidentiality in a virtual visual-world setting while listening to sentences with direct and indirect evidentiality. An eye-movement monitoring experiment was conducted where the participants were asked to choose the corresponding picture (a form of visual evidence) appropriate for the use of either direct or indirect evidentiality. The results indicated that both the late and the heritage bilingual groups responded less accurately and more slowly in the direct evidential condition than in the indirect evidential condition, while the monolingual speakers did not differ between the two conditions. The late and early bilingual speakers' target fixations showed a similar difference between the direct and indirect evidential conditions. We argue that the data are not consistent either with the Interface Hypothesis or with maturational constraints (i.e., order of acquisition or age of onset to bilingualism). We conclude that evidentiality erodes easily under incomplete acquisition and attrition in Turkish heritage grammars, especially when the dominant majority language has no comparable evidentiality marking.

Chapter 6 provides a general discussion and the conclusions from the studies reported in this dissertation. It was shown that evidentiality is a vulnerable grammar domain in both individuals with agrammatic aphasia and in heritage speakers of Turkish. Notwithstanding the different underlying reasons for these impairments and attrition effects, the outcomes are similar: there is a clear disadvantage of the direct evidential in both pathological and non-pathological language loss. The direct evidential form was difficult in the Turkish agrammatic speakers' speech output (Chapters 2 and 3). The reason for this difficulty is the assignment of past time reference; in the case of direct evidential, a link between speech time and a personally witnessed event has to be established, which is hard for agrammatic speakers to compute. The direct evidential form was also shown to not evoke native-like sensitivity in the heritage speakers as verified by their eye-movements (Chapter 5). The heritage speakers were insensitive to violations both by direct and indirect evidentiality in the RTs study (Chapter 4), they seem to have restructured and simplified the semantic and pragmatic contents of the evidentiality paradigm.

Samenvatting

In het Turks wordt evidentialiteit, de linguïstische encoding van informatiebronnen, grammaticaal uitgedrukt door morfemen aan het werkwoord toe te voegen, die directe (-dl) en indirecte (mlş) evidentialiteit aangeven. In deze dissertatie wordt onderzocht in welke mate het evidentialiteitssysteem van het Turks vatbaar is voor verschillende soorten van taalverlies veroorzaakt door hersenschade (in dit geval agrammatische afasie) of door de verwerving van een minderheidstaal in tweetaligen. De onderzoeken in deze dissertatie hebben ons begrip van de neurolinguïstische en psycholinguïstische aspecten van evidentialiteit uitgebreid. De neurolinguïstische aspecten die gerelateerd zijn aan de manier waarop de evidentiële vormen zijn aangetast in Turkse sprekers met agrammatische afasie en de psycholinguïstische aspecten die gaan over de verwerking van evidentiële vormen in de gezonde tweetalige hersenen zijn onderzocht.

Hoofdstuk 1 presenteert een linguïstische introductie over het uitdrukken van evidentialiteit in het Turks en geeft een achtergrond over zijn neurolinguïstische en psycholinguïstische aspecten. Wat betreft de neurolinguïstische aspecten hebben individuen met agrammatische afasie problemen met het verwijzen naar het verleden vergeleken met verwijzing naar periodes die niet in het verleden plaatsvinden. Volgens de Past Discourse Linking Hypothesis (PADILIH: Bastiaanse et al., 2011) is verwijzing naar de verleden tijd discourse-gebonden en daarom verstoord in agrammatische afasie. Dat betekent dat werkwoorden die naar de verleden tijd verwijzen moeilijk zijn voor agrammatische sprekers; maar er is niet veel onderzocht over werkwoordsvormen van de verleden tijd in Turkse agrammatische sprekers.

Vanuit een psycholinguïstisch perspectief laten sprekers van een minderheidstaal (oftewel vroege tweetalige sprekers), van wie de beheersing van de eerste taal vaak zwakker is dan hun tweede taal, vaak tekortkomingen zien in hun kennis van de grammatica van hun eerste taal. Er wordt verwacht dat het taalverwervingsproces van sprekers van een minderheidstaal verstoord is tijdens hun jeugd, dit komt waarschijnlijk door

omstandigheden van ontoereikende talige toevoer, waardoor sommige aspecten van de inflectionele morfologie van hun taal verslijten als ze volwassen zijn. De meeste voorgaande studies met sprekers van een minderheidstaal hebben aangetoond dat onvolledige taalverwerving en patronen van verslijt in hun kennis van de inflectionele morfologie van hun eerste taal te wijten zijn aan de kwetsbaarheid van linguïstische interface (zoals Montrul, 2009). Dat betekent dat de inflecties die gerelateerd zijn aan de syntaxis-pragmatiek interface vatbaar zijn voor onvolledige verwerving en slijtage in sprekers van een minderheidstaal. Dit idee is gebaseerd op de Interface Hypothesis (Sorace, 2000; Sorace & Filiaci, 2006; Sorace & Serratrice, 2009).

Het doel van Hoofdstuk 2 is om aan te tonen (1) dat Turkse agrammatische sprekers evidentieële werkwoordsvormen in zinnen kunnen produceren die gebonden zijn aan de informatiebronnen; (2) dat ze het perspectief van de informatiebron waarbij de evidentieële vorm hoort kunnen identificeren. Door zowel een zinsproductietaak en een bronidentificatietaak te gebruiken, hebben wij aangetoond dat Turkse agrammatische sprekers slecht presteerden in de productie van werkwoorden die voor directe evidentialiteit vervoegd moesten worden, terwijl de productie van werkwoorden die gebruikt werden in contexten met geïnfereerde en gerapporteerde gebeurtenissen relatief intact was. Onze bevindingen van de bronidentificatietaak daarentegen toonden aan dat indirecte informatiebronnen (in dit geval infereren en rapporteren) moeilijk te onderscheiden waren voor agrammatische sprekers, terwijl direct waargenomen informatiebronnen redelijk makkelijk te identificeren waren. De productiedata ondersteunen de PADILIH, wat suggereert dat verwijzing naar het verleden moeilijk is voor agrammatische sprekers, omdat hiervoor een verbinding met de discourse nodig is. Wij argumenteren dat de directe evidentieële vorm de discourse-gebonden variant is binnen het evidentialiteitsparadigma, omdat het gebruik hiervan verbonden is met de directe waarneming van de spreker van een gebeurtenis in de verleden tijd. Daarom is de directe evidentieële vorm moeilijk te produceren voor agrammatische sprekers, hoewel ze weten dat het gebruik van directe evidentialiteit gerelateerd is aan het visueel getuige zijn van een gebeurtenis.

Hoofdstuk 3 is gericht op de vraag of het begrip van evidentieële werkwoordsvormen is aangetast vergeleken met andere werkwoordsvormen in de narratieve spraakproductie van Turkse agrammatische sprekers. Met de bevindingen uit ons narratieve spraakproductie-experiment, bestaande uit een open-einde interview en het vertellen van een verhaal, hebben wij aangetoond dat de diversiteit van de werkwoorden van Turkse agrammatische sprekers verminderd was, terwijl hun gebruik van werkwoordsvervoegingen min of meer normaal was. Desondanks was hun gebruik van directe evidentieële morfemen verstoord in de zin dat er een compromispatroon tussen vervoeging voor directe evidentialiteit en diversiteit van werkwoorden gevonden werd. Agrammatische sprekers die een grote hoeveelheid werkwoorden voor directe evidentialiteit vervoegden, gebruikten weinig diversiteit in deze werkwoorden, terwijl agrammatische sprekers die een grotere diversiteit aan werkwoorden met directe evidentialiteit produceerden weinig evidentieële morfemen produceerden. Dit patroon was niet geobserveerd voor indirecte evidentieële vormen of voor vormen in de onvoltooid tegenwoordige tijd. Deze gegevens zijn overeenkomstig met Bastiaanse's (2013) bewering dat de naam van een gebeurtenis oproepen en vervoegen voor de tijd waarop de gebeurtenis plaatsvind moeilijk is voor agrammatische sprekers.

Het doel van Hoofdstuk 4 was om de mate waarin de evidentieële werkwoordsvormen zijn aangetast door onvolledige taalverwerving of verslijt in Turkse minderheidstaalsprekers te onthullen. Een zin-verificatietaak werd afgenomen bij minderheidstaalsprekers en ééntalige sprekers van het Turks, waarbij de deelnemers moesten reageren op schendingen in de evidentialiteit van finiete werkwoorden en op schendingen van de verwijzing in de tijd van niet-finiete deelwoorden. Het doel van het experiment was om te testen of Turkse minderheidstaalsprekers minder gevoelig waren voor schendingen van evidentialiteit, een vorm die gerelateerd is aan de syntaxis-pragmatiek interface, vergeleken met niet-finiete deelwoorden, waarvan het gebruik gerelateerd is aan syntactische kennis. Zoals voorspeld wordt volgens de Interface Hypothesis, presteerden de minderheidstaalsprekers minder accuraat (en hadden langere reactietijden) bij het beantwoorden van schendingen in evidentialiteit vergeleken met schendingen van verwijzing in de tijd.

Het doel van Hoofdstuk 5 was om uit te leggen hoe Turkse minderheidstaalsprekers, vergeleken met late tweetaligen en ééntaligen, evidentialiteit verwerken in de context van een virtuele visuele-wereld terwijl ze naar zinnen met directe en indirecte evidentialiteit luisterden. Er werd een experiment uitgevoerd waarin oogbewegingen geobserveerd werden en deelnemers gevraagd werden om de overeenkomstige foto (een vorm van visueel bewijs) te kiezen die paste bij het gebruik van directe of indirecte evidentialiteit. De resultaten toonden aan dat zowel de late tweetaligen als de minderheidstaalsprekers minder accuraat en langzamer antwoordden in de directe evidentiële conditie vergeleken met de indirecte evidentiële conditie, terwijl de ééntalige sprekers geen verschil lieten zien tussen beide condities. De fixaties op het doel van de late en vroege tweetalige sprekers lieten een vergelijkbaar verschil zien tussen de directe en de indirecte evidentiële condities. Wij argumenteren dat de data niet overeenkomstig zijn met de Interface Hypothesis of met beperkingen in de rijping (zoals de volgorde van verwerving of de leeftijd waarop de tweetaligheid begonnen is). Wij concluderen dat evidentialiteit makkelijk erodeert in het geval van onvoltooide verwerving en verslijt in de grammatica van Turkse mindertaalsprekers, vooral als de dominante meerderheidstaal geen vergelijkbare evidentiële markering heeft.

Hoofdstuk 6 biedt een algemene discussie en de conclusies van de onderzoeken die in deze dissertatie beschreven worden. Het was aangetoond dat evidentialiteit een kwetsbaar domein in de grammatica is van zowel individuen met agrammatische afasie als minderheidstaalsprekers van het Turks. Ondanks de verschillende onderliggende redenen voor deze stoornissen en slijtage effecten zijn de uitkomsten vergelijkbaar: er is een duidelijk nadeel voor de directe evidentiële vorm in zowel pathologisch als niet-pathologisch taalverlies. Het gebruik van de directe evidentiële vorm was moeilijk in de spraakproductie van de Turkse agrammatische sprekers (Hoofdstukken 2 en 3). De reden voor deze moeilijkheid is het toepassen van verwijzing naar de verleden tijd; in het geval van directe evidentie moet er een verbinding gemaakt worden tussen de tijd van spreken en een gebeurtenis waarvan de spreker getuige was, wat moeilijk te vormen is voor agrammatische sprekers. De directe evidentiële vorm bleek ook geen moedertaalsprekerachtige gevoeligheid uit te lokken in minderheidstaalsprekers, wat bevestigd werd door hun oogbewegingen

(Hoofdstuk 5). De minderheidstaalsprekers waren ongevoelig voor schendingen van directe en indirecte evidentialiteit in het reactietijdonderzoek (Hoofdstuk 4), zij lijken de semantische en pragmatische inhoud van het evidentialiteitsparadigma geherstructureerd en gesimplificeerd te hebben.

About the author

Seçkin Arslan was born on 5th March 1984, in Kırklareli, Turkey. He finished his studies in English language teaching at the Anadolu University in Eskişehir in 2006. In 2009, he was awarded with an Erasmus-Mundus Scholarship to study at the European Masters in Clinical Linguistics (EMCL), and he attended his study program at the Universities of Milano-Bicocca (IT), Potsdam (DE), and Groningen (NL). In 2010, he obtained his Masters' degree from the Universities of Groningen and Potsdam. In 2012, he was admitted to the PhD Program International Doctorate for Experimental Approaches to Language And Brain (IDEALAB) with an Erasmus-Mundus Joint Doctoral (EMJD) fellowship for three years. He was also awarded with an International Macquarie University Research Excellence Scholarship for Doctor of Philosophy in Cognitive Science (Tuition). He received his doctoral training from the Universities of Groningen (NL), Potsdam (DE), Trento (IT) and Macquarie (Sydney, AU). He conducted his research studies at the Center for Language and Cognition Groningen (CLCG; University of Groningen), Potsdam Research Institute for Multilingualism (PRIM; University of Potsdam) under supervision of Prof. dr. Roelien Bastiaanse and PD. dr. Claudia Felser. He has actively collaborated with Prof. dr. Ayhan Aksu-Koç (Boğaziçi University) and Prof. dr. İlknur Maviş (Anadolu University). The author continues his research studies as a postdoctoral researcher at the Potsdam Research Institute for Multilingualism (PRIM; University of Potsdam).

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Evidentiality is referred to as the linguistic expression of information sources marking how the speaker knows about an event. In Turkish, expressing past events has two 'flavors': the direct (-DI) or the indirect evidential (-mIş) forms have to be suffixed on the verb depending on whether the event is known through direct or indirect information sources, respectively.

This dissertation aims to unveil the extent to which the evidentiality system in Turkish is susceptible to types of language loss induced either by agrammatic aphasia (a language disorder due to brain damage) or by heritage language acquisition in early bilinguals.



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ISSN: 0928-0030

ISBN: 978-90-367-8532-7 [printed version]

ISBN: 978-90-367-8531-0 [digital version]