

Wh-Argument/Adjunct Asymmetry in Sentence Processing*

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ABSTRACT: This study investigates the processing of complex sentences with wh-phrases trying to point out whether the proposals stating that arguments are processed easier than adjuncts work for wh-phrases in case of Turkish. A wh-argument and a wh-adjunct were used in two eye-tracking experiments with two word orders, and two embedded verb types as the variables. The orders and the type of the embedded verbs were the same in each experiment to provide the wh-phrase type to be the main variable to compare. The general outcome of the study showed that wh-argument was processed more quickly than wh-adjunct supporting the diversification proposed by both formal and experimental approaches in terms of argument adjunct distinction. In a particular condition, in which the subcategorization features of the embedded verb mismatched with the number of arguments, the processing of wh-adjunct was faster than wh-argument. This seems to support a verb-oriented approach in licensing the scrambled wh-phrases.

Keywords: wh-argument, wh-adjunct, sentence processing, eye-tracking

Tümce İşlemlerde Ne-Üyesi/Eklentisi Asimetrisi

ÖZ: Bu çalışma, üyelerin eklentilerden daha hızlı işlemlendiğini belirten önermelerin ne-öbekleri için de Türkçe bağlamında geçerli olup olmadığını ortaya çıkartmayı amaçlayarak ne-öbeği içeren karmaşık tümceler işlemlenmesini inceler. Çalışmada iki göz-izleme deneyinde, bir ne-üyesi ve bir ne-eklentisi, diğer değişkenler olan iki farklı sözcük dizilişi ve iki tür yantümce eylemiyle (geçişli ve çift geçişli) birlikte kullanılmıştır. Ne-öbeğinin türünün karşılaştırılacak başlıca değişken olması için, her iki deneyde de aynı tür yantümce eylemleri ve aynı sözcük dizilişi tekrar kullanılmıştır. Çalışmanın genel sonucu ne-üyesinin ne-eklentisinden daha hızlı işlemlendiğini göstererek formal ve deneysel yaklaşımlar tarafından üye ve eklenti üzerine öne sürülen farklılığı destekler niteliktedir. Yantümce eyleminin altulamama özelliklerinin üye sayısı ile eşleşmediği özel bir koşulda ise ne-eklentisi ne-üyesinden daha hızlı işlemlenmiştir. Bu da yer

* The eye-tracking data used in the present study have been gathered from some part of the data given in the PhD dissertation named "Processing of Turkish complex sentences with wh-phrases" (Hacettepe University, Department of English Linguistics).

deęiřtiren ne-öbeklerinin lisanslanmasında eylem-odaklı bir yaklařımı destekler niteliktedir.

Anahtar sözcükler: ne-üyesi, ne-eklentisi, tümce iřlemeleme, göz-izleme

1 Introduction

In both formal linguistic and psycholinguistic literature arguments and adjuncts are considered to represent different roles in language modeling and processing. The distinction between them has been a matter of interest for some time. It is known that there is a syntactic distinction between arguments and adjuncts through a formal perspective. In GB and P&P, the issue has attracted considerable interest, while it has not gotten that attention in Minimalism (Smiecińska, 2001). Haegeman (1992) classifies non-theta-governed items such as adjuncts to behave like subjects, which can only satisfy ECP (*empty category principle*) by antecedent-government. So, an asymmetry between complements, which are theta-governed and non-complements, which are antecedent-governed is expected. In Radford (1988), it is stated that while arguments ascribe a central aspect of an action, adjuncts ascribe some non-central aspect of an action. Carnie (2007) indicates that the theta-grid of a verb consists of only arguments, which are obligatory elements, however, adjuncts never appear in the theta-grid of verbs since they are entirely optional. Adger (2004) states that adjuncts are not the items that are incorporated into sentence via checking selectional features and the mechanism which provides the incorporation of adjuncts into phrase structure is still a major topic of research. It is further indicated that no selectional feature is satisfied in terms of adjunct incorporation, so this operation is not carried out by Merge since the operation Merge is applied only when it is triggered by a selectional feature. Adjuncts enter the derivation by the operation *Adjoin*. On the other hand, arguments are defined as the items assigned a θ -role by the predicate in the sentence. The position in which the θ -role is given is the position that the argument is *Merged*, which indicates as a whole that adjuncts and arguments are considered to be incorporated into syntactic structure by two different mechanisms. Moreover, it is stated by Chomsky (1995) that the problem around adjuncthood may drive to the conclusion that perhaps they may really do not belong to the system that is being under discussion. Distinguishing this component of the language faculty seems to be increasingly understandable.

On the psycholinguistics side, Liversedge et al. (2003) state that although not all theories identify a qualitative distinction between the processing of arguments and adjuncts, there is a considerable amount of study showing that the processing of arguments and adjuncts cost differently on the processor. For instance, Boland and Boehm-Jernigan (1998) investigate how lexical constraints have an impact on syntactic analyses of ambiguous regions of

isolated sentences and indicate that different mechanisms are at work in the attachment processes of arguments and adjuncts; while arguments are lexically specified, adjuncts are specified via global syntactic rules (also see Kennison (2002) for a similar distinction between argument vs. adjunct attachment strategies). It is further indicated that lexically specified attachments (the arguments) have the priority in importance of attachment over syntactically governed attachments, which causes a bigger cost in processing for adjuncts when compared to arguments. In a similar fashion, Liversedge et al. (1998) indicate that the ambiguous phrases are chosen by the readers to be processed as arguments initially, but not as adjuncts. It is also stated by Ferretti et al. (2001) that 'locations' are not among the set of immediately primed thematic roles by verbs, which can be ascribed to adjuncts; whereas agents, and patients are, which are to be ascribed to arguments. Clifton et al. (1991) analyze the reading times of sentences with prepositional phrases, the syntactic analysis of which are disambiguated by plausibility conditions. It is found out that, when the prepositional phrase was a syntactic argument, reading times were faster than a syntactic adjunct favoring a preference for arguments over adjuncts. This outcome led them to get a more general conclusion about the theories of parsing strategies proposing that initial decisions are made through both phrase structure rules and the formation provided by the part of speech of words; and lexical items play a role in guiding parsing.

As it is seen, it can be asserted that, through both formal and experimental approaches, argument adjunct distinction is a widely accepted fact of a linguistic phenomenon. But it is also observed that, the source of this distinction is a matter of debate as proposed by MacDonald et al. (1994). In the mentioned study, it is claimed that the difference between the processing of arguments and adjuncts only stem from their relative frequencies since both of them are lexically specified.

Although there seems to be a controversy in the source of the distinction between argument and adjunct processing, the divergence between them is interpreted as to reflect itself on the comparative ease and priority in argument processing over adjunct. For example, it is stated by Kennison (2002) that the two divergent perspectives on sentence processing (constraint satisfaction, versus structural orientation) both favor the processing of arguments being preliminary and easier to be processed. According to structural based theories, arguments are processed more easily depending on their attachment sites in the phrase structure. Arguments are attached to the more recent part of the phrase marker. Due to this, in cases in which the NP following the verb is an adjunct, a reanalysis is needed, while the following NP is an argument, reanalysis is not needed. This situation is reflected as a processing load. The influence of the verb information is observed in cases of reanalysis according to this approach. In other words, word information comes after the realization of the following

NP to be an argument or an adjunct. On the other hand, according to theories favoring the use of lexical information during the initial stages of syntactic analysis, such as constraint satisfaction theories, readers analyze an ambiguous NP as an argument following a biased transitive verb. But if the following NP is realized to be an adjunct, reanalysis is needed. When the verb is an intransitive one, the comprehenders do not predict either an argument or an adjunct NP.

Similar to the different properties of argument/adjunct NP/DPs, wh-arguments and wh-adjuncts are also considered to show various extraction properties out of wh-islands. For instance Huang (1982) states that while tenseless wh-islands allow argument extraction, they do not allow adjunct extraction; also Sabel (2002) indicates that object wh-movement out of a wh-island is better than adjunct movement or subject wh-movement.

Related to the processing studies on argument – adjunct asymmetry, the processing properties of wh-arguments and wh-adjuncts, the effect of the length of the dependency between the filler and the gap and the role of verb argument structure in processing long distance dependencies in relation to wh-phrases are among the concerns of sentence processing strategies in psycholinguistic literature for some time (see Boland et al., 1995; Hofmeister and Sag, 2010; Stepanov and Stateva, 2015).

Hawkins (1999), following Fodor (1978, and 1989) states that the filler – gap relationship created by the link between the moved item and its trace, which can be observed through wh-phrases in questions, relative clauses and similar structures, is a major source of data for psycholinguistic analyses on sentence processing and much of the problem regarding the processing strategies of these types of dependencies have not yet been settled in a full-fledged manner. It is further indicated in the same study that it is widely accepted that there is a processing difficulty related to above-mentioned types of structures, and human language processor has an intense processing load during the formation of relationship between the filler and the gap.

2 Aim of the Study

As stated in the introduction, a considerable amount of work has been carried out on understanding the role of argument adjunct distinction in language processing through filler – gap dependencies between displaced items, which are observed in relative clause structures and the wh-phrase extraction out of embedded structures. In the light of the arguments given above, the present study aims at contributing to the literature on argument vs. adjunct processing through data on Turkish complex sentences with wh-phrases in two word orders. The word orders are specified related to their availability for producing multiple readings and creating at least two different structures at LF.

The formation of *wh*-questions in Turkish has been studied by various researchers through a formal framework (Akar, 1990, 2000; Bozşahin and Göksel, 2007; Göksel and Özsoy, 2000; Göksel et al., 2007; Görgülü, 2006; İşsever, 2003; Kornfilt, 1996, 2003; Özsoy, 1996, 2009; Uzun, 2000, etc.). Also on the matter of *wh*-argument vs. *wh*-adjunct licensing in terms of island constraints, the asymmetry caused by the argument vs. adjunct property of *wh*-phrases has been pointed out by Özsoy (1996), Arslan (1999), Görgülü (2006) and Çakır (2015). However, not much work has been carried out on the processing properties during on-line processing of these types of structures through a psycholinguistic perspective.

This will also provide an understanding of how *wh*-arguments and *wh*-adjuncts are processed in Turkish complex sentences, and put forward the possible effects of the divergence between *wh*-argument and *wh*-adjuncts on processing in Turkish. The data collection tool is organized in order to gather on-line data during reading of Turkish complex sentences with two different *wh*-phrases providing the comparison of variables created out of the divergence in *wh*-phrase usage. As will be given in the method and procedure sections below, the sets of sentences in the study include different kinds of verbs in terms of their subcategorization features. This will also contribute for understanding the interaction of *wh*-argument/*wh*-adjunct with the verb; and further, will give information about the processing strategies of Turkish, which allows the scrambling of both NPs and *wh*-phrases (Erguvanlı, 1984; Akar, 1990; Kornfilt, 2003; Miyagawa, 2003). Due to the SOV word order of Turkish, the *wh*-phrases used in the study (both argument and adjunct) precede the embedded and main verbs in the sentences. This relates that the parser will wait for licensing the *wh*-argument or *wh*-adjunct until it comes across with the first and second verbs in the sentences. At that point, the type of the embedded verb, whether it allows two or three arguments in its subcategorization frame, is supposed to give information about the possible processing divergences of *wh*-arguments and *wh*-adjuncts in Turkish complex sentences. Thus, this study aims at answering the following research questions:

1. Do *wh*-arguments and *wh*-adjuncts impose different loads on the processor?
2. If a divergence is observed in the processing strategies of *wh*-arguments and *wh*-adjuncts, is it possible to relate this to the subcategorization features of the verb(s) in a complex Turkish sentence?

3 Method and Data Collection

The data of the present study, which investigates the argument/adjunct diversification in processing complex sentences with *wh*-phrases in Turkish, have been gathered through a two-phased eye-tracking experiment session.

3.1 The Design of the Data Collection Tool

The data collection tool consists of two experiments carried out separately on 30 native speakers of Turkish for each experiment. The first experiment includes 40 target sentences composed of eight conditions. The variables of the first experiment are; two different word orders (*order.1* | *subject.1* – *wh-word* – *subject.2* – *object* – *embedded verb* – *main verb*; *order.2* | *subject.1* – *subject.2* – *wh-word* – *object* – *embedded verb* – *main verb*) two different embedded verb types (*transitive and ditransitive*) and two different biasing contexts (*interrogative and declarative*), thus making eight conditions in total. Each condition included five different sentences, which make a total of 40 target sentences. Each of these five sentences in the same condition differs only in terms of the embedded verbs, main verbs, subjects and the objects. However, the order, the embedded verb type (whether transitive or ditransitive) and the biasing context (interrogative, declarative) are the same providing a more reliable statistical validity by enhancing the number of the items to be calculated.

The transitive and ditransitive embedded verbs used in the experiments are as follow; ‘*görmek*’ (to see), ‘*kırmak*’ (to break), ‘*deęiřtirmek*’ (to change), ‘*kaybetmek*’ (to lose), and ‘*bitirmek*’ (to finish); ‘*vermek*’ (to give), ‘*götürmek*’ (to take), ‘*açıklamak*’ (to explain), ‘*göndermek*’ (to send, to transmit) and ‘*yollamak*’ (to send). Also five different main verbs have been used in each condition: ‘*söylemek*’ (to say), ‘*anlatmak*’ (to tell), ‘*bildirmek*’ (to report), ‘*hatırlatmak*’ (to remind), and ‘*duyurmak*’ (to announce).

The *wh*-phrase used in the first experiment is *kim-e* (who-Dat). *Kim* (who-Nom) is a *wh*-argument. Arguments need to be licensed in the sub-categorization frames of predicates. In these terms, the *wh*-argument *kim-E* (who-Dat) has been chosen in order to provide the ambiguous reading, which causes problem for the licensing of the *wh*-phrases in complex sentence structure in Turkish.

The organization of the data collection set of the second experiment is the same as the first experiment except the type of the *wh*-phrase. The *wh*-phrase used in the second experiment is a *wh*-adjunct *ne zaman* (when). Using a *wh*-adjunct instead of a *wh*-argument in the second experiment provides understanding the behavior of the processing mechanism when the argument structure of the embedded verb and the type of the *wh*-phrase are considered.

Wh-adjunct does not refer to any entity that exists in the sub-categorization frame of the predicate and thus helps pointing out the potential influence of the embedded verb type and *wh*-phrase interaction during processing. Moreover, it helps comparing the potential outcomes of argument/adjunct divergence in processing complex sentences having ambiguous reading between declarative, interrogative and both.

In the first experiment, the first and the second condition sentences have obligatorily interrogative reading; while the third, fourth, seventh and eighth condition sentences have double reading (both interrogative and declarative). In the same experiment the sentences of the fifth and the sixth conditions produce ungrammatical sentences.

In the second experiment, the sentences belonging to all eight conditions have double reading (both interrogative and declarative).

3.2 Eye-tracking Metrics Used in the Study

In the present study, the ‘first fixation durations’ and ‘total fixation durations’ are used as the metrics of eye tracking data to analyze the divergence in the processing of wh-arguments and wh-adjuncts. The sentences in the data collection tool are compartmentalized as areas of interests (AOIs). Each AOI is a word in the sentence, and the related fixation data is measured according to these AOIs. Rayner and Pollatsek (2006) state that eyes do not move on the text or screen smoothly during reading, but they make series of rapid movements. These movements are called ‘saccades’. Saccades are different from ‘fixations’. During fixations, eyes are relatively still. New information is encoded during the phase of fixation, and when there is a difficulty in processing the length and the frequency of the fixation increase (Liversedge and Findlay, 2000). Also Garrod (2006) indicates that the duration of fixations reflect the reading processes to be executed easily or swiftly.

Different types of fixation data have been used as the metrics of evaluation in psycholinguistic literature. ‘First fixation duration’ relates the duration of the first fixation on a word or a specified AOI (Meseguer et al., 2002; Rayner and Pollatsek, 2006); while it is the ‘total fixation duration’, which indicates the sum of the durations of all fixations on a word including regressive saccades relating the total time spent for reading the AOI (Rayner and Juhasz, 2006; Rayner and Pollatsek, 2006).

3.3 Procedure

The first experiment was conducted in two phases in April and May of 2012 with 30 native speakers of Turkish. The participants were all undergraduates, studying their first, second and third semesters. The students participating in the study are chosen among freshmen and sophomores who are not yet well acquainted with linguistics courses, especially with syntax and psycholinguistics. The reason for this preference was to minimize the effect of awareness of the aims of the study.

An instruction on the procedure was given to each participant before the experiment began. It was demanded from the participants to read the sentence

for the “biasing context” first and second, the target sentence. Before the experiment began, each participant’s pupils were calibrated with the device. The sentences were written in Calibri font, with size 24, and in black on a white background. The 40 target sentences were randomized and the filler sentences, which did not include any wh-phrase, were used in order to distract the attention of the participants from wh-phrase configuration.

The biasing context sentence appeared above the target sentence providing the participants to check for each sentence on the same screen without interrupting the experiment. The participants decided when to pass onto another target sentence by clicking the ‘space’ button on the keyboard. Each time the participants pressed the space button a biasing context and the target sentence appeared on the screen. During experiment session no audio input or instruction was given to the participants. The participants all had normal or corrected to normal vision. They sat on a chair in front of the computer screen, which is 60 cm far away from the screen.

The experiment was run on Tobii T120 eye-tracker, which is integrated into a 17” TFT monitor (1280 x 1024 pixels). The device collects data on 120 Hz rate. The software running the eye-tracker is Tobii software, version 3.1.3.

The mean time of completing the first experiment was 4 minutes 12 seconds. At the end of the experiment session, each value gathered out of the above-mentioned metrics has been transferred to MS Excel to carry out item-by-item fixation (first and total) duration analysis. Then, independent t-test was applied for the data in order to validate the statistical reliability. The organization of the items set of the first experiment is given in table 1 below:

Table 1. Eight conditions of the data collection tool in the 1st experiment

Cond.	Order	Context	Emb. Verb	Set	Interpretation
1	s1-wh-s2...	Interrogative	Transitive	A	Interrogative
2	s1-wh-s2...	Declarative	Transitive	B	Interrogative
3	s1-wh-s2...	Interrogative	Ditransitive	C	Double
4	s1-wh-s2...	Declarative	Ditransitive	D	Double
5	s1-s2-wh...	Interrogative	Transitive	A	Ungrammatical
6	s1-s2-wh...	Declarative	Transitive	B	Ungrammatical
7	s1-s2-wh...	Interrogative	Ditransitive	C	Double
8	s1-s2-wh...	Declarative	Ditransitive	D	Double

The organization of the data collection set of the second experiment is all the same with the first experiment except the type of the wh-phrase. The wh-phrase used in the second experiment is a wh-adjunct *ne zaman* (when). Using a wh-adjunct instead of a wh-argument in the second experiment provides understanding the behavior of the processing mechanism when the argument

structure of the embedded verb and the type of the wh-phrase are considered. Also, it makes it possible to compare the processing times of the sentences with wh-arguments and wh-adjuncts, thus providing support for examining the possible divergences between arguments and adjuncts in terms of sentence processing.

The second experiment has been accomplished in November 2012 in two different sessions. 30 undergraduate students administered for the experiment. None of the participants in the first experiment took part in the second one to inhibit a possible bias for the experiment materials. The procedure applied in the first experiment was also put into operation for the second one. The same script size, font and background color was used for the second experiment. The organization of the items set of the second experiment is given in table 2 below:

Table 2. Eight conditions of the data collection tool in the 2nd experiment

Cond	Order	Context	Emb. Verb	Set	Interpretation
1	s1-wh-s2...	Interrogative	Transitive	A	Double
2	s1-wh-s2...	Declarative	Transitive	B	Double
3	s1-wh-s2...	<i>Interrogative</i>	<i>Ditransitive</i>	<i>C</i>	<i>Double</i>
4	s1-wh-s2...	<i>Declarative</i>	<i>Ditransitive</i>	<i>D</i>	<i>Double</i>
5	s1-s2-wh...	Interrogative	Transitive	A	Double
6	s1-s2-wh...	Declarative	Transitive	B	Double
7	s1-s2-wh...	<i>Interrogative</i>	<i>Ditransitive</i>	<i>C</i>	<i>Double</i>
8	s1-s2-wh...	<i>Declarative</i>	<i>Ditransitive</i>	<i>D</i>	<i>Double</i>

4 Results and Discussion

The word order of Turkish plays an important role in analyzing the processing of displaced wh-arguments and adjuncts in complex sentence structure. Turkish is a head-final SOV language. The embedded verb comes before the main verb, after the argument/adjunct wh-phrase is read in complex Turkish sentence with a canonical word order. Thus, it is wise to expect the first verb (verb of the embedded clause) in complex sentences to be very effective in processing and licensing the fronted wh-phrase. It should also be stated that the type of the embedded verb (transitive/ditransitive), the type of the fronted wh-phrase (argument/adjunct) and the place of the fronted wh-phrase interact during processing. The results of the study will be discussed considering the “first and total fixation durations” recorded on the wh-phrase and embedded verb regions of the sentences comparing two experiments (wh-argument and wh-adjunct experiments).

Before passing onto analyzing the results in detail, an important point to be mentioned is the availability of a three-way interpretation for some of the sentences used in the present study¹.

Other than the “matrix question” and “declarative” readings, some of the sentences seem to be able to create a “declarative question” reading as a third option, however the main body of the present study concentrates on the “matrix question” and “declarative” interpretations of the sentences. This is due to the following reasons. In psycholinguistic literature on sentence processing, the “structural distance hypothesis (SDH)” and “linear distance hypothesis (LDH)” are among the competing theories in explaining filler – gap dependencies. In Akal (2014), the same data used in the present study have been examined in terms of pointing out whether structural or linear distance is effective in the processing of complex structures with displaced wh-phrases through examining the regressive saccade frequencies of native Turkish speakers during silent reading. It is found out at the end of the study that it is the “linear distance” between the filler and its gap, which plays the major role in processing ambiguous complex sentences with wh-phrases in Turkish. The participants had more regressive saccades and longer processing times in sentences with longer linear distance and shorter structural distance between the filler and the gap. By taking this finding as the base, it is considered that, even if the sentence were to be interpreted as an “embedded question reading” it would be the linear distance, which would play the major role in determining the effects of wh-argument vs. wh-adjunct divergence on processing. Moreover, the “embedded question” and “declarative” interpretations would not create different “structural distances” between the filler and the gap. Even if it would, the outcome stating that the “linear distance” is determinant in processing strategies would render the “embedded question” and “declarative” reading divergence out of concern for their impact on processing. Also, in order to point out the processing divergences created by the wh-phrase types, the sentences in the present study include wh-arguments and wh-adjuncts in the same word orders, and in the same locations; i.e. they have the same “linear distances” between the displaced item and its base-generated position.

As a further matter, when the “declarative question” readings of the sentences are considered, the “structural distance” that the wh-phrase takes between its base-generated and landing position at LF would not create a distance as long as it would have when it would create in “matrix question

¹ A possibility for a three-way interpretation of some of the sentences in the study has been mentioned in regard to one of the evaluations of the referees. The evaluation proposes that the wh-argument *kime* (who-dat) can be interpreted as the Indirect Object of both matrix and embedded clauses (moving to the left of its subject). The discussion related to this evaluation has been given through the second and the third paragraphs of the “Results and Discussion” section of the study.

reading”. In other words, whether the sentence is interpreted as “declarative” or “embedded question”, the fronted wh-phrase would create a shorter structural distance than the one it would create during a “matrix question” reading, which indicates a possible two – way processing divergence for the sentence processor. On the other hand, in terms of the linear distance that is realized on the surface, the participants have experienced just two structures, which means that the surface forms (the linear distance) already create two possible processing strategies (See Akal (2014) for a more detailed discussion in terms of SDH and LDH in Turkish complex sentence structure and see Gibson (1998, 2000), and O’Grady et al. (2003) for a detailed analysis of the effects of linear distance between the filler and the gap on processing).

4.1 Analysis of ‘First Fixation Durations’ on Wh-phrases Cross Experimentally

4.1.1 The First Word Order (Conditions 1, 2, 3, and 4)

In the first experiment, the place of the argument wh-phrase *kim-E* “who-Dat” in the sentences of the first four conditions is just before the embedded clause subject (word order 1). For the first four conditions, the details are as given:

In Condition 1, the wh-phrase is an argument, the biasing context is interrogative, the embedded verb type is transitive and the interpretation is obligatorily interrogative. Sentence (1) is an instance of five different sentences of the first and second conditions in the first experiment;

- (1) Ahmet kim-e Ayşe-nin kitab-ı gör-düğ-ü-nü söyle-di
 Ahmet-Nom who-Dat Ayşe-Gen book-Acc see-Ind-3s-Acc say-Past-3s
 ‘To whom did Ahmet say that Ayşe saw the book?’

The only difference between the first and the second condition is the biasing context². The structures of the sentences are similar except the biasing context, which is declarative in the second condition. However, the obligatory reading of the sentence is interrogative. The mean value of the ‘first fixation durations’ recorded on the wh-region of condition 1 and condition 2 sentences in the wh-argument experiment are respectively 0.209 seconds, and 0.182 seconds.

In Condition 3, the wh-phrase is an argument, the biasing context is interrogative and the embedded verb type is ditransitive, and the interpretation is double (both interrogative and declarative). Sentence (2) is an example of

² The interrogative biasing context is “*Sen biliyor musun? (Do you know it?)*”, while the declarative one is “*Ben de bilen herkese sordum ve öğrendim. (I asked everyone who knew it and learnt.)*”

five different sentences belonging to condition three and four in the first experiment:

- (2) Can kim-e Zeynep-in kitab-ı ver-diğ-i-ni söyle-di
 Can-Nom who-Dat Zeynep-Gen book-Acc give-Ind-3s-Acc say-Past-3s
 ‘To whom did Can say that Zeynep gave the book?’
 ‘Can said Zeynep gave the book to whom.’

The only difference between condition three and four is the biasing context³. The declarative and interrogative biasing contexts provide the double reading for each. The mean value of the ‘first fixation durations’ recorded on the wh-region of condition 3 and condition 4 sentences in the wh-argument experiment are respectively 0.208 seconds, and 0.207 seconds.

In the second experiment, the organization of the sentences of the first four conditions are the same (i.e. the word order, the biasing contexts and the types of the embedded verb) except the type of the wh-phrase. The wh-phrase used in the second experiment is wh-adjunct *ne zaman* “when”. One of the major differences between the conditions in the first and second experiment is on the interpretations of the sentences clearly stemming from the wh-phrase type and its interaction with the embedded verb. While in the first experiment, the interpretations of the sentences may vary according to the embedded verb type and word order; in the second experiment all of the sentences in each condition produce double reading (both interrogative and declarative). Sentence (3) is an instance used in the first two conditions of the second experiment;

- (3) Ahmet ne zaman Ayşe-nin kitab-ı gör-düğ-ü-nü söyle-di
 Ahmet-Nom when Ayşe-Gen book-Acc see-Ind-3s-Acc say-Past-3s
 ‘When did Ahmet say that Ayşe saw the book?’
 ‘Ahmet said when Ayşe saw the book.’

Sentence (3) above may represent the sentences used in both condition 1 and 2 in the second experiment. The only divergence is related to the biasing context⁴, however no difference in interpretation due to the biasing context can be derived since both conditions provide double reading. The embedded verb type used in the above sentence is transitive. The mean value of the ‘first fixation

³ The interrogative biasing context is “*Bir türlü duyamadım. (I couldn’t hear it in no way)*” while the declarative one is “*Daha fazla saklayamadı. (S/he couldn’t keep it anymore.)*”

⁴ The interrogative biasing context is “*Sen biliyor musun? (Do you know it?)*”, while the declarative one is “*Sebebini çok merak ediyordum ve artık öğrendim. (I was very curious about its reason and now I’ve learnt.)*”

durations' recorded on the wh-region of condition 1 and condition 2 sentences in the wh-adjunct experiment are as follow; 0.245 seconds, and 0.262 seconds.

In the sentences belonging to condition 3 and condition of the second experiment (wh-adjunct), the embedded verb type is ditransitive, and the interpretation is double (both interrogative and declarative). Sentence (4) is an example of five different sentences belonging to condition 3 and 4 in the second experiment;

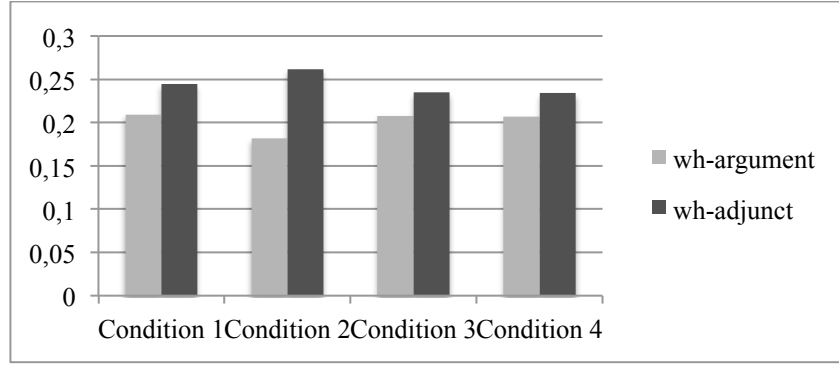
- (4) Can ne zaman Zeynep-in kitab-ı ver-diğ-i-ni söyle-di⁵
 Can-Nom when Zeynep-Gen book-Acc give-Ind-3s-Acc say-Past-3s
 'When did Can say that Zeynep gave the book?'
 'Can said when Zeynep gave the book.'

The mean value of the 'first fixation durations' recorded on the wh-region of condition 3 and condition 4 sentences in the wh-adjunct experiment are respectively 0.235 seconds, and 0.234 seconds.

When the 'first fixation' durations on the wh-phrase region in the first word order are compared across experiments, it is observed that in the second experiment, in which the fronted wh-phrase is a wh-adjunct, the mentioned durations on the wh-region are higher than the ones in the first experiment, in which the type of the fronted wh-phrase is an argument. This outcome gathered out of the comparison of the two experiments seems to support the views favoring a divergence in the processing load of wh-arguments and wh-adjuncts. As mentioned before, the longer first fixation duration on some region of any sentence indicates the problem in the initial processing of the related item. In this case, it is the wh-adjunct, which causes a longer first fixation duration than the wh-argument. The difference between the 'first fixation durations' on each condition across experimentally is statistically significant (*the two-tailed P value equals < .00*). The divergence between the related values in terms of argument adjunct distinction is also seen in Figure 1 below:

⁵ The interrogative biasing context is "*Bir türlü duyamadım. (I couldn't hear it in no way)*", while the declarative one is "*Daha fazla saklayamadı. (S/he couldn't keep it anymore.)*"

Figure 1. The mean values of the ‘first fixation durations’ on wh-phrase regions in the first word order



It is seen through the comparison given above that when the place of the wh-phrase is the same, and all the variables (the embedded verb type and the biasing context) are considered together in the same word order, the processing of the wh-adjunct is more costly for the processor than the processing of the wh-argument.

4.1.2 The Second Word Order (Conditions 5, 6, 7, and 8)

A similar outcome in terms of wh-argument – wh-adjunct distinction is also observed in the sentences formed in the ‘second word order’, in which the wh-phrase is located following the embedded clause subject (conditions 5, 6, 7, and 8). When the wh-argument *kim-E* ‘who-Dat’ is located inside the embedded clause formed with a transitive embedded verb, it creates ungrammaticality as shown in sentence (5) below:

- (5) *Cemal Demet-in kim-e kitab-ı gör-düğ-ü-nü söyle-di⁶
 Cemal-Nom Demet-Gen who-Dat book-Acc see-Ind-3s-Acc say-Past-3s

The sentence given in (5) is ungrammatical in Turkish. The embedded verb is a transitive one, which means that it can only get one more item inside its subcategorization frame other than the subject NP. In this case, the wh-argument is inside the embedded clause along with the other object NP *kitabı* ‘book-Acc’. This causes the ungrammaticality. Condition 6 sentences also

⁶ The interrogative biasing context is “*Senin haberin var mı? (Have you heard about it?)*”, while the declarative one is “*Ben de bilen herkese sordum ve öğrendim. (I asked everyone who knew it and learnt.)*”

shares the same structure except the biasing context, which is a declarative one. However, whether the biasing context is interrogative or declarative, it is not able to provide any grammatical interpretation for the sentence. The mean values of the ‘first fixation durations’ recorded on the wh-region of the sentences in the first two conditions are 0.156, and 0.168 seconds.

In the sentences of condition 7, and 8, the place of the wh-argument is the same with the previous two conditions; however, the embedded verb type is ditransitive, which makes the sentences in these two conditions grammatical. The two biasing contexts⁷ for each condition also provide double reading as interrogative and declarative. Sentence (6) below is an instance of condition 7 and 8:

- (6) Fatih Sevgi-nin kim-e oyuncuğ-ı götür-düğ-ü-nü anlat-tı
 Fatih-Nom Sevgi-Gen who-Dat toy-Acc take-Ind-3s-Acc tell-Past-3s
 ‘To whom did Fatih tell that Sevgi took the toy?’
 ‘Fatih told to whom Sevgi took the toy.’

The embedded verb is a ditransitive one and thus it allows for both the wh-argument and the object NP *oyuncağı* “toy-Acc” to exist inside the embedded clause, and the two biasing context sentences provide the double reading for the sentence both in condition 7 and 8. The mean of the “first fixation durations” recorded on the wh-region is 0.164 seconds and 0.166 seconds respectively.

In the second experiment, in which the wh-phrase is an adjunct, the structures of the sentences belonging to conditions 5, 6, 7, and 8 are the same as the ones in the first experiment. Also, as stated before, all the sentences belonging to each of the conditions in the second experiment have double readings provided by the biasing contexts⁸ for each. Sentence (7) given below is an instance of condition 5, and 6 in the wh-adjunct experiment:

- (7) Cemal Demet-in ne zaman kitabı gör-düğ-ü-nü söyle-di
 Cemal-Nom Demet-Gen when book-Acc see-Ind-3s-Acc say-Past-3s
 ‘When did Cemal say that Demet saw the book?’
 ‘Cemal said when Demet saw the book.’

The mean values of the “first fixation durations” recorded on the wh-adjuncts of condition 5 and 6 sentences are 0.235 and 0.243 seconds respectively.

⁷ The interrogative biasing context is “*Sen biliyor musun? (Do you know it?)*”, while the declarative one is “*Ali sonunda Fatih’i konuştu. (Ali finally made Fatih speak.)*”

⁸ The interrogative biasing context is “*Senin haberin var mı? (Have you heard about it?)*”, while the declarative one is “*Ben de bilen herkese sordum ve öğrendim. (I asked everyone who knew it and learnt.)*”

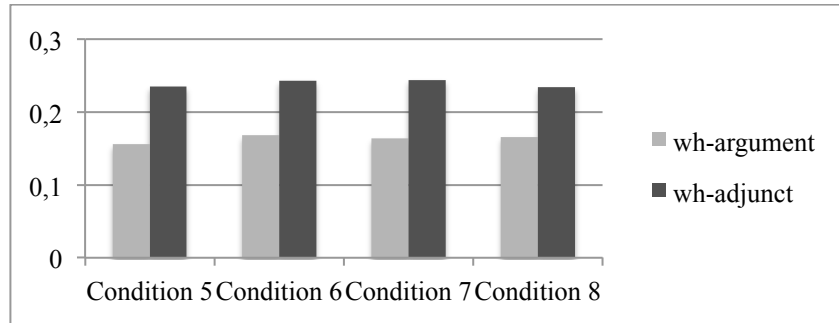
In condition 7 and 8, the wh-adjunct is also inside the embedded clause. The only difference is the type of the embedded verb (ditransitive). Sentence (8) given below is an example of the mentioned group of sentences. The sentence has double interpretation;

- (8) Alper Būřra-nın ne zaman kitab-ı ver-diđ-i-ni söyle-di⁹
 Alper-Nom Būřra-Gen when book-Acc give-Ind-3s-Acc say-Past-3s
 ‘When did Alper say that Būřra gave the book?’
 ‘Alper said when Būřra gave the book.’

The means of the ‘first fixation durations’ recorded on the wh-region of condition 7 and condition 8 sentences in the wh-adjunct experiment are respectively 0.244 and 0.234 seconds.

The results on the comparison of the “first fixation durations” on the wh-regions in terms of the second word order show that, when the wh-phrase is an argument, the processing is easier than the case in which the wh-phrase is an adjunct (*the two-tailed P value equals < .00*). The difference between the related values in terms of argument adjunct distinction is seen in figure 2 below:

Figure 2. The mean values of the ‘first fixation durations’ on wh-phrase regions in the second word order



4.1.3 General Discussion for the “First Fixation Durations” on Wh-phrases

Regardless of the word order and the embedded verb type, the processing is more costly with wh-adjuncts than wh-arguments. As mentioned beforehand, the first four conditions are structured through the first word order, in which the wh-phrase is out of the embedded clause, and the second half of the conditions

⁹ The interrogative biasing context is “*Bir türlü duyamadım. (I couldn’t hear it in no way)*”, while the declarative one is “*Daha fazla saklayamadı. (S/he couldn’t keep it anymore.)*”

are formed with the second word order in which the wh-phrase is inside the embedded clause. Also, the conditions 1, 2, 5 and 6 include sentences with transitive embedded verbs, whereas the conditions 3, 4, 7, and 8 are composed of sentences with ditransitive embedded verbs. In each case, the wh-adjunct gets more “first fixation duration” when compared to wh-argument as shown in table 3 below:

Table 3. The mean durations of the first fixations recorded on the wh-phrase

First experiment (wh-argument)	Second experiment (wh-adjunct)
Condition.1: 0.209 seconds	Condition.1: 0.245 seconds
Condition.2: 0.182 seconds	Condition.2: 0.262 seconds
Condition.3: 0.208 seconds	Condition.3: 0.235 seconds
Condition.4: 0.207 seconds	Condition.4: 0.234 seconds
Condition.5: 0.156 seconds	Condition.5: 0.235 seconds
Condition.6: 0.168 seconds	Condition.6: 0.243 seconds
Condition.7: 0.164 seconds	Condition.7: 0.244 seconds
Condition.8: 0.166 seconds	Condition.8: 0.234 seconds

The values of the recorded first fixation durations on wh-adjuncts are higher than that of wh-arguments. First fixation durations are related to initial parsing decisions (Frenck-Mestre, 2005). This clearly shows that, in Turkish, which is a head-final language, the displaced wh-adjunct causes more trouble for the parser than a displaced wh-argument in the first phase of processing. Although, when the sentences are compared according to the subcategorization frame features of the embedded verbs and the interaction of the wh-phrase, especially the wh-argument; various conclusions can be derived considering processing strategies (favoring a verb-based approach over garden-path approaches) of displaced wh-phrases in complex sentence structure in Turkish. But, since the major aim of the present study is to figure out whether wh-argument/wh-adjunct distinction in processing creates a divergence on the decisions of the processor, it is probable to assert that wh-adjuncts are more costly than wh-arguments to be processed at the first stages of parsing in Turkish.

A striking outcome is also related to conditions 5, and 6. In the first experiment (wh-argument), these conditions produce ungrammatical sentences, while they produce grammatical and double interpretations in the second experiment (wh-adjunct). Although the wh-argument sentences produce ungrammatical utterances, the “first fixation durations” recorded on the wh-adjunct are still higher than the ones in the wh-argument. This may be explained via a predisposed labeling of wh-adjuncts to have a secondary value in attachment preferences over wh-arguments. Since the outcome is assessed through “first fixation durations”, which means that the reader has not read any

of the verb(s) in the sentence, it would not be possible to build up a structure to attach the wh-phrase material. So, the outcome can solely be valued over a biased reading of the wh-adjunct over wh-argument. In Frazier and Rayner (1982) it is reported that first fixation durations on the disambiguating region were longer in case of a resolution of the temporary ambiguity in favor of the non-preferred reading. The parser may have considered the wh-argument to be attached to the upcoming verb during the first phase of processing and the adjunct may have been regarded to create a potential ambiguity since it will not be licensed in the subcategorization frame of any potential forthcoming predicate. Also, in a parallel fashion, it may be argued that arguments are considered to be more elemental units over adjuncts, so it has been conventionalized to process arguments more easily than adjuncts even if any potential licenser has not shown up in the sentence.

4.2 Analysis of 'Total Fixation Durations' on Wh-phrases Cross Experimentally

4.2.1 The First Word Order (Conditions 1, 2, 3, and 4)

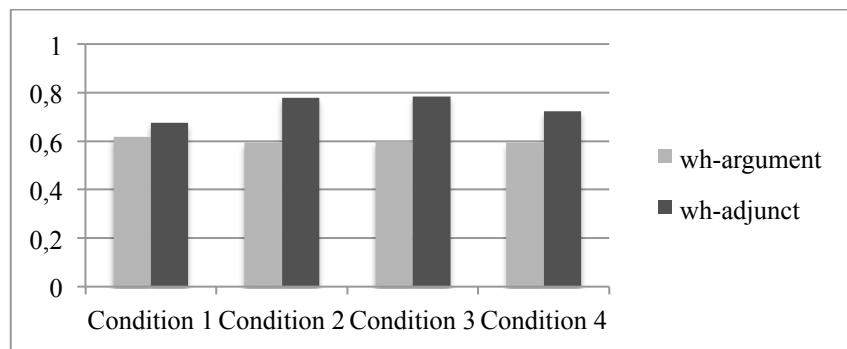
This section analyzes the 'total fixation durations' recorded on the 'wh-phrase region' in the first and second experiments. The first comparison will be made on the first word order sentences in which the wh-phrase is located before the embedded clause subject (conditions 1, 2, 3, and 4). The outcomes clearly show that the time spent for processing the fronted wh-adjuncts is more than the time consumed for processing wh-arguments.

In the sentences of the first and the second conditions of the wh-argument experiment, the wh-phrase precedes the embedded clause subject, and the embedded verb type is transitive. The means of the "total fixation durations" recorded on the wh-phrase in these two conditions are 0.618 and 0.594 seconds respectively. The interpretations are both obligatorily interrogative. On the other hand, the sentences in the third and the fourth conditions are formed with ditransitive embedded verbs causing double interpretation by the help of the biasing contexts. The means of "total fixation durations" recorded on the wh-argument of these sentences are 0.599 and 0.594 seconds respectively.

When the sentences belonging to the first four conditions are checked in the second experiment, which is implemented with a wh-adjunct, it is seen that the "total fixation durations" on the wh-phrase region increase in each condition. As mentioned beforehand, the difference between the first two conditions and the following two conditions is the embedded verb type. While this divergence is reflected on the interpretations of the sentences in the first experiment, which is carried out with a wh-argument, it does not affect the interpretations in the second experiment. All sentences have double readings in the wh-adjunct versions. The mean durations of the recorded "total fixations" on the wh-

adjunct in the second experiment are as follow; condition1: 0.676; condition2: 0.779; condition3: 0.785 and condition 4: 0.722 seconds. The divergence between the outcomes of the two experiments related to the “total fixation durations” recorded on the wh-phrase regions is statistically significant (*the two-tailed P value equals < 0.00; and equal variances not assumed < .01*).

Figure 3. The mean values of the ‘total fixation durations’ on wh-phrase regions in the first word order



The “total fixation durations” on the wh-phrase region increases when the wh-phrase is an adjunct in the first word order sentences regardless of the type of the embedded verb. This clearly relates to a processing difficulty on the related region of the sentence due to the type of the fronted wh-filler. The processor seems to have less trouble when it is an argument although the embedded verb permits one or two object NPs in the domain of the embedded clause.

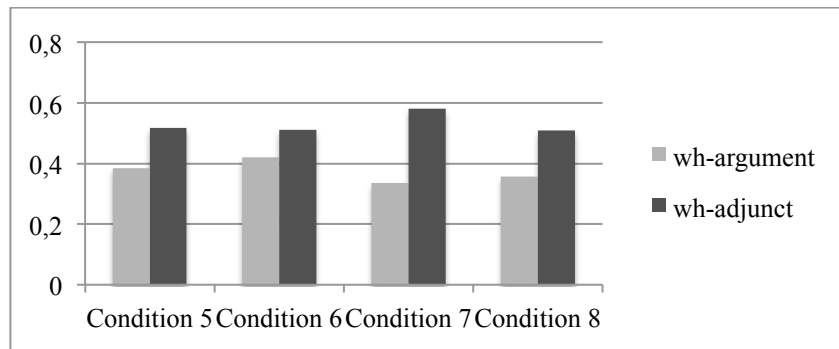
4.2.2 The Second Word Order (Conditions 5, 6, 7, and 8)

A similar outcome is observed on the “total fixation durations” recorded on the wh-phrases of sentences belonging to the second word order (conditions 5, 6, 7, and 8). In each of the conditions, the total fixation durations increase when the wh-phrase is an adjunct. As mentioned before, the sentences of the fifth and the sixth conditions in the first experiment, which have a wh-argument inside the embedded clause, produce ungrammatical sentences, while they produce grammatical sentences with double interpretation when the same structures are formed with wh-adjuncts. Although the grammaticality of the sentences changes, the increase in the “total fixation durations” on the wh-adjunct remains rigid. The “total fixation durations” recorded on the wh-argument in the fifth and the sixth conditions are; 0.385, and 0.421 seconds respectively. The sentences are formed with transitive embedded verbs, and the existence of an object NP along with a wh-argument inside the embedded clause created an

ungrammatical reading due to the subcategorization frame features of the embedded verb. However, in the seventh and the eighth conditions, the sentences are formed with ditransitive embedded verbs. Related to the biasing context sentences, it is possible to derive double readings out of each sentence in these two conditions. The means of “total fixation durations” on the wh-arguments are respectively 0.336 and 0.356 seconds.

When the recordings on the wh-phrase, which is a wh-adjunct in the second experiment are examined, it is seen that the durations increase as follow; condition 5: 0.517; condition 6: 0.511; condition 7: 0.580 and condition 8: 0.508 seconds. All of the sentences in the second experiment produce double readings. The difference between the outcomes of the two experiments related to the “total fixation durations” recorded on the wh-phrase regions of the sentences constructed in the second word order is statistically significant (*the two-tailed P value equals < .00*). The divergence is given in figure 4 below:

Figure 4. The mean values of the ‘total fixation durations’ on wh-phrase regions in the second word order



4.2.3 General Discussion for the “Total Fixation Durations” on Wh-phrases

The general outcomes related to the “total fixation durations” recorded on the wh-phrase regions of the sentences in both the first and second word orders indicate that in each case, whether the embedded verb allows two object NPs or one, the amount of total fixation durations on wh-adjunct are higher than the one on wh-arguments. The interaction of the type of the wh-phrase and the type of the embedded verb (either transitive or ditransitive) may show an effect on the fixation results considering conditional comparison, however, does not change the major outcome in terms of argument adjunct distinction on processing as can be seen in table four given below:

Table 4. The mean durations of the total fixations recorded on the wh-phrase

First experiment (wh-argument);	Second experiment (wh-adjunct)
Condition.1: 0.618 seconds	Condition.1: 0.676 seconds
Condition.2: 0.594 seconds	Condition.2: 0.779 seconds
Condition.3: 0.599 seconds	Condition.3: 0.785 seconds
Condition.4: 0.594 seconds	Condition.4: 0.722 seconds
Condition.5: 0.385 seconds	Condition.5: 0.517 seconds
Condition.6: 0.421 seconds	Condition.6: 0.511 seconds
Condition.7: 0.336 seconds	Condition.7: 0.580 seconds
Condition.8: 0.356 seconds	Condition.8: 0.508 seconds

As it is seen above, the participants had more trouble in processing the wh-adjunct than processing wh-argument, which is reflected also through the “total fixation durations” on the wh-phrase region in 40 target sentences in each experiment. The outcomes seem to be in harmony with the proposals differentiating the time for processing arguments and adjuncts by stating that, the processing of wh-adjuncts are more costly than the processing of wh-arguments. Total fixation duration relates the sum of the durations of all fixations on a word, including the rereads of the related item (Rayner and Juhasz, 2006; Rayner and Pollatsek, 2006). This may relate that, just like the trouble in processing wh-adjuncts over wh-arguments during the initial parsing, the Turkish processor has a difficulty in processing wh-adjuncts also after coming across with the embedded and main verbs in the complex sentence structure. The type of the embedded verb has an effect on the licensing of the wh-phrase, but regardless of the embedded verb subcategorization features, in each case, the wh-adjunct is observed to get more fixation duration than wh-argument, which relates a divergence in the attachment preferences of the parser for wh-arguments and wh-adjuncts.

4.3 Analysis of “Total Fixation Durations” on the Embedded Verb Region

Besides the eye-movement records on ‘wh-phrase’ region, the wh-adjunct – wh-argument asymmetry in processing is also observed through the ‘total fixation durations’ on the ‘embedded verb region’ of the sentences. The fixation records on the embedded verb region have been taken into consideration in order to validate the probability of parser’s choice in considering the verbal information in processing fronted wh-fillers in complex structures in Turkish. Since the fronted wh-phrases precede the embedded and main verbs, it is probable for the Turkish parser to handle the wh-phrase information along with the upcoming verbal features, especially in terms of subcategorization frame features.

When the ‘total fixation durations’ on the embedded verbs of the sentences in conditions 1, and 2 are compared cross experimentally, it is seen that the ‘total fixation durations’ on the embedded verb of the sentences in the second experiment (wh-adjunct) are higher than the ones in the first experiment (wh-argument). The means of total fixation durations on the embedded verbs in the sentences of condition 1 and 2 in the first and second experiments are as follow:

Experiment.1 (wh-argument): Condition.1: 0.696 seconds; Condition.2: 0.604 seconds
Experiment.2 (wh-adjunct): Condition.1: 0.714 seconds; Condition.2: 0.707 seconds

As it is seen above, the ‘total fixation durations’ on the embedded verb used with a wh-adjunct are higher than the one with a wh-argument. But it should be indicated that the difference is not statistically significant (*the two-tailed P value equals < .311*). In the sentences belonging to condition 1 and 2, the wh-phrase is located before the embedded clause subject, and the embedded verb types are transitive. This outcome may be related to the type of the fronted wh-phrase and its interaction with the embedded verb type. A more robust interpretation on this matter can only be done after comparing the total fixation values recorded on the embedded verb regions of condition types one by one cross experimentally. The comparison belonging to conditions 3, and 4; conditions 5, and 6; and conditions 7, and 8 sentences are given as follow;

Experiment.1 (wh-argument): Condition.3: 0.585 seconds; Condition.4: 0.582 seconds
Experiment.2 (wh-adjunct): Condition.3: 0.770 seconds; Condition.4: 0.689 seconds

Condition 3, and 4 are composed of sentences with ditransitive embedded verbs, and have the following word order; *s1 – wh – s2 – obj – ev – mv*. As it is seen, the ‘total fixation durations’ on the ‘embedded verb’ region of conditions 3, and 4 in the second experiment (wh-adjunct) are higher than the durations on the same region of the sentences in the same conditions of the first experiment (wh-argument) as observed in condition 1 and 2 sentences across two experiments. The sentences with wh-adjuncts caused more processing time on the ‘embedded verb’ whether it is transitive or ditransitive when the wh-phrase is placed before the embedded clause subject, i.e. in a farther position from the first verb in the sentence. The divergence is also statistically significant (*the two-tailed P value equals < .01*).

When the same values are compared across experiments in conditions 5 and 6, it is observed that the outcome on the ‘total fixation durations’ on the

embedded verb region does not give a similar outcome with the first four conditions, in which the sentences are formed in the first word order (*s1 – wh – s2 – obj – ev – mv*). The values are given below;

Experiment.1 (wh-argument): Condition.5: 0.7 seconds; Condition.6: 0.745 seconds

Experiment.2 (wh-adjunct): Condition.5: 0.583 seconds; Condition.6: 0.553 seconds

As it is seen above, the total fixation durations on the ‘embedded verb region’ in the first experiment (wh-argument) are higher than the total fixation durations on the same item in the second experiment (wh-adjunct), which is contradictory with the previous results on the wh-adjunct vs. wh-argument processing comparison on the embedded verb region. The divergence is also statistically significant (*the two-tailed P value equals < .03*).

Before discussing the reasons of this divergence, it is also needed to have a look at the ‘total fixation durations’ on the same items in the last two conditions across two experiments. When the same values on the ‘embedded verbs’ of the sentences in condition 7 and 8 of the first and the second experiments are checked, it is seen that the total fixation durations on the embedded verb regions in the second experiment (wh-adjunct) are higher than the values on the same item in the first experiment (wh-argument) as given below;

Experiment.1 (wh-argument): Condition.7: 0.583 seconds; Condition.8: 0.553 seconds

Experiment.2 (wh-adjunct): Condition.7: 0.742 seconds; Condition.8: 0.659 seconds

The divergence between the total fixation durations on the embedded verbs in the 7th and 8th conditions of the two experiments is also statistically significant (*the two-tailed P value equals < .04*).

When the ‘total fixation durations’ on the ‘embedded verb’ regions of the sentences are compared according to the fronted wh-phrase types across conditions, an outcome as given below is observed:

- Conditions 1 and 2 (*s1 – wh – s2 – obj – ev – mv / transitive embedded verb*)
Embedded verb total fixation values are higher in the *wh-adjunct* experiment than wh-argument
- Conditions 3 and 4 (*s1 – wh – s2 – obj – ev – mv / ditransitive embedded verb*)
Embedded verb total fixation values are higher in the *wh-adjunct* experiment than wh-argument

- Conditions 5 and 6 (*s1 – s2 – wh – obj – ev – mv / transitive embedded verb*)
Embedded verb total fixation values are higher in the *wh-argument* experiment than *wh-adjunct*
- Conditions 7 and 8 (*s1 – s2 – wh – obj – ev – mv / ditransitive embedded verb*)
Embedded verb total fixation values are higher in the *wh-adjunct* experiment than *wh-argument*

As it is seen above, the total fixation durations on the ‘embedded verb regions’ in sentences formed with fronted *wh-adjuncts* are all higher than the same fixation durations on the same items of the sentences constructed with fronted *wh-arguments* except conditions 5 and 6. This finding seems to be in harmony with the outcome showing longer fixation duration on *wh-adjuncts* than *wh-arguments* when the two experiments are compared as a whole and is correlated with Boland and Boehm-Jernigan (1998)’s and Liversedge et al. (2003)’s claims indicating that arguments, which are lexically specified, have priority in processing over adjuncts. Adjuncts are considered to be syntactically specified, thus having a heavier processing load. Also, in Kennison (2002) it is reported that NP arguments have been processed more quickly than NP adjuncts when they come after biased transitive verbs, but there has been no significant difference between the processing of NP arguments and adjuncts when they follow biased intransitive verbs. Moreover, it has been proposed that the type of the verb in front of the NPs influenced how the arguments and adjuncts are processed, in that, adjuncts were processed more quickly when they follow biased intransitive verbs than when they came after biased transitive verbs. Four conditions have been used in the mentioned study and among the four conditions it was the condition in which the NP adjunct follow biased transitive verbs was the most costly one for the processor. It has been interpreted that this finding was in parallel with the two competing theories in sentence processing. It was in harmony with structure oriented theories since they expect for the processor to predict an argument following a transitive verb and when an adjunct NP is present in the context, the processor needs a reanalysis which is reflected through longer reading times on the item.

This claim is supported in the present study when the ‘total fixation durations’ on *wh-arguments/adjuncts*, and the ‘embedded verb regions’ of the sentences are examined. But the situation related to conditions 5 and 6, in which the word order is *s1 – s2 – wh – obj – ev – mv*, and the embedded verb type is *transitive* seems to relate a contradictory finding. In conditions 5 and 6, the total fixation durations on the embedded verb region in the first experiment (*wh-argument*) are higher than the total fixation durations recorded on the embedded verb region of the second experiment (*wh-adjunct*). This divergence might be related to the embedded verb type and the linear proximity of the *wh-phrase* to the verb. In conditions 5 and 6, the fronted *wh-phrase* is inside the

embedded clause, and the embedded verb type is transitive. The transitive embedded verb has one empty internal argument position in its subcategorization frame and it is actually occupied by the object NP in the sentence. For instance;

- (9) *Cemal Demet-in kim-e kitab-ı gör-düğ-ü-nü söyle-di
 Cemal-Nom Demet-Gen who-Dat book-Acc see-Past-Ind-3s say-Past-3s

The sentences in conditions 5 and 6 of the first experiment are ungrammatical in Turkish. This fact is reflected on the processing times of the related sentence; and the divergence clearly stems from the processing difficulty observed in the embedded verb region. In the study, as a whole, there are eight conditions in each experiment, and they are the conditions 5 and 6 in the first experiment (wh-argument), which create an ungrammatical structure for Turkish. The problem in the processing of these types of sentences seems to have stemmed from the mismatch between the number of the arguments that can be assigned by the embedded verb and the coexistence of wh-argument along with another NP (*kitab-ı* “book-Acc” in the example given above) inside the embedded clause. This should be interpreted as, although the processing of adjuncts are reported to be more costly than the processing of arguments, and which is in harmony with the findings of the present study, for that specific case, the processing of the fronted wh-phrase seems to be at the mercy of the subcategorization frame features of the verb when the wh-phrase is inside the boundaries of the clause formed with the first predicate in the linear order. Other than the position of the fronted wh-phrase (being either outside or inside the embedded clause, which is directly related to the distance to the first predicate in the sentence), the sole difference stemming from the argument – adjunct divergence of the wh-phrase comes after the interaction of the subcategorization frame features of the first predicate and the argument – adjunct divergence of the fronted phrase in hierarchy of processing strategies of the Turkish parser.

5 Conclusion

In the present study, the processing of complex Turkish sentences with fronted wh-arguments and wh-adjuncts is analyzed. The study aimed at figuring out whether the proposals stating that arguments are processed more easily than adjuncts are valid for Turkish, which is a scrambling language with an SOV order.

It is observed that the type of the fronted wh-phrase and the type of the embedded verb interact in licensing the wh-phrases in complex sentences in Turkish. This interaction plays a crucial role on determining the pace of

processing, but when all variables are equal, it is clearly observed through the first fixation and total fixation durations recorded on the wh-phrases and embedded verb regions, that fronted wh-adjuncts are processed at a slower rate than wh-arguments. On that respect, the findings of the present study are in harmony with the previous findings of Clifton et al. (1991), and Liversedge et al. (2003) stating that processing of arguments and adjuncts impose different amounts of processing load on the parser.

The first fixation durations recorded on the wh-phrase regions of the sentences show a clear divergence between the initial parsing of wh-arguments and wh-adjuncts. Wh-arguments are always processed more easily than wh-adjuncts regardless of the place of the wh-phrase in the sentence. This may indicate that even before the embedded and main verbs are read (due to the head final property of Turkish), the parser may be biased on behalf of the wh-argument attachment for the upcoming structure, and be biased for a more labored processing for adjunct attachment. The same conclusion is also observed cross experimentally through the examination of the total fixation durations recorded on the wh-phrase regions. In both the first and the second word orders, in all sentence types, either formed with a transitive or ditransitive embedded verb, the total fixation durations on the wh-adjunct are higher than the ones recorded on wh-arguments. Both of the first and total fixation duration differences between the wh-argument and wh-adjuncts seem to support the proposals by Boland and Boehm-Jernigan (1998), and Kennison (2002) favoring different attachment properties of arguments and adjuncts. Boland and Boehm-Jernigan (1998) indicate that arguments are lexically specified, while adjuncts are attached by global syntactic rules; and moreover, the lexically specified items have priority in attachment over syntactically attached ones. The findings of the present study also show that wh-adjuncts impose a heavier processing load on the processor than wh-arguments.

Another striking outcome of the study is gathered through the analysis of total fixation durations recorded on the embedded verbs of the sentences. The outcomes show similarity with the previous ones, relating longer reading times on embedded verbs following wh-adjuncts than wh-arguments except condition five and condition six sentences. In these conditions, the recorded total fixation durations on embedded verbs are higher in wh-argument sentences than wh-adjunct sentences. The sentences in these two conditions produce ungrammatical utterances when the wh-phrase is an argument due to the subcategorization frame features of the embedded verb, the place of the wh-phrase and the existence of an argument NP object. The wh-argument cannot be licensed by the embedded verb and thus creates longer reading times on the embedded verb, whereas the same problem is not observed in sentences formed with wh-adjuncts. This outcome indicates, when it is considered together with the previous fixation data on wh-phrases, the processing of wh-phrases is

directly related to the attachment preferences created by the types of the wh-phrases at first hand, and secondly, to the role of the upcoming verb in licensing the wh-phrase in a linear proximity base.

As a general outcome, the results seem to support both formal and experimental approaches, which assume a divergence between arguments and adjuncts in modeling linguistic structure. Arguments are to be considered to cause less processing load on the processor than adjuncts, but when the argument structure assigned by the verb mismatches with the type of the wh-phrase, the processor has more trouble with a fronted wh-argument. This may pave the way for claiming that arguments are more elemental units in linguistic modeling than adjuncts.

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