Hacettepe University Graduate School of Social Sciences
English Linguistics

PROCESSING OF TURKISH COMPLEX SENTENCES WITH WH-PHRASES

Taylan Akal

Ph. D. Dissertation

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Prof. Dr. Nalan Büyükkantarcıoğlu (Danışman)

Prof. Dr. Işıl Özyıldırım (Üye)

Prof. Dr. Deniz Zeyrek (Üye)

Prof. Dr. Özgür Aydın (Üye)

Yukarıdaki imzaların adı geçen öğretim üyelerine ait olduğunu onaylarım.

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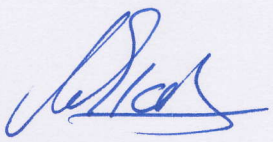

Taylan Akal

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ÖZET

AKAL, Taylan. *Ne-öbeği bulunan Türkçe karmaşık tümcelerin işlemlenmesi*, Doktora Tezi, Ankara, 2014.

Bu çalışmada, ne-öbeği bulunan Türkçe karmaşık tümcelerin işlemlenmesi göz-izleme yöntemiyle incelenmiştir. Türkçe'deki işlemleme stratejileri, altmış katılımcıya uygulanan ve iki aşamada gerçekleştirilen iki deneyle analiz edilmiştir. Veri toplama aracı sekiz koşuldan oluşmaktadır: iki farklı sözcük dizilişi (*özne1 – ne – özne2 – nesne – yardımcı eylem – ana eylem*; ve *özne1 – özne2 – ne – nesne – yardımcı eylem – ana eylem*), iki farklı yardımcı eylem (*geçişli* ve *çiftgeçişli*) ve katılımcıların anlamsal belirsizlik içeren tümcelerde iki farklı (*soru* ve *düztümce*) yorumlama yapmaları için iki farklı önyargı oluşturacak bağlam. 1. deney 'kim-E' ile uygulanırken, 2. deney 'ne zaman' ile uygulanmıştır. Çalışma, Türkçe işleyicinin uzun-mesafeli bağ barındıran tümceleri işlerken, 'garden-path' modeline uygun, öncül bir sözdizimsel analiz mi yaptığını, ya da Türkçe'nin baş-son yapısına bağlı olarak eylem tarafından sağlanan anlambilimsel ve sözdizimsel bilginin birlikte işlendiği ve yardımcı eylemin türü dolayısıyla etkilenen bir işlemleme mi yaptığını ortaya koymayı amaçlamaktadır. Çalışmanın bir diğer amacı da, bir ne-öbeğinin temel pozisyonuyla çalkalandığı pozisyon ve mantıksal formdaki pozisyonu arasındaki çizgisel ya da yapısal mesafenin işlemlemeye etkisini saptamaktır. Son olarak çalışma, ne-öbeğinin türünün ve bunun eylemle ilişkisinin işlemeye etkisini cevaplamaya çalışmaktadır. Türkçe işleyicinin tümcenin ilk okuması sırasında öncül bir sözdizimsel yapı oluşturmadığı fakat eylem kaynaklı bilgiyi paralel bir biçimde kullandığı bulunmuştur. Ayrıca, çizgisel mesafenin yapısal mesafeye üstün gelerek işlemleme sırasında ana belirleyici olduğu ve son olarak da ne-katılanının ne-belirtecimsisinden, geçişli yardımcı eyleme olan çizgisel yakınlık durumu dışında, daha kolay işlemlendiği gözlenmiştir.

Anahtar Sözcükler

Tümce işleme, Ne-öbekleri, Göz-izleme, Yertutucu-Boşluk Bağı, Anlam bulanıklığı.

ABSTRACT

AKAL, Taylan. *Processing of Turkish complex sentences with wh-phrases,* PhD Thesis, Ankara, 2014.

This study analyses the processing of complex sentences with wh-phrases in Turkish via the application of eye-tracking. The processing strategies in Turkish have been analyzed through two eye – tracking experiments in two phases, applied to sixty native speakers of Turkish. The data collection tool is composed of eight conditions: two different word orders (*s1 – wh – s2 – obj – ev – mv; and s1 – s2 – wh – obj – ev - mv*), two different embedded verb types (*transitive* and *ditransitive*) and two different biasing contexts in order to provide the participants with double reading for ambiguous sentences (*interrogative* or *declarative*). Experiment1 is conducted with 'kim-E' (*to whom*), while experiment2 is conducted with 'when' (*ne zaman*). The study aimed at pointing out whether the Turkish processor makes an initial syntactic analysis during reading sentences with long-distance dependencies, similar to garden – path model of sentence processing, or makes use of the semantic and syntactic information provided by the verb simultaneously due to the head final structure of Turkish affected with the type of the embedded verb. Also, the study aimed at figuring out the effect of the linear or structural distance between the default position of a wh-phrase and its scrambled position, and also the LF position in processing. Finally, the study tries to answer the effect of the type of the wh-phrase interacting with the verb type in processing. It has been found that the Turkish processor does not build an initial syntactic structure during the first pass reading of the sentence and thus, makes use of the verbal information in a parallel fashion. Also, the linear distance seems to be a major determinant during processing prevailing the structural distance, and finally, it is observed that wh-arguments are processed more easily than wh-adjuncts except the cases depicting a linear proximity with a transitive embedded verb.

Key Words

Sentence Processing, Wh-Phrases, Eye-tracking, Filler-Gap Dependency, Ambiguity.

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CHAPTER 1
INTRODUCTION: THE GROUNDS

1.1. AN OVERVIEW ON PSYCHOLINGUISTIC ANALYSIS OF LANGUAGE PROCESSING ON THE BASIS OF SENTENCE PROCESSING

Psycholinguistic study takes its origins in two disciplines; psychology and linguistics. The research domain of psycholinguistics includes, in its broadest sense, to discover by the help of which psychological processes humans acquire and use language (Gleason et al.: 1998: 3). The processes involved in language processing, thus the major themes of psycholinguistic study are language comprehension (how humans perceive and understand speech and written language), language production, and language acquisition (Carroll, 1994: 6).

It is not possible to distinguish the psycholinguistic study from the scientific trends in psychology and linguistics when the historical development of the field is taken into consideration. The linguistic tradition witnessed groundbreaking shifts of trends in the study of language through time as from the times of comparative linguistics in American Bloomfieldian tradition to structuralism, which primarily aimed at describing the units of language. With the dominancy of behaviorist point of view in psychology, the human language was seen as a form of behavior around the midst of the 20th century. The attitude towards language changed through the end of 1950s with Chomsky's review of Skinner's 1957 'Verbal Behavior' in 1959. That was the date of introduction of the transformational grammar approach on the underlying structure of language and the knowledge of people on their languages. Psycholinguistics produced much in attempt to test the psychological reality of this linguistic theory. Although the efforts provided well-defined and supportive outcomes on the linguistic knowledge of speakers and the language acquisition of children, they did not put forward powerful findings in terms of the processes involved in understanding and producing speech. In 1970s, cognitive psychology began to encapsulate psycholinguistics, and nowadays, with the aid of computational metaphor and highly

developed experimental techniques, psycholinguistics has received its autonomous identity from linguistics. The major aim of present day psycholinguistic endeavor is to study language-processing components up to their most basic units and to put forward how these components work together (Harley, 2005:12-13) and to unveil the mental representations and processes by the help of which humans produce and comprehend language. The psycholinguistic study uses a wide range of techniques to accomplish this aim (Garrod, 2006). Since the emerging times of psycholinguistics, the study on how language is produced and comprehended is a matter of concern. For instance, Miller (1968) states that the major aim of psycholinguistics is to define the processes, which are at work, during a person uses sentences, and it is at the time of using sentences when the real important point in issue appears in terms of psycholinguistic problems. The time of using sentences in communication is the time when the problem of productivity becomes apparent since with sentences, productivity is infinite. It is further indicated that the problem of interpreting utterances is not only related to assigning meaning to individual words, but combination of these meaningful components in grammatical sentences is also a critical issue in how interpretation is realized in communication.

1.1.1. Sentence Processing

Language becomes a powerful tool for communication after the words are combined into sentences, and sentences are combined into texts (Wingfield and Titone, 1998:228). When natural language speakers access the lexical entry for a word, they reach two kinds of information; one is the information, which is about the meaning of the word, and the other is about the syntactic category and thematic roles, which can be attributed to the word. Crocker (1999:191) states that it is possible to make a contrast between lexical access and sentence processing. While getting lexical access might seem to be a simple process of matching the phonological and orthographic features of a word with an already established entry in your mental lexicon, processing a sentence during which all the words have already been recognized individually, seems to be employing some other mechanisms with effective roles in order to derive the interpretation throughout the whole sentence.

In order to come to a final interpretation of a sentence, thematic roles should be assigned to the words in the sentence being processed. The argument structure of a verb provides the guidance for thematic role assignment in the sentence. It is the determinant of the relationships among the units in terms of action, being, and existence. So it would not be wrong to assert that verbs play a major role in parsing. Parsing is the process of computing the syntactic structure of a sentence, which is central to thematic role assignment. During the parsing process, first, the syntactic category of each unit in the sentence should be specified as noun, verb, adjective, adverb, etc. and second, these categories should be combined in to construct phrases. The readers or listeners attempt forming the representation of the meaning of the whole sentence throughout the information gathered from individual words and their combinations (Harley, 2005:262).

In terms of the processing strategy used by the human parser, ambiguity resolution is a key concept in a psycholinguistic endeavor. Wingfield and Titone (1998:238 – 239) state that ambiguity studies have long been of interest for psycholinguistic interest and scholars have used ambiguity in order to perceive syntactic parsing. Harley (2005:264) also indicates that it is very difficult to recognize what is going on during processing when there is no obstacle for the parser (like the one during ambiguity resolution), and it is because of this, that most research on how parsing is accomplished has been conducted on syntactically ambiguous sentences.

1.1.2. Theories on Processing Developed through Ambiguity Resolution

In terms of sentence processing, ambiguity resolution is one of the key concepts studied in order to point out which model is best favored. Kennison (2001) states that verb information is used in the initial stages of ambiguity resolution that is considered as one of the possible constraints on the processing availabilities. Crocker (1999:219) indicates that in interactive models, semantic-fit constraints are merged with syntactic ones in order to resolve ambiguities while in modular two-stage models, the analysis based on structural

needs are formed at first hand. Only after that procedure does, the thematic processor checks for the semantic fit to either accept or reject the formed construction.

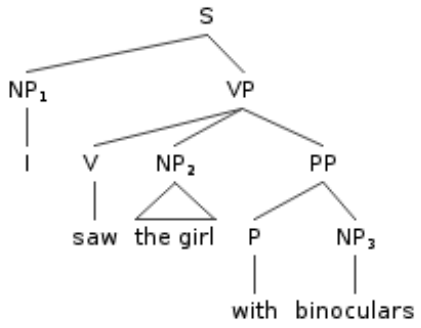
It is possible to state, from where we stand now, that there are two major competing theories in psycholinguistic literature which attempt to define and explain the processing strategies of sentences as carried out by the human parser. One is a group of autonomous models in which the processing is thought to occur in a two-stage procedure. In these two-stage models, the initial stage makes use of only the syntactic information in order to build a syntactic representation of the sentence. The other one is the interactive model in which the processing is realized in a single-stage basis. In this one-stage model, the syntactic representation is built upon a process in which syntactic and semantic information is merged (Harley, 2005:263). Field (2004:69) states that on behalf of the point of view proposed by interactive models, the mind is capable of exchanging the incoming knowledge between all levels of processing simultaneously; whereas in autonomous models, every level taking part in processing operates independently from each other. Pickering and van Gompel (2006) indicate that any modular account for sentence processing is a two-staged procedure, in which the first stage is the modular one, whereas the secondary one is not usually modular. Rayner et al. (1983) claims that a possible thematic processor has no effect in the initial analysis, but during reanalysis. It is possible to consider Frazier (1984) to be the initiator of a modular, two-stage model of parsing. The model consists of two modules as the syntactic and thematic ones. The syntactic processor forms a constituent structure representation, which then integrates the required semantic roles by the help of the thematic processor by taking into consideration the real-world knowledge. As cited in Crocker (1999:218), it is among the key assumptions of Frazier (1984) that the initial decisions are operated purely syntactically, lacking the influence of thematic processor. This means that the rejection of a top-down processing effect is created by the semantic role attachment. This property is also proposed in most modular models. It is further indicated that in modular models, the mechanism does not work in a fashion as one module begins processing after the preceding one ends with its work. However, every module provides the processing output for the other one incrementally while the sentence is

being processed. On the other hand, interactive models propose a parallel parsing mechanism in which different forms of constraints work simultaneously so as either to exclude or give assistance to discrete analyses.

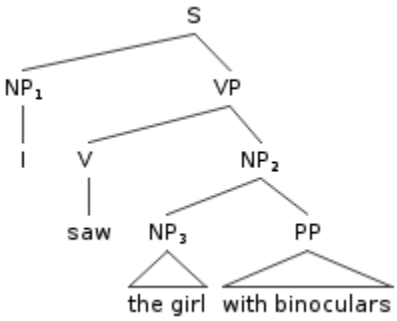
The structure-oriented, modular strategies are based generally on two major principles proposed by Frazier (1979) in order to point out the processing strategies of the human language parser. These are the principles of 'minimal attachment (MA)' and 'late closure (LC)'. Minimal attachment is defined as: 'attach incoming material into the phrase marker being constructed using the fewest nodes consistent with the well-formedness rules of the language'. Whereas, late closure is defined as: 'when possible, attach incoming material into the clause or phrase currently being parsed'. Crocker (1999:220) states that this type of processing model is strictly incremental since the parser incorporates all incoming lexical items into the analysis during they are encountered. One of these two strategies determines which direction the analysis goes on to. If an opposition between the two strategies occurs, minimal attachment gets the priority. Finally, it is the garden-path situation, which takes place in the end, if the parser realizes that the selected type of analysis is incorrect. This outcome leads to retracing an alternative analysis. That's why, Frazier's approach for the parsing mechanism is given the name 'Garden-Path Theory'. Crocker (1999:220) states that, in the sentences given below, according to an incremental model of processing, the attachment of the preposition 'with' should be performed before the object NP is encountered, since the thematic properties of the object has no use in that phase of processing.

1.a. I saw the girl [*pp* with binoculars].
1.b. I saw the girl [*pp* with flu].

In terms of an incremental processing fashion, 'the minimal attachment hypothesis (MA)' would favor the 2.a. (below) analysis over 2.b. (below) since it would involve fewer nodes as seen below:



2.a.



2.b.

It can therefore be concluded that, the garden-path theory, rather than the content of the items to be processed, takes the upcoming syntactic structure into account in building the parsing strategy, and the number of the nodes created in the process is of major importance. Also, the other principle of garden-path theory, the 'late closure (LC)' hypothesis expects the parser to attach the NP '*the sock*' as the object of '*mending*' below in 3.a. rather than the subject of the main clause:

3.a. While Mary was [*VP* mending [*NP* the sock]] [*S* it fell off her lap].
3.b. While Mary was [*VP* mending] [*S* [*NP* the sock] fell off her lap].

Frazier and Rayner (1982)

The reason for this attachment according to the LC is that the parser should attach the incoming NP to the most recent phrase (the VP formed with 'mending') but not the unanalyzed S.

Crocker (1999:223) posits that this view is open to challenge since according to present-day linguistic theories there is crucial distinctions in terms of the roles of the nodes on a tree diagram. For instance, there are differences on case assignment and thematic role assignment nodes; so, each node in a syntactic tree is not treated equally.

On the other hand, Pickering and van Gompel (2006) indicate that interactive sentence processing models are also called constraint-based (constraint-satisfaction) models. This

model has been purported and well defined in MacDonald (1994), MacDonald et al. (1994), Trueswell et al. (1993), Trueswell and Tanenhaus (1994). Interactive models indicate that the processor makes use of all sources of information and is influenced by them to get help for all of the possible analyses during processing, and it is accomplished concurrently. Pickering et al. (2000) defines the constraint-based accounts as the ones in which the choices of the parser are determined by the simultaneous interaction of multiple constraints such as sub-categorization preferences, syntactic cues, the meaning of the language units, prosody, punctuation and the nature of the discourse context. For instance, Wingfield and Titone, 1998:240) state that in the sentence 4 below, although the language users are consciously aware of the NP reading of '*the old man'*, the alternative interpretation in which '*old*' is a noun, and NP by itself and '*man*' is a verb has also been activated in a sub-level of conscious awareness.

4. The old man the boats.

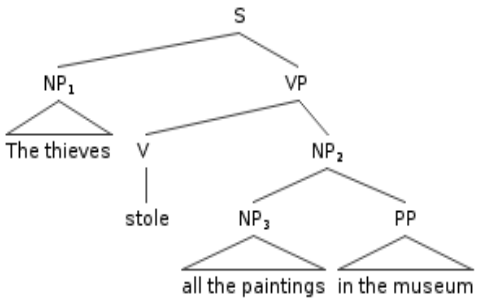
According to the constraint-satisfaction theory, the readers realize that there might be an error in parsing, after arriving at the end of the sentence, and then the alternative interpretation, which was formerly in an unconscious level, is activated and brought to a conscious level in order to resolve the ambiguity.

For instance, Taraban and McClelland (1988) state that any syntactic violation has not an additional difficulty on processing during reading, if there is, it is little or no more than thematic role assignment expectations of the readers. It is further indicated that the expectations depend on the specific content of the sentence, rather than on any syntactic principle like 'minimal attachment'. The sentence 5.b. below includes a 'minimal attachment' construction while 5.a. does not; since the PP '*in the night*' in 5.b. should be attached to the verb '*stole*', and thus creating fewer nodes (*as it was stated before, minimal attachment principle dictates the preference for a formation with fewer nodes*) than 5.a., in which the PP '*in the museum*' should be attached to the verb '*stole*', creating more nodes, as shown below in 6.a. and 6.b.:

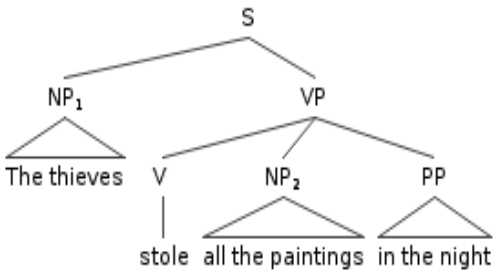
5.a. The thieves stole all the paintings in the museum while the guard slept.

5.b. The thieves stole all the paintings in the night while the guard slept.

6.a.



6.b.



If minimal attachment were at work in processing of these two sentences, it would be expected that the reading process of the first sentence (5.a.) would cost more effort than the second one (5.b.) since it is a more complex sentence than the VP attachment. But Taraban and McClelland (1988) observed that 5.a has been read faster than 5.b. It was discussed that the words in the sentence until '*museum*' and '*night*' create a semantic bias for the non-minimal interpretation. It is indicated that, that's why, it is not the syntactic structure and attachment preferences according to this structure, which affects the processing, but it is the semantic role assignment on words what causes difficulty in processing, which in the broader sense, favors a constraint-based interactive model of parsing in sentence processing.

Other than these two strategies, Pritchett's (1992) approach, which is also a two-stage model, makes use of thematic information in the initial stage (Crocker, 1999; van Gompel, 2006). 'Theta attachment' and 'on-line locality constraint' are the two assumptions proposed by Pritchett (1992). While the former one indicates that the theta-criterion[1] attempts to apply at every stage during parsing, the latter one specifies that unless the target

[1] Theta criterion: a) Each argument is assigned one and only one theta role.
b) Each theta role is assigned to one and only one argument. (Chomsky, 1981).
b) Each theta role is assigned to one and only one argument. (Chomsky, 1981).

position is governed or dominated by its source position, the human sentence processor can not complete the correct attachment for the units. Crocker (1999:225) states that Pritchett's model mainly relies on the verbal heads on parsing, which means for verb-final languages (like Japanese or German) a delay in processing, and thus not an incremental way of processing should be at work. In the framework of Pritchett's account, Crocker (1999:225) indicates that Crocker (1996) purports A-Attachment (AA) to replace Theta Attachment. A-attachment dictates; "attach incoming material, in accordance with X-bar theory[2], so as to occupy (potential) A-positions[3]". It is stated that this approach provides a way of preventing from referring to thematic information specifically, which may be unavailable especially for verb-final languages.

Through a general look on the serial (garden-path model) and parallel (constraint-based) models of parsing, it is observed that; in serial two-stage models, syntactic and semantic information used for processing are divided into two separate sections. While only syntactic information is used in the initial stage, in the second stage, semantic information is used. In parallel models of parsing, all the information (syntactic and non-syntactic) is used at the same time on order to create alternative representations. Pritchett's (1992) model, which is also a two-stage model, seems to stand somewhere in between since it makes use of semantic information in the initial stage. This approach was slightly modified by Crocker (1996), as stated above, to involve A-attachment replacing theta attachment in accordance with X-bar theory, which provides a hatch for verb-final languages.

Harley (2005:283) states that among the models for parsing there is little consensus about their validity. The variability in the outcomes seems to be closely related to the divergence among the techniques used in the experiments. It is further indicated that the proponents of each model criticize the others as assessing the materials in a wrong way, making faulty or weak experiment designs or interpreting the results of the experiments in a wrong way.

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[2] X-bar theory is first proposed by Chomsky (1970). "Bar level" represents the level which is between the "head" and the "phrase" levels. "X" stands for any category.

[3] A-position: Subject and object positions which are potentially assigned a theta-role. *Definition from Chomsky (1981)*.

1.1.3. Processing Filler-Gap Dependencies

Hawkins (1999) states that in standard transformational grammar, and in the later studies which are based on transformational grammar, wh-phrases in questions, relative clauses and similar constructions are thought to be base generated in a position and then moved to the leftmost location of the related clause. According to the government and binding theory (GB) a 'trace'[4] is left in the position where the wh-phrase is originally generated and co-indexed with the moved element (wh-phrase) as shown in 7.a. below:

7.a. Who*i* [do you think that Mary saw O*i*]

It is further indicated that in relative clauses, there is an additional co-indexation between the trace, the moved element and the head of the relative clause as shown in 7.b. below:

7.b. the person*i* [who*i* you think that Mary saw O*i*]…

Hawkins (1999:244)

Hawkins (1999) states, following Fodor (1978, 1989), that in psycholinguistics the 'moved element' and the 'trace' created by this kind of movement are represented as the '*filler*' and the '*gap*' respectively; and much of the problem related to the processing strategies of the dependencies between these units during parsing have not yet been settled in psycholinguistic endeavor in a full-fledged manner. What are the points of consensus are the facts that first, this type of structures (filler-gap dependencies) is difficult to process; and second, the human language processor gets an intense processing load and produces a large amount of exertion during forming the relation between the filler (the moved element) and the gap (the trace left behind).

[4] Haegeman (1992:285 – 286) defines 'trace' as an empty category which encodes the base-position of a moved constituent, and also, the moved element is called the 'antecedent' of the trace.

Harley (2005:287) states that the human processor fills the gaps when encountered during sentence processing. Furthermore, the trace loads an extra work on the language processor since it has to be held in memory, and this is observed through the measurements of the electrical activity of the brain. Also, it seems that there is a filler strategy in all languages, and it is a general characteristic that when an ambiguity occurs, a gap is filled with the most recent probable filler. In psycholinguistic literature, it is probable to observe the interest on gap filling in accordance with the emergence of transformational grammar. For instance, Fodor's (1978) study concentrates on the how the human language parser works on transformations. It is stated that in sentence 8 below, determining the role of the wh-word through its surface form is not probable and the only way of relating the role of the moved question word is the postulation of a gap following the verb 'make' as seen below:

8. What do you want Mother to make for Mary?

(Fodor, 1978: 428)

This means that in the deep structure, there is an NP in the mentioned position, and this NP has been moved or been deleted in the surface form. Since in sentence 8 there is no other transformation than a wh-movement, the gap should represent the wh-word's deep structure position carrying both the grammatical and semantic features of the expected NP in the expected position in the deep structure. It is further indicated that in the time of study, the understanding of these type of mental representations, the alternative theories in order to explain this phenomenon, as the co-indexation of the related items (the gap and the filler constituent), or the parser's replacing the question word in its deep structure position before coming to the semantic interpretation of the sentence, are not more than metaphors.

As stated above, studying relative clauses and wh-phrases always tend to evaluate the data through similar approaches, for example both include ambiguity resolution, and how the processor deals with ambiguity resolution. In that respect, it is probable to state that garden path theories and constraint-satisfaction approaches try to interpret dependencies in these types of language constructions such as wh-questions and relative clauses. Pickering and

van Gompel (2006) state that garden-path theory introduced the 'Active-Filler Strategy/Hypothesis' or 'The Minimal Chain Principle' to explain unbounded dependencies. It is indicated by Hawkins (1999) that there seems to be a 'first resort strategy' in parsing, which asserts that a gap is created as soon as possible, and is filled with the filler providing a relief on working memory. According to this strategy, in sentence nine below, there should be two possible gap sites for '*which student*' during parsing; one is immediately after verb '*ask*' and the other is after preposition '*about*' as seen below:

9. Which student*i* did you ask (O*i*) Mary about (O*i*)?

(Hawkins, 1999:247)

'*Which student*' must have been firstly interpreted as the object of '*ask*', which indicates an immediate (first) assignment to the first sub-categorizer encountered. Then, this interpretation is revised after the processor comes up with '*Mary*' and since NP '*Mary*' should be occupying the '*object*' position. In that respect, '*which student*' becomes unfilled filler yet again. After the processor encounters '*about*' the filler '*which student*' is assigned as complement. This is named by Clifton and Frazier (1989:292) as the 'active filler hypothesis' as indicated above.

> **Active Filler Hypothesis:** When a filler of category XP has been identified in a non-argument position, such as COMP, rank the option of assigning its corresponding gap to the sentence over the option of identifying a lexical phrase of category XP. (Clifton and Frazier, 1989:292).
> Also, see Frazier and Clifton (1989)[5] for the immediacy of assigning the filler with the gap as soon as possible.

[5] *Active Filler Strategy (AFS)*: When a filler has been identified, rank the option of assigning it to a gap above all other options. (Frazier and Clifton, 1989:95).

The processor prefers the analysis, which allows gap filling to any other analysis that does not, according to 'Active Filler Strategy' (AFS) (Pickering and van Gompel, 2006:459).

The 'minimal chain principle', which has been regarded as a slightly modified version of active filler strategy, thus thought to be placed under garden path theory was first proposed by De Vincenzi (1991) as stated in Aoshima et al. (2004).

> **Minimal Chain Principle:** Avoid postulating unnecessary chain members at S-structure, but do not delay required chain members.
>
> (De Vincenzi, 1991:13, in Aoshima et al., 2004).

This principle indicates that the parser should interpret a unit in the possible surface position and assumes the possible filler-gap dependency only as a last resort.

On the other hand, the 'thematic role or lexically driven approaches', described and investigated in section 1.1.2, which examined the processing ambiguity resolution, is stated to be as an alternative approach for 'active filler strategy' in psycholinguistic literature by Aoshima et al. (2004). The thematically driven approaches necessitate the filler-gap dependency to be settled with an argument's need to be associated with a predicate in terms of thematic role satisfaction. It is also directly related with case assignment necessity. More generally, as indicated in the section given above, this tradition of filler-gap dependency formation has been represented in principle-based, and constraint-based accounts of parsing. It is apparent that Chomsky's (1981) theta-criterion is crucial for this tradition. Aoshima et al. (2004) state that while there is one possibility to interpret the verb driven account as the unique source of active filler effects which necessitates the search for a filler to begin after coming up with a potential predicate, another possibility is the thematic interpretation requirement to begin as soon as a moved filler is detected, which in turn, causes to search for a potential predicate to assign the argument role to the filler. This means that both the filler and the predicate are capable of creating the need to find a gap which finally can be evaluated as part of a more general constraint-based account that

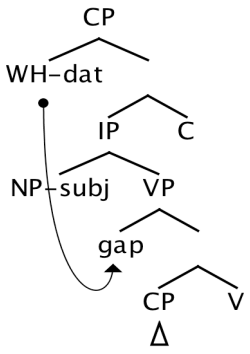
dictates all categories to have lexical constraints and each of these categories are able to initiate efforts to satisfy the mentioned constraints. It is further indicated in Aoshima et al. (2004) that the variation between these two accounts is difficult to be observed in head initial languages like English since in a sentence like 10.b below (originally in Stowe, 1986), the '*filled gap effect*' (FGE) observed in the direct object region could be the result of an association process of both the filler or the verb with the features they need[6].

10.a. My brother wanted to know if Ruth will bring us home to Mom at Christmas.

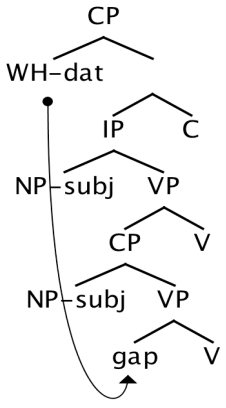
10.b. My brother wanted to know who Ruth will bring us home to _____ at Christmas.

So, in head-initial languages all three assumptions, the 'active filler hypothesis', 'verb-driven account', and 'full constraint-driven approaches', seem to be compatible with the characteristic of the language and thus has received limited attention. According to Aoshima et al. (2004) in a head-final language, like Japanese, the above-mentioned three accounts may reflect different forecasts in terms of long-distance dependency formation as seen below:

A. Active filler/ Minimal chain

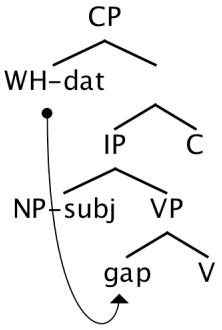


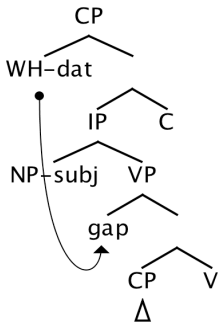
B. Verb-driven



[6] Stowe (1986) reports that a slower reading time has been observed on pronoun 'us' in 10.b above compared to 10.a, which does not include wh-fronting. This finding has been regarded as an indication of '*filled gap effect*' *(FGE)*.

C. Full Constraint-driven





While it is seen that head-final languages may seem to support or eschew the gap filling accounts, some other approaches may challenge the creation of gaps during parsing. For instance Pickering and Barry (1991) purport that the processor has a tendency to connect the fillers directly with the verbs, or any other sub-categorizer to license the thematic role and case issues for interpretation. Pickering and van Gompel (2006) criticizes this approach as, while deriving the same outcomes with active filler strategy in some constructions, being unable to explain ambiguity resolution processes in word order and relative clause ambiguities in German and Dutch. It is further stated that in these languages, these types of ambiguities may have stemmed from processing difficulties with a particular information structure (Kaan, 2001 in Pickering and van Gompel (2006:459).

Stowe (1986) states that if how people achieve assigning the moved wh-element to a gap position, for instance, in which it is thought that a potential noun phrase (NP) carrying the same features with the moved element (e.g. wh-phrase) may have dwelled, fundamental questions about how humans process language can be answered and moreover, whether language process is carried out in a top-down or bottom-up fashion. This can be interpreted, as, in harmony with present-day debate, that can be an answer for whether human language processing mechanism operates in a serial or parallel model.

It seems possible to relate the verb-driven constraint-based theories of processing with serial lexical-guidance account, which has its origins in lexical-guidance account proposed by Ford et al. (1982) and Fodor (1978). The serial lexical-guidance account indicates that in the process of a parser's decision for analysis, it is only the sub-categorization information, which plays the role, i.e. the model takes the properties of the verb into consideration to a high degree. In that sense, Pickering et al. (2000) asserts that constraint-based accounts in which the sub-categorization preferences are not the only item influential in determining parsing preferences are more general than serial lexical-guidance accounts. Pickering et al. (2000) state that it is a debatable issue if some sources of information is used immediately during processing the syntactic ambiguity resolution, or their uses are delayed until a later stage during parsing. Moreover, it is indicated that semantic and discourse factors are at work much earlier than the previous studies proposed, but the problem is still to be discussed whether these influences reflect initial parsing decisions or an immediate revision during processing.

Besides garden – path and constraint – based theories on parsing, referential theory of parsing, which was stated to be based on Crain and Steedman (1985) in Ni et al. (1996), tries to explain the parsing procedures of the human processor. Ni et al. (1996) state that in determining the immediate parsing choices of the perceiver, the relative complexity of the discourse representations have a major role. In their study, which was carried out via the application of four experiments in order to evaluate the impact of semantic/referential complexity and general world knowledge on the on-line resolution of structurally ambiguous sentences, they have found out that semantic/referential principles are used immediately during on-line processing of ambiguity resolution and these principles anticipates world knowledge. Moreover, in the resolution of structural ambiguities, the complexity of the alternative discourse representations if critical. Also, Harley (2005) indicates that in referential theory of parsing, the processor forms analyses in parallel and makes use of discourse context to disambiguate the sentence immediately, which distinguishes it from garden – path models. On the other hand, what distinguishes referential theory from constraint – based ones, which also uses all sources of semantic

information including the world knowledge, is the fact that only the referential complexity within the discourse model is crucial in the process of disambiguation in referential theory. Pickering (1999) proposes that referential theory can be applied only for ambiguities existed between simple and complex noun phrases, and as a result of this, it is applicable for serving a complete account of initial parsing decisions which is also supported via the findings of Ni et al. (1996) stating that while semantic-referential information is used immediately, more general world knowledge is only available after a while. Moreover, Pickering (1999) indicates that, the evidence derived out of studies carried out on the effect of context shows that context may have effects that is observed as soon as the processor encounters a critical phrase in the sentence but does not prove that context has the ability to affect the initial parsing strategies. In the light of the discussions given above, the scope of the study included interrogative and declarative biased sentences to provide double readings for the participants but the major discussion in terms of initial parsing decisions has been made around two major theories of parsing, the garden – path theory and constraint – based theory.

The issue of whether the misanalysis of syntactically ambiguous sentences is the product of an earlier syntactic attachment procedure like ‘minimal attachment’ or ‘late closure’ which are consistent with ‘garden-path model’ as observed and asserted by Frazier and Rayner (1982) or whether verb biases affect processing very rapidly and thus used during initial processing makes the problem to be discussed for Turkish complex sentence structure with ambiguity at the mercy of verb-final order of Turkish. Since all the items to be attached in a syntactic mechanism precede the argument in a Turkish sentence, at least in the ambiguous cases created in the sentence set of the present study, the parser does not have any other choice than waiting for the argument to set the syntactic structure. The only grammatical marker to indicate a complex structure in the sentence sets is the ‘accusative case marker *‘-I’* on the object DPs. Although the genitive marker *‘(n)In’* on the second subject of the sentences may indicate a possible upcoming complex sentence structure, it does not necessarily dictate the sentence to be composed of two clauses. If an expectance for a syntactic structure is created during initial processing, it is only satisfied or dissatisfied

when the reader comes up with the first verb in the order following the accusative marked object DP located in each of the target sentences. Thus, this fact which makes the place of the wh-word and the existence of the genitive marked DP subject (the second subject) less important in order to specify whether the sentence is complex or simple, seems to make the licensing of fronted wh-phrases in Turkish debatable when the issue is considered in terms of a probable initial syntactic parsing or a simultaneous procedure of parsing taking into account both syntactic structure and the semantic information provided by the verb. As mentioned above, the satisfaction or dissatisfaction of an expectance for an initially built syntactic structure is realized only when the processor has come up with the first verb (the embedded verb) in the sentence. The transitive and ditransitive[7] divergence provides the distinction for a complex or simple structure in the experiment design.

[7] The term 'ditransitive' in the present study has been used in order to designate the 'double-object' verbs in Turkish, which allow two DPs, or a DP and a CP object in its argument structure. The use of the term 'ditransitive' does not offer any suggestions on the merge of objects in Turkish in terms of the debate on the universal order and the hierarchy of direct objects (DOs) and indirect objects (IOs).

CHAPTER 2
THE STUDY

2.1. BACKGROUND TO THE STUDY

As it has been stated in section 1.1.3, head-final languages may provide an availability to distinguish among approaches (active-filler strategies, thematic role-lexically driven approaches) in explaining how human language processor works during filler-gap dependency resolution.

In psycholinguistic endeavor for pointing out how the human language parser processes ambiguities including long distance dependencies, relative clauses, and possible ambiguities stemmed from licensing of the fillers with the potential gap(s) have been major topics of research and debate. While it is evident that many works on English have been carried out, it is also a universal tendency to test the hypotheses on language processing mechanisms on languages other than English, which may either have head-initial or head-final nature, or some other language-specific mechanisms to mark question formation with wh-constructions such as, Ng (2008) on Chinese; Frazier (1987), Kaan (1997) on Dutch; Schlesewsky et al. (2000) on German; Rado (1999) on Hungarian, De Vincenzi (1991) on Italian, Miyamoto and Takahashi (2002, 2004) on Japanese, Sekerina (2003) for Russian, and etc. Aoshima et al. (2004) indicate that a head-final language like Japanese may be a good source of research for testing the approaches which try to define the mechanisms at work in long-distance dependencies since each approach (active filler, verb-driven and full-constraint driven) may provide different results while all these approaches make similar estimations for verb-initial languages like English.

In that respect, Turkish, which allows scrambling of NPs and wh-phrases to a considerable degree may also provide fruitful outcomes for a study on human language parsing mechanism. While Turkish is a head-final language like Japanese, which predict different

concrete outcomes for the three different approaches, it lacks any question particle to specify the interrogative scope of the wh-phrase in wh-question formation, which is a major property of Japanese (Aoshima et al. 2004; Miyamoto and Takahashi, 2002; 2004; Ueno and Kluender, 2003). This means that there may be another possibility for challenging the approaches dominating the field, both being a head-final and lacking a question particle (Q-particle) language.

2.1.1. Wh-phrases in Turkish

While the wh-question formation in Turkish has been studied by many researchers through a formal framework (Akal, 2007; 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.) not much work has been done on the processing mechanisms during processing sentences including scrambled/moved wh-phrases in different locations in the sentence, which create long-distance dependencies. Turkish wh-phrases are open to debate in their formal nature in terms of being the scrambled variants of a wh-in-situ nature or require obligatory sentence-initial movement in some circumstances; moreover, Turkish complex sentences are highly ambiguous when the wh-phrases appear in various locations as creating matrix questions or embedded questions.

In Turkish, wh-phrases, in both main and embedded clauses, are considered to remain in-situ (Uzun, 2000; Özsoy, 1996). In Özsoy (1996), wh-phrases are defined to occur in the positions in which their NP-counterparts are to be found in a regular sentence and as a result of this, wh-phrases do not realize an overt movement in surface structure; thus, they are considered to remain in-situ. Moreover, Akar (2000) proposes that wh-movement in Turkish is not a syntactic rule. In an interrogative sentence structure in Turkish, an obligatory movement of a wh-element to a certain position is not observed. If a canonical position is to be assigned for Turkish wh-phrases, it is proposed to be the immediately pre-verbal position (Akar, 1990; 2000; Kural, 1992). It is possible to observe that the wh-phrases in a Turkish sentence may be located in various positions. This fact is related to the

scrambling property of Turkish. It is possible to state that scrambling is seen in languages, which have free word order and which are at the same time considered to be wh-in-situ languages. Turkish is stated to be a language, which has a property of scrambling both for NPs and wh-phrases. (Erguvanlı, 1984; Akar, 1990; Kornfilt, 2003; Miyagawa, 2003). Özsoy (1996:139) indicates that Turkish does not possess a syntactic rule of wh-movement and defines wh-in-situ in relation to Turkish as follows: wh-phrases occur in those positions in which their NP-counterparts would be found in a regular sentence. Thus, the wh-phrase does not realize an overt movement in surface structure and remain in-situ. The placing of the wh-word in the embedded clause of a complex sentence (as shown in sentence 11 below) is explained by Özsoy (1996) as the extracting of the wh-phrase from a structure and placing it in an A' – position – Spec of Comp:

11. Akın [ben-im ne zaman gel-me-m-i] söyledi?
Akın I – gen. when come-sub-gen-acc say-past-3rd-sing.
"When did Akın say I should come?"
(Özsoy, 1996:141)

The scope of the wh-word does not change and still remains the matrix clause. So, what has been derived through sentence 11 is regarded to be the result of the scrambling property of wh-phrases in Turkish in general. Also, see Lieberman and Aoshima (2006) indicating that the scrambling of the wh-phrase does not affect the scope of the question. But when the subjunctive –mE is replaced with indicative –DIk, it is possible to derive two different meanings with the same order, one of which is a matrix and the other is an embedded question reading as given in sentence 12 and sentence 13 respectively (Kornfilt, 1996; Akal, 2007).

12. Akın [ben-im ne zaman gel-diğ-im-i] söyledi?
Akın I – gen. when come-ind-gen-acc say-past-3rd-sing.
"When did Akın say I came?"
13. Akın [ben-im ne zaman gel-diğ-im-i] söyledi.

Akın I – gen. when come-in-gen-acc say-pst-3rd sing.
"Akın said when I came."

Apart from the subjunctive and indicative marker divergence on the interpretation of the scope relation of wh-phrases in a complex Turkish sentence, even a single sentence may cause two different interpretations with the same marker on the embedded verb, the same place for the wh-phrase, the same embedded clause verb and the same main verb as seen in sentences 14, 15, 16 and 17 below. Sentence 14 has double reading with declarative and interrogative with a wh-argument on the position located just before the embedded clause subject. Sentence 15 has double reading with declarative and interrogative with wh-argument placed just after the embedded clause subject preceding the dative marked object. Sentence 16 has double reading with declarative and interrogative with a wh-adjunct placed preceding the embedded clause subject and sentence 17 has double reading with declarative and interrogative with wh-adjunct placed after the subject of the embedded clause, preceding the dative marked object:

14. Mustafa kime Emel'in kitabı verdiğini söyledi
Mustafa-nom who-dat Emel-gen book-acc give- pst-ind-3rd say-pst-3rd

15. Mustafa Emel'in kime kitabı verdiğini söyledi
Mustafa-nom Emel-gen who-dat book-acc give- pst-ind-3rd say-pst-3rd

16. Mustafa ne zaman Emel'in kitabı verdiğini söyledi
Mustafa-nom when Emel-gen book-acc give- pst-ind-3rd say-pst-3rd

17. Mustafa Emel'in ne zaman kitabı verdiğini söyledi
Mustafa-nom Emel-gen when book-acc give- pst-ind-3rd say-pst-3rd

Although wh-phrases in Turkish is stated to scramble to various positions, it is not applied in an unlimited fashion, and the scrambling sites of the wh-phrases create some consequences

related to the information structure of Turkish. For instance Akar (2000:70) states that backgrounding which is one of the features of the scrambling of NPs in Turkish cannot be applied for wh-words. Examples in (18a-b) clearly show that wh-phrases cannot occur in post-verbal position:

18.a. * [S [NPt_i] [VP Nergis'e t_i kızdı] kim$_i$]
Nergis-dat get angry-past who

18.b. * [S [NP Aslı] [VP yarın t_i dönecek] nereden$_i$]
Aslı-nom tomorrow come back-future where-abl
(Akar, 2000:70)

It is further indicated by Akar (2000) that a wh-word can be topicalized only if it has a theta-role, and that a wh-word in the position of an oblique object cannot be topicalized in Turkish. (19a-b) and (20a-b) show this view:

19.a. [S' [SPEC Kim] [S[NP *ti*] [VP Nergis'e *ti* kızdı]]]
who Nergis-dat get angry-past
"Who got angry with Nergis?"

19.b. [S' [SPEC Hangisini] [S [NP Sinan] [VP sana *ti* verdi]]]
which-poss/1stsg-acc Sinan-nom you-dat give-past
"Which one did Sinan give you?"

20.a. *? [S'[SPEC Nereye] [S' [NP Aslı] [VP gitti]]]
where-dat Aslı-nom go-past
"Where did Aslı go?"

20.b. *? [S'[SPEC Ne zaman] [S'[NP Aslı] [VP gitti]]]
when Aslı-nom go-past

"When did Aslı go?"

It should be noted here that sentences 20.a and 20.b are open for grammaticality judgments intuitively. They should sound highly flawless for many native Turkish speakers.

Akar (2000) further suggests that when wh-word does not move out of the VP, Q-scrambling is observed to work properly for oblique objects.

21.a. [S Sinan [VP ne zaman sizi *ti* davet etti]]
Sinan-nom when you-acc invite-past
"When did Sinan invite you?"

22.b. [S Sinan [VP sizi ne zaman *ti* davet etti]]
Sinan-nom you-acc when invite-past
"When did Sinan invite you?"

If the formal approaches to the wh-in-situ phenomenon in Turkish are to be summarized, the formation of the wh-question may be divided into two approaches one of which favors an LF movement of the wh-phrase to Spec-CP (Akar, 1990; Özsoy, 1996), another approach proposes that the formation of wh-question in Turkish is provided via an operator-variable chain. The [Q] operator in C-domain co-indexes the wh-phrase and thus no movement in LF is required (Arslan, 1999). Also, wh-phrases are proposed to be variables that do not have internal interrogative forces and are assigned various readings by external variables, which means the existence of an operator-variable chain. Also, İşsever (2009) proposes that there is a close interaction between wh-in-situ and focus in Turkish and the formation of interrogatives is a matter of co-indexing the wh-operator with a wh-variable, the former moved to the Spec-CP to check the [wh] feature and the latter moved to the specifier position of the Focus Phrase (SpecFocP) which has further been stated that the wh-operator in Spec-CP unselectively binds all wh-variables in its scope.

It is clear that Turkish wh-question formation has intensively been handled through a formal framework and seems to be debatable in many respects. On the other hand, carrying out an experimental approach on the processing of wh-question formation in Turkish may provide fruitful outcomes for understanding the issue. When we have a broader look at the issue, it is seen that the problem should be handled both experimentally and in an interrelated fashion to understand the nature of wh-question formation in Turkish. In that respect, Bozşahin and Göksel (2007) state that one of the basic shortcomings in Turkish linguistics is in the lack of interrelating the studies on prosody with syntax and performance. The better the role of prosody is comprehended in grammar, which until now was regarded as a side-effect, it is predicted that the studies on prosody will get a central place in forming the empirical base of linguistic theories. Also, Özge and Bozşahin (2007) study the different realizations of prosody in declarative sentences and state that in order to form the place of "meaning" in performance, it is needed to study the syntactic and the prosodic form as a whole. In that respect, the unsolved problematic characteristic of wh-phrases in Turkish complex sentence structure needs a full-fledged examination taking into consideration the layers beyond syntactic coding in cognitive processes.

It should be noted that although the study of the processing of wh-phrases and the long-distance dependency created by the scrambled/moved wh-phrases has not been a frequently chosen field of research in Turkish psycholinguistic endeavor, there are studies which implements a psycholinguistic method for studying some other issues of Turkish language. For instance, syntactic priming and the comprehension of concealed questions are among those, the means of data collecting of which are sentence completion and eye-tracking (Bahadır, G. and Hohenberger, A., 2012b; Bahadır, G. and Hohenberger, A., 2012a; Bahadır, G., 2011a; Bahadır, G., 2011b; Bahadır, G. and Hohenberger A., 2010). Besides the studies on syntactic priming and concealed questions, relative clause structure is another topic of concern implemented in an experimental way of research in the field. For instance, Slobin (1986) studies the comprehension and acquisition of subject and object relative clauses in Turkish. It is stated in Slobin (1986) that the acquisition of relative clauses in Turkish is slower than the acquisition of relative clauses by English speaking

children; and this is indicated to be related to both the non-recognition of non-finite verb forms and the difference created in the default clause structure by marking the object relative clause subject with a genitive marker in Turkish. The data of the related study showed that it is not welcomed by the Turkish children to interpret the genitive marked NP as the agent which is located sentence initially which leads them to select the first NP following as the agent. Related to this, object relative clauses are stated to be more difficult to be implemented than subject relative clauses.

Also it is possible to see various studies in the production of relative clause types by Turkish speaking children in psycholinguistic literature, as for instance Ekmekçi (2001) which investigates the production of subject and object relative clauses; Özcan (2000) which studies the parallel function effect to be at work during the production of relative clauses in Turkish. The study has been carried out via the participation of monolingual Turkish-speaking children aged between five and nine. It has been indicated that the acquisition order of Turkish relative clauses does not show a direct parallelism with what 'parallel function hypotheses' asserts.

It is possible to state that the production, processing and comprehension of subject and object relative clauses is a major topic of field in Turkish psycholinguistics. For instance, Özge et al. (2010a) studies the production of relative clauses by Turkish children comparing with adults. It is found that both children and adults used subject relative clauses more than they use object relative clauses, and children were less successful at producing object relative clauses than subject relative clauses. This finding is stated to be in relation to five factors as; first; frequency difference between subject (more) and object (less) relative clauses, which may reflect the input the child, is exposed to. Second is the word order difference. The object relative clause order is SVO, which is out of the canonical order of Turkish since it reverses the object – verb order, and thus both children and adults may be trying to follow the canonical order reflected on subject relative clause use. Third; multiple form-function mappings, as the difference between the genitive marking of the subject in the object relative clause with the accusative marking of the object in subject relative

clauses. Genitive marking has more than one function, while the accusative case only marks the accusative object. The more the function of a particle, the more difficulty it may load on the processor to become activated in spontaneous speech. Fourth is the genitive possessive agreement observed in object relative clauses making it more complex than the subject relative clause; and fifth, the perspective shift, which is needed for the object relative clause task used in the study, but the subject relative clause task.

Another study is Özge et al. (2010b), which also studies the comprehension of relative clauses comparing the reversible and non-reversible subject and object relative clauses in two groups of native Turkish speakers; as 5 to 8 year old children and adults, respectively. The findings show that children were better at reversible subject relative clauses than object relative clauses, which is in line with previous studies favoring the earlier acquisition of subject relative clauses than object relative clauses. Moreover, it is observed that reversible subject relative clauses were more accurate in questions than in imperatives and vice versa has been obtained for the object relative clauses, which is indicated to be directly related with accusative case marking in Turkish providing children the cue that accusative marker marks the object unambiguously.

Also, Özge and Marinis (2010), study whether incremental cues are used by 5 to 8 year old Turkish speaking children or not during processing sentences with relative clauses in comparison to adults. The research has been implemented via an auditory-moving-window task including target items having relative clauses and declarative sentences with different word orders as the control items. The non-canonical word order of relative clauses in Turkish with rich morphosyntax is reported to provide an availability to test if the upcoming information is used in on-line processing incrementally in a head-final language like Turkish. It is found out that 5 to 8 year old children make use of the morphological cues in order to estimate the following lexical and morphosyntactic material and providing to parse sentences as incrementally as adults.

In Özge et al. (to appear), which studies whether the parallel function hypothesis (PFH) – indicating that children make use of the ease provided by the harmony of the grammatical role of the complex NP both in embedded and matrix clauses – is effective in on-line processing of relative clauses in Turkish or not. The design of the experiment is based on the subject and object roles of the NPs in relativized clauses and their interaction. The study shows that the PFH has not been supported with Turkish data, and the assignment of the roles on the relative clauses as subject or object is related to the place of the NP in the sentence. That is, when the relative clause is seen as the first NP in the sentence, it is assigned a subject role, while it is assigned the object role when it is observed to be the second NP in the sentence. Although the importance of the place of the relative clause is proposed to be effective, it is further indicated in the study that this might be a too broad generalization, and therefore, it has been suggested that the processor realizes the existence of a complex NP earlier than the head NP assigning a temporary role to it, then, failing to make a revision afterwards, due to the processing cost stemmed from the number of the arguments in the structure, which in total detains the participants from using the case marking cues on the sentence-initial NPs.

Another study by Özge et al. (2010) on the production and parsing of subject and object relative clauses in Turkish favors the incrementality in parsing and production, which is observed through three experiments. It is reported that in sentence referent matching experiment, a disadvantage on behalf of object relative clauses is observed for children, which is interpreted to be in line with structural distance hypothesis, reserving another option also for the effect of complex morphosyntax. In picture elicitation experiment, it is indicated that both children and adult groups avoided object relative clauses, which is discussed to be a symptom for incrementality. Also, the outcomes of the self-paced reading experiment are interpreted not to yield filler-gap effects but establishing the incrementality and morphosyntactic asymmetries detected in production.

The study of relative clauses, majorly on the subject and object relative clause distinction and the reflection in the divergence of these two on the comprehension and processing of the clause types have also been handled through agrammatic speech production. Yarbay-

Duman et al. (2005) and Yarbay-Duman et al. (2008) may be given as instances of studies carried out on the processing of agrammatic speech. Yarbay-Duman et al. (2005) study the production of basic order Turkish sentences in comparison with subject and object relative clauses by agrammatic speakers of Turkish. They test the hypotheses favoring that the problems observed in agrammatic speech are due to the derived structure on the one hand and on the certain positions on the syntactic tree, on the other. It is stated that Turkish relative clauses are composed of structures smaller than TP or CP, and only include (Asp)ect (P)hrases which makes it possible to compare the hypothesis experimentally. At the end of the study, it is observed that the production of non-finite relative clauses which do not have tense inflection but syntactic movement are more difficult for Turkish agrammatics to produce, while the production of finite basic word order clauses do not cause difficulty comparatively, which, as a result, is an indication of the potential difficulty for agrammatic speakers of Turkish to have problems with the structures including syntactic movements (derived order). It is further stated that this finding also shows that functional projections to tense are syntactically active in Turkish agrammatic speech.

Another study on the production of relative clauses in Turkish agrammatic speech is Yarbay-Duman et al. (2008). In their study they examine the production of finite main clauses and non-finite relative clauses in agrammatic Turkish speakers by a sentence completion test. It is found out that structurally derived clauses cause problems for agrammatic speakers of Turkish observed through the increasing rate of difficulty in the production of non-finite relative clauses in comparison to the production of finite main clauses. The hypotheses that the issue has been handled within in the mentioned study concentrate on the finiteness of the verb and its effect on the agrammatic production on the one hand, and the other hypothesis emphasizing the importance of the sentence complexity such as '*derived order problem* (DOP-H)' which states that all languages have a default word order and any divergence from this order is the derived form. The DOP-H is not limited to finite verbs, and predicts that object scrambling, which is low in the syntactic tree is also impaired in agrammatic speech. DOP-H emphasizes that sentences including derived form of constituents are more problematic than the ones with the basic word order. Shortly

saying, DOP-H is not concentrated on a single position on the syntactic tree, but simply asserts the validity of a moved constituent in the agrammatic production. The outcomes of their study relate that simple sentences with finite verbs are preserved by Turkish agrammatics, and the overt movement of the noun phrase hinders the production of speech irrespective of the position of the units in the hierarchical organization of the sentences. So, it is asserted that the outcomes of the study are in parallel with DOP-H since it suggests that finite verbs are relatively undamaged if there is no overt movement. In parallel, it is suggested that it is the overt movement of the noun phrase, not the nominalization process that causes the problematic case. Furthermore, it is also stated that the issue should be tested on subordinate clauses having nominalization without any overt movement such as 'Ahmet'in geldiğini biliyorum – *Ahmet-gen come-nominalization-agr know-tense-agr (I know that Ahmet has come/came)*' due to their assertion that sentences with overtly moved noun phrases are more difficult to produce for the agrammatic speakers in Turkish without taking into consideration the positions of the units in the syntactic tree.

On the matter of pointing out the processing strategies of the Turkish processor, Aydın (2007) also takes the processing of subject and object relative clauses into consideration. Aydin (2007) investigates the processing of subject and object relative clauses in Turkish by L2 (second language) learners and by a few agrammatics through the application of a picture selection task. The study is based on the comparison of the '*structural distance hypothesis* (SDH)' and '*linear distance hypothesis* (LDH)' in terms of the processing difficulty of relative clauses in Turkish. It is hypothesized that in Turkish in which the RCs precede the noun, if the subject relative clauses are comprehended more easily the SDH will be supported, while if a controversial outcome is gathered, LDH will be supported. In Turkish, in deriving a subject relative clause, the DP subject has a shorter way of realizing itself as the final output structurally (the distance between the gap and the filler), although has a longer distance linearly. For the object relative clauses, although the distance is longer structurally, it is shorter linearly. At the end of the study, it has been found out that Turkish L2 learners comprehended subject relative clauses more easily than object relative clauses, which is an indication of SDH. In the group of agrammatics, it is observed that the 'head

errors' made both for subject and object relative clauses are the results of interpreting the first NP in the clause as the agent. Aydın (2007)'s study has the importance in terms of its exploring the processing strategies of the Turkish processor by comparing structural distance based and linear distance based approaches, which seem to be in line with one of the main questions of the present study (the place of the wh-phrase and its effect on the processing load).

Another study, which is also closely related, although not investigating the wh-phrases, to the present study in terms of trying to point out the long distance dependencies with displaced units and the possible gap sites in Turkish is Aydin and Cedden (2010). In their study, Aydin and Cedden (2010) investigate processing of Turkish sentences through reading time measurements. The target sentences in the mentioned study are composed of three different word orders as; SOV sentences, SVO sentences which host post – verbal movements of constituents, and SVO sentences with '*ki*-clauses' in which post – verbal constituents are base generated. The aim of their study is to find out how the filler – gap dependency is processed in cases, in which the gap position is allowed to be located before the filler, like the sentence type (23) just given below in Turkish;

(23) Siz *ti* önermiştiniz [*yarın akşam kaçmamızı*]*i*
You-3rd-pl advise-pst next night run away-subj-gen-3rd-pl
'You advised us to run away next night'

It is stated by Aydin and Cedden (2010) that, the sentences with SVO order including scrambling of the constituents to the post – verbal region have the longest reading times while the sentences with the default order in Turkish (SOV) have the least time of reading. In constructions in which the filler is placed first, the parser adopts a filler based account to process the sentence, but in cases in which the constituents are placed verb finally in SVO structures like the ones in their study, gap precedes the filler, thus the difference between the reading times observed between SOV and SVO (with post – verbal scrambling) sentences should be explained via gap-oriented strategy. The role of theta-role assignment

is excluded due to the absence of a significant difference in reading times between SVO sentences with '*ki*-clauses' and SOV sentences. It has been argued that, if the processing load due to SVO sentences with post-verbal scrambling is due to the theta-role assignment strategy of the main verb, the same effect should have been observed also in SVO sentence with '*ki*-clauses'. It is stated that when the processor reaches the '*ki*-complementizer', the need for theta-role assignment is deleted, so the reason for a processing load in SVO sentences does not stem from unsatisfied theta-role assignment, but from the search for a gap or a filler position. It is further indicated that, in a gap-oriented strategy, the sub-categorization features of the main verb provides the processor with a clue about the gap position which makes it possible for the processor to form the filler – gap chain in the first available position. Finally, the results have been interpreted as an indication of a possible 'active gap strategy'; or the 'minimal chain principle (De Vincenzi, 1991)' proposing a strategy in which the fillers and gaps have the potential to initiate an active search through processing. This study is also important in exploring the potential filler – gap dependency in Turkish which may be observed through the examination of the displaced units which is one of the ways of studying the dependencies, or to pint out the possible traces and their reality in language processing as well relative clause constructions and of course with moved/scrambled wh-phrases.

When we have a look at the experimental way of research conducted on Turkish we see that the wh-question formation has not been a major topic of investigation, which could bear informative insights on long-distance dependencies. But some work on filler – gap dependency has been established through relative clause formation in Turkish as given above. In that respect it is needed to mention another study (Çele and Gürel, 2001), which questions the effects of Turkish, acquired as the first language, on the island constraints on English as the L2. In terms of the processing wh-phrases, Çele and Gürel (2001) study the processing of long distance wh-dependencies in English by comparing speakers of English, Turkish and Spanish. The Turkish and Spanish speakers are L2 learners of English who speak Turkish and Spanish as their acquired first languages, respectively. The aim of their study is concentrated on the comparison of the island effects observed in Turkish and

English; and point out the possible effect of the case-related flexibility in wh-extraction in Turkish, which is not observed in English. It is tested if the L1 Turkish learners will apply an extraction for the English wh-phrases as their first language allows. They conclude at the end of their study that L2 learners are as good as the native speakers in identifying the ungrammatical extractions; and no difference has been observed between L2 learners one group of which has acquired a wh-movement language like Spanish as L1 and the other group of speakers who acquired Turkish as the L1. As a very general outcome, they assert that L2 learners are able to acquire the island constraints in L2 and as a result of this island constraints are found in all languages although the extraction behaviors may vary. It is seen that the above-mentioned study does not examine the processing strategies of the wh-phrases in Turkish.

The instances given above on the formal studies of wh-question formation may give a clue on the ambiguity of specifying the scope relations of wh-phrases in Turkish during processing complex sentences by native speakers. It seems that is not very probable and robust to name the situation as the scrambling property of wh-phrases in Turkish since the reconstruction of the scrambled element is not realized in the landing site, or at least, it causes two different derivations one of which reconstructs the scope relation in the base position while the other one forms totally a new scope relation. While this argument is based on the theoretical framework of the wh-question formation study in Turkish, it must inevitably have a reflection on an experimental psycholinguistic analysis of the phenomenon. As it is going to be argued in the 'hypothesis' section of the present study (2.2.) just below, the argument on the processing strategies of Turkish complex sentences with wh-phrases provides a broad ground to discuss on. The controversial situation of the wh-phrases in complex sentence structure must also be represented on the processing strategies of the Turkish processor which certainly be evaluated through experimental ways which is the major concern of the present study. Whether Turkish processor builds an initial syntactic analysis during reading the sentences in which the embedded and main verbs comes at the end of sentences in a garden-path analysis fashion, or the processor forms the exact structure only when the sentences are totally read taking into consideration the

thematic relations created by the verbs at the end of sentences by constructing a unified, constraint based analysis of the complex sentences with wh-phrases will be discussed. Also the type of the wh-phrase (argument – adjunct), the place of the wh-phrases (in terms of its distance to the first potential licenser (the verb) in the sentences and the effects of the sub-categorization frames of the embedded verbs (transitive – ditransitive) will be the major concerns of the present study in order to point out the processing strategies of the Turkish processor.

In these respects, Turkish seems to provide a very valuable ground for a study, for both testing the universal hypothesis of how the parser works in processing long-distance dependencies with wh-phrases, and how the mechanism works for Turkish native speakers in interpreting ambiguous complex sentences including wh-phrases in different positions.

2.2. HYPOTHESES

As stated in above-sections, garden – path theories and constraint – based theories on processing structural ambiguities in sentences claim different proposals for the parsing strategies of the human parser. According to 'active filler strategy', which is a major component of garden – path theories of parsing, the parser actively searches for a gap position to assign the filler to. If a potential location is specified, the parser immediately associates it with the filler and if the association is realized not to be working, i.e. the location is occupied by another lexical item, a reanalysis is required. On the other hand, constraint – based theories, which are 'thematic role or lexically driven approaches', require that the filler – gap dependency to be formed in the framework of thematic role assignment requirements of an argument with the potential licenser, i.e. a predicate. Following Aoshima et al. (2004) stating that the filler either begins searching for a gap as soon as meeting with a potential predicate, or the fronted filler to start looking for a predicate to assign the thematic role since the thematic role requirement begins as soon as the filler is detected by the processor.

Taking into consideration the verb-final characteristic of Turkish with its flexible organization of case-marked DPs in a complex sentence structure, it is possible to expect a verb-based analysis of fronted wh-fillers in ambiguous complex sentences. Turkish, unlike verb-initial languages, should delay the expectation for a gap until the predicate is recognized, which means that a processing difficulty should be observed in cases in which the fronted wh-filler is located farther from the first predicate (embedded clause verb) in sentences. In the present study, the first word order sentences have the following word order; *subject 1 – wh-word – subject 2 – object – embedded verb – main verb*, while the second word order sentences have a word order like; *subject 1 – subject 2 – wh-word – object – embedded verb – main verb*. It is expected to observe higher 'first fixation', and 'total fixation' durations; and more 'regressive saccades' towards the wh-word in the sentences formed with the first word order in which the fronted wh-word is located outside of the embedded clause when the two word orders are compared. It should also be included at this point that, the influence of the distance of the fronted wh-word from the first verb in the sentence on processing may be bound to – *or at least be affected to some degree by* – the generally accepted processing difference between arguments and adjuncts. Miyamoto and Takahashi (2002) assert that matrix clause wh-questions in Japanese are read more slowly than embedded clause wh-questions if there is no attached Q-particle to the embedded verb. Also, Aoshima et al. (2004) propose that due to an earlier satisfaction of constraints on thematic interpretation and scope licensing in Japanese, fronted wh-words should be associated with an embedded clause. Taking into consideration these proposals as supportive findings on a similar language in terms of word order, it is also possible to expect a verb – based processing strategy for Turkish as to be reflected through the above mentioned measures of eye movements on the mentioned units in the sentences in the present study.

If a divergence on the 'first fixation times' on the wh-words is observed between two word orders (wh-words in the first word order to have longer 'first fixation durations' than the ones in the second word order), a claim on the effect of distance of the fronted wh-filler to

the first verb in the sentence should be considered. The reason for the expectance for an increase on the 'first fixation times' stems from the fact that Turkish is a verb-final language and the processor cannot react to the licensing of the wh-word until the predicate is read. But if the 'first fixation durations' on the wh-words diverge in relation to their places before reading the first predicate in the sentence, then this could mean that the genitive marker on the second subject in the sentence may have an effect for an indication of an embedded clause, although this does not have to be the obligatory case, and if the wh-words in the first word order sentences have longer 'first fixation durations' than the ones in the second word order, the processor may have been affected by the distance between the wh-filler and the first verb during parsing and as a result, the existence of the fronted wh-filler inside the embedded clause may have made it easier to be processed since Turkish, like Japanese, has a tendency to license the fronted wh-phrases inside the embedded clause in Turkish.

Besides the expectance for a processing difficulty linked with the distance of the fronted wh-filler with the first verb in the sentence, the organization of the study makes it possible to analyze the processing strategies of Turkish parsers comparing garden – path theories with constraint – based ones. Garden – path theories of parsing are structure oriented theories of parsing stating that the parser first builds a structure during processing the sentence and the failure of the first structure building, which is realized through ambiguity, is compensated with reanalysis. On the other hand, constraint – based theories indicate that the structural and semantic information is processed simultaneously and the verb information is used also during initial parsing. The present study aims at discovering which strategy the Turkish parser uses during processing complex Turkish sentences with ambiguity, formed with wh-phrases in two different locations. Turkish is a verb final language, and in complex sentence structures, which are used as the target ones in the present study, the embedded verb and the main verb are located at the end of the sentences. The sentences also include an accusative marked DP object in the embedded clause region as shown in the sample sentences given below:

24. Mustafa kime Emel'in soruyu değiştirdiği bildirdi
Mustafa-nom who-dat Emel-gen question-acc change-pst-ind-3rd notify-pst-3rd

25. Mustafa Emel'in kime soruyu verdiğini bildirdi
Mustafa-nom Emel-gen who-dat question-acc give-pst-ind-3rd notify-pst-3rd

First of all, if Turkish parser implies a structure bound parsing mechanism, it will not be possible to detect for the parser if the structure is complex or simple until the accusative marked DP object is read. It is the accusative marked DP object which necessitates the existence of a secondary clause in the sentence which means that the place of the wh-word does not indicate whether it is located inside or outside of the embedded clause; and thus, the place of the wh-word will not help the parser to form either a two-layered or one-layered structure to assign the fronted wh-word with its licenser. But after the accusative marked DP object is processed, the parser has the chance to realize that the structure is bi-clausal and the fronted wh-word may either be licensed inside or outside of the embedded clause. This realization also provides to test which mechanism the Turkish parser applies during processing fronted wh-phrases in complex sentence structure. If a structure oriented parsing mechanism is applied, the processor should have a trouble with ungrammatical sentences in the study, in which the wh-word is inside the embedded clause (following the genitive marked subject and preceding the accusative marked object of the sentence) and in which the embedded verb is a transitive one in the first experiment which tests sentences with fronted wh-arguments as seen in sentence 26 below[8]:

26. *Cemal Demet'in kime kitabı gördüğünü söyledi
Cemal-nom Demet-gen who-dat book-acc see-pst-ind-3rd say-pst-3rd

Sentence 26, which is an instance of the target sentences in the first experiment, is ungrammatical due to the mismatch between the argument structure of the embedded verb

[8] The organization of the sentence sets will be given in detail in sections 3.3., 3.3.1., and 3.4., 3.4.1. in terms of the items and conditions included in each experiment.

(transitive) and the number of the items that need case and thematic role to form a grammatical sentence (two DPs). If the parser in Turkish uses a structure oriented parsing during initial processing, it should have trouble with the first item indicating that the sentence is ungrammatical, and this trouble must be reflected through the initial data on eye tracking. In the present study the 'first fixation durations' are used as a measure of initial processing indicator. In that respect, it is the embedded verb which indicates the ungrammaticality of the sentence, on the other hand, the sentences formed with ditransitive embedded verbs in the same experiment do not cause an ungrammaticality as seen in sentence 27 below:

27.	Alper	Büşra'nın	kime	kitabı	verdiğini	söyledi	
	Alper-nom	Büşra-gen	who-dat	book-acc	give-pst-ind-3rd	say-pst-3rd	

So, if the parser applies a primary syntactic analysis during the initial stage of processing, it should have a trouble as soon as it comes up with the embedded verb immediately in target sentences as exemplified in 26, and a divergence is expected to be observed between conditions formed with transitive embedded verbs (conditions 5 and 6) and conditions formed with ditransitive embedded verbs (conditions 7 and 8). If the parser creates an initial syntactic analysis, it should decide after reading the accusative marked DP object (*kitab[I] – book-[Acc]*) in the following order as seen in brackets; [*Alper Büşra'nın kime kitabı* ___ ___] that the upcoming structure is complex, should build a syntactic structure providing the grammaticality of a complex sentence which is only possible with the existence of a ditransitive embedded verb. Apparently, this would cause an expectance for a ditransitive embedded verb if a primary syntactic analysis is created bound to the structure. If the parser comes up with a transitive verb at this point, the 'first fixation duration', which is considered to give information on the initial parsing mechanism of the processor, on the transitive embedded verb must be higher than the one recorded on ditransitive one comparatively since longer fixation durations are indicators of difficulty in processing. The existence of the transitive verb clashes with the pre-supposed syntactic structure built initially during parsing and this has to be reflected on the processing time of the critical

item. If any divergence is not observed between the 'first fixation durations' on the embedded verbs in conditions 5 and 6 compared to conditions 7 and 8, then it is not possible to hypothesize an initial syntactic parsing decision for Turkish. The critical point to mention here is that the initial syntactic analysis should only be reflected through the 'first fixation durations' on the mentioned items. A possible divergence on the 'total fixation durations' and 'total regression frequencies' on above the target items are supposed to reflect the parser's aim for resolving the ambiguity after reaching the end of the sentence which means that the final items in the sentences (the embedded and the main verbs due to the verb – final nature characteristic of Turkish) have been read and the unsolved ambiguity created a difficulty in the processing of the sentence through a more general perspective. Thus, a potential initial syntactic analysis should be sought by the help of the 'first fixation durations' on the item, which is considered to support or eliminate the expectances created during the initial processing of the sentence while reading.

Moreover, due to an expectance for a verb-based parsing strategy, it is also expected for the processor to have more trouble in the second word order (subject1 – subject2 – wh-phrase – object – embedded verb – main verb) when the embedded clause is formed with a transitive verb than the processing in the first word order in the same environment (i.e. transitive embedded verb with wh-argument). This effect should especially be observed when the fronted wh-word is an argument. In psycholinguistic literature, adjuncts are considered to be more costly for the human sentence processor than arguments due to the divergence between the relationships of arguments and adjuncts with predicates (Liversedge et al., 2003). The distinction between arguments and adjuncts has been studied both formally and experimentally, in terms of processing issues in linguistics. Radford (1988) states that while arguments attribute an aspect of an action, which is central, adjuncts ascribe non-central aspects of an action. Also, through a formal framework, arguments are shown in the theta-grid of a verb, and which is only consisted of arguments, adjuncts are never located in a theta grid of a verb since they are optional elements. It is indicated in Liversedge et al. (2003) that there is a considerable amount of research proposing the existence of a difference between argument and adjunct processing in the costs created for the processor

during processing. Boland and Boehm-Jernigan (1998) studies the impact of lexical constraints on syntactic analyses of ambiguous regions of isolated sentences and propose that adjuncts and arguments are attached via distinct mechanisms. It is indicated that while adjuncts are specified by global syntactic rules, arguments are attached lexically. Moreover, this outcome is interpreted on behalf of the argument for a faster processing while adjuncts are thought to impose bigger processing costs on the processor due to the priority of lexically specified attachments (arguments) over syntactically specified ones (adjuncts). In a parallel fashion, in Liversedge et al. (1998), it is proposed that ambiguous phrases are to be chosen to be processed as arguments initially, but as adjuncts. Also, Ferretti et al. (2001) makes a distinction between thematic roles of 'locations' on the one hand, and 'agents' and 'patients' on the other stating that the former ones are not among the set of immediately primed thematic roles by verbs while the latter ones are. In psycholinguistic literature, there are also studied stating that the difference in the processing of arguments and adjuncts is only due to their relative frequencies, and both of them are lexically specified (MacDonald et al., 1994). According to Kennison (2002) the two different perspectives on sentence processing, the constraint based ones and structurally driven ones, both favor the proposal that arguments are processed more easily and preliminarily, although the mechanims are related to different procedures, in the former one, the recency of the attachment site is considered to be influential, while in the latter one, the type of the verb specifies the expectation of the comprehender. In the present study, the processing of wh-adjuncts are expected to be more costly when two wh-phrase types are compared one by one in the same environments in line with the previous findings, but in a more specific case, in which the wh-word is located inside the embedded clause formed with a transitive verb and with a DP object, wh-argument sentences are thought cost more processing load on the processor. If this expectance is realized, this outcome has also the potential to support the previously proposed verb-based processing strategy for the Turkish parser since embedded verb is the first predicate encountered in the complex sentence structure with ambiguity in Turkish. If the proposal stating that Turkish parser looks for the predicate to license the fronted wh-filler is verified, it should be reflected on the 'fixation durations' and 'regressive saccades' on the embedded verb region when the wh-word is an argument, located inside the

embedded clause formed with a transitive embedded verb. On the contrary, if embedded verb type (transitive/ditransitive) and wh-word type (argument/adjunct) interaction does not give significant divergences on 'first fixation', 'total fixation' and 'regressive saccade frequencies', the proposal claiming that Turkish sentence processor takes the first predicate in the sentence to license the fronted wh-fillers in a clause-boundary sensitive manner, and processing of fronted wh-phrases in Turkish is highly verb-based will be debatable and the problem will have to be discussed through a different perspective.

2.3. RESEARCH QUESTIONS

This study aims at finding answers for the following questions:

1. How are ambiguous complex sentences with fronted wh-phrases are processed in Turkish? Does the Turkish processor make an initial syntactic parsing or is it the syntactic and semantic information provided by the verb, which assigns the scope relations together?

2. Is it the linear distance or the structural distance between the fronted wh-phrase and its gap position in ambiguous complex sentences, which affects the processing strategies of the Turkish parser?

3. When an ambiguity occurs in both orders, does the place of the wh-phrase affect the processing of complex ambiguous sentence type in Turkish? What may be the relevance of this in terms of processing filler-gap dependency in Turkish?

4. Is it possible to hypothesize that the processing of fronted wh-arguments and that of wh-adjuncts are realized in the same way? If a divergence between the processing of wh-arguments and wh-adjuncts is observed, what may be the reason(s) for this difference? To what degree is the transitivity/ditransitivity of the embedded clause verb effective on a possible divergence?

5. Does the argument/adjunct nature of the wh-phrase interact with the sub-categorization frame features of the verbs in Turkish during processing ambiguous complex sentences?

2.4. BOUNDARIES OF THE STUDY

The present study investigates the processing strategies in Turkish complex sentence structure with wh-words. As stated above, the nature of the Turkish wh-phrases is controversial in terms of the scope relations they form in embedded and main clauses; thus, the examination of the processing strategies of the Turkish sentence processor in ambiguous complex sentences related to the scope relations of wh-phrases may provide a valuable ground for research. This study includes two different wh-words; a wh-argument (*kime* 'who-dat') and a wh-adjunct (*ne zaman* 'when'). The reason for implementing both an argument wh-word and an adjunct wh-word is to point out the possible differences in the processing of two wh-words belonging to two different classes in basic sentence formation in relation to both syntactic and semantic criteria of node attachment and licensing. Of course it is not possible to point out the characteristics of all the items in the wh-word inventory of Turkish by examining the above-mentioned two wh-phrases, so the present study is limited to two samples of Turkish wh-words, one from the list of wh-arguments and one from the list of wh-adjuncts. If a broader investigation is carried out covering all the wh-words in the inventory, more fruitful outcomes may be gathered.

Besides the limitation on the number of the wh-words used in the study, the locations of the wh-phrases are limited to two. The first position is the one just before the second subject in the sentence (*subject1 – **wh-word** – subject2 – object – embedded verb – main verb*) and the other one is the location following the subject of the second subject (*subject1 – subject2 – **wh-word** – object – embedded verb – main verb*). These two places are picked up according to their power of ambiguity creating as a result of complex scope relations. Besides these

locations, the wh-words in Turkish may be placed at the very beginning of both a complex, and a simple sentence. Also, the most natural position in Turkish – the verb-initial position – has not been used in the present study. For a future study, the processing recordings of the complex sentences with the wh-words placed in the mentioned positions may be used in order to compare the results of the present investigation, which may provide a broader point of view.

As stated before, the specification of the scrambled wh-phrases in Turkish complex sentence structure is beyond sentence structure, i.e. highly influenced by structures such as context, which is beyond the sentence meaning, and also by intonation contours. The present study tries to point out how the scrambled wh-phrases are processed in ambiguous complex sentences which is a controversial issue in many respects, thus the proposals put forward do not claim to define all the filler – gap dependencies, head – operator chains and issues of LF movement in Turkish as a whole.

CHAPTER 3
METHODOLOGY

The data of this study, which investigates the processing of wh-words forming long – distance dependences in complex sentence structure in Turkish have been gathered through a two-phased eye-tracking experiment session, which will be described and exemplified in detail below. The details of each experiment will be defined in separate sub-sections as 'experiment 1' and 'experiment 2'; and each sub-section will be followed by 'procedure' sections giving the details about the implementation processes of the experiments.

3.1. ABOUT THE BASIC STEPS: EYE-TRACKING AS A WAY OF COLLECTING ON-LINE DATA

Mitchell et al. (2008) state that in psycholinguistic literature, the studies on syntactic processing majorly get the experimental data through two on-line methods; self-paced reading and eye-tracking. Garrod (2006) states that for a psycholinguistic study of language processing, recording the eye movements of a reader during reading a written text provides measuring on-line behavioral dependent variables in linguistic stimuli. It is further indicated that eye-tracking method for gathering written data is the least interfering technique for evaluating the on-line processes, which are at work during reading.

The tracking of eye-movements has produced vast number of results since the end of 1970s and beginning of 1980s (Rayner, 1998). Rayner and Pollatsek (2006) state that eye-movements have been thought to represent one of the best ways for analyzing language comprehension processes, and are the best ways of pointing out the moment-to-moment processing. It is also indicated that the data gathered out of eye-movement recording provide relatively natural data in comparison to other techniques since the procedure of recording during reading is not a component of an artificial task.

Phillips (2001) states that in order to understand parsing strategies, the analysis of eye-movements provides useful source of data. As stated above, relative clauses, and in recent years, wh-phrases have been among major themes investigated in psycholinguistics in order to figure out the cognitive processes in sentence comprehension and interpretation. For pointing out the issues discussed in the realm of psycholinguistic literature eye-tracking method has been used to examine a broad span of linguistic processes from lexical access and resolving lexical ambiguities, to syntactic analysis, and resolution of anaphora, which is related to discourse processing phenomena (Garrod, 2006). It is indicated by Phillips (2001) that among various techniques that psycholinguistics makes use of to obtain data on language processing such as event-related brain potentials (ERPs), self-paced reading tests, cross-modal lexical priming; eye tracking is a widely implemented way of collecting physical, objective, and concrete data. Eye-tracking method, which does not interfere with the normal reading process, is stated to be effective especially in determining without vagueness when the reader makes a decision about some feature of the linguistic input during language processing (Garrod, 2006). It is further indicated by Garrod (2006) that although ERP is also considered to be not interfering with the normal reading process, it is very convenient for the analysis of the processes, which immediately follow presentation of the triggering stimulus since the ERP signal becomes gradually noisy over time which means that it is not a very suitable technique for examining such processes like syntactic reanalysis or integration of a sentence into the discourse context. This proposal for the disadvantage of an ERP study seems like to favor the application of eye-tracking method to be in parallel with the aims of the present study since the resolution of the syntactic ambiguity created by the place of the wh-word in Turkish complex sentence structure seems to highly demand for a syntactic reanalysis of the structure during on-line processing. It should also be indicated that the two of three eye-tracking measurement metrics used in the present study (‘total fixation durations’ and ‘regressive saccade frequencies’) provide outcomes on reanalysis data recorded on the pre-specified areas of interests in the target sentences in accordance with the aims of the present study.

3.2. ANALYSIS OF EYE-TRACKING DATA

Frenck-Mestre (2005) states that the analysis of saccades, fixations and regressions, which are produced by the eyes during reading a sentence or a fragment of text, provide richest accounts in order to answer the questions on processing issues. Taking record of these movements provides a researcher with the availability to reach to an accurate report of the readers' instant syntactic processing and revisions for processing during reading.

In the present study, the 'first fixation' durations, 'total fixation' durations, and 'regressive saccade' frequencies from specified areas of interests to specified areas of interests (AOIs) have been used for analysis and discussion. The sentences were divided into 'areas of interests'. Each area of interest (AOI) has been composed of a unit in the sentence; in other words, each unit in the sentence represents an area of interest as given below:

Alper	Büşra'nın	kime	kitabı	verdiğini	söyledi
AOI1	AOI2	AOI3	AOI4	AOI5	AOI6

The 'first fixation durations', 'total fixation durations' in milliseconds (ms) on each AOI has been recorded during reading, and the 'regressive saccades' made from and to the above-mentioned areas of interests have been counted and total frequencies of regressions have been used as one of three metrics for data evaluation.

3.2.1. Regression Analysis

Rayner and Pollatsek (2006) state that when text is difficult, readers tend to move their eyes back in the text. These backward movements made by the eyes during reading a text or a line, are called regressions. Regressive saccades are the instances of the readers' misanalysis of what they have read and aim at re-reading the text to recover the suitable analysis (Just and Carpenter, 1980). Vitu and McConkie (2000) indicate through a corpus

analysis on novel reading by adults that 15.3% of all saccades[9] were 'regressive' (saccades made backwards). Rayner and Pollatsek (1989:113) state that the reason that the readers make regressive saccades stem from comprehension difficulty, and attempts to solve the comprehension problem, also Mestre (2005) states that the pattern of regressions may give useful information on the difficulty of text processing. It is further indicated by Mitchell et al. (2008) that, although there is not yet a consensus to specify the perfect measurement for quantitative eye-tracking studies, there is no doubt that problems occurred at various levels of linguistic analysis, from graphemic processing and lexical analysis to higher-level discourse processing, may cause regressions, and thus, there is concrete evidence that regressive movements are closely related to problems at syntactic processing.

Rayner (1998) indicate that about 10 – 15 % of the saccades in English are regressions (right to left movements along the line or to the previous line). It is possible to divide regressions as short and long ones. Short regressive saccades are generally a few letters long, which may be the result of a need to proceed efficiently. Whereas long regressive saccades (more than 10 letters spaces back) may stem from the lack of comprehending the text by the reader, and in these circumstances, good readers are very successful at aiming their eyes on the related part of the text, which caused the readers problem during reading.

It is proposed in Frazier and Rayner (1982) that when readers come up with a region that disambiguates a former problem in the sentence, they often regress back to the region which causes a failure in comprehension thanks to their quite a high degree of spatial memory. Besides Frazier and Rayner (1982), Mitchell et al. (2008) assert that there is solid evidence that regressive eye-movements are related to problems in syntactic problems. In their study, which included two separate experiments, Mitchell et al. (2008) observed that the outcomes of the 2nd experiment clearly showed an influence of a linguistic manipulation on the distributions of landing sites of fixations inside the regression sequence. These findings are also discussed to be in harmony with the true spirit of 'Selective Reanalysis

[9] Saccade: Rapid eye-movements made continually during reading, looking at a scene or searching for an object (Rayner, 1998:373).

Hypothesis'. They also conclude with a remark with a need for a further analysis to overcome the challenge to adapt or extend the theories for modelers to explain regression-linked data gathered through eye-movement studies.

In their eye-tracking study on sentences having temporary structural ambiguities, Frazier and Rayner (1982) have found that the regressive saccades of the readers do not get back to the sentence initial position in an automatic fashion, on the contrary, the pattern of regressions are part of a parsing mechanism which aims Selective Reanalysis for a reanalysis attempt, using all the information available about the type of the error made beforehand during reading the sentence.

Another study examining the regressive saccade through eye tracking belongs to Meseguer et al. (2002). Their research, which analyzes the locally ambiguous but globally unambiguous Spanish sentences, is reported to extend Frazier and Rayner's (1982) effort to get evidence for a selective reanalysis strategy, during which the eyes make regressions to an earlier point in the sentence, the structural analysis of which needs a revision. The sentences in the related study have been divided into areas of interests and among the regression analysis, they calculated the regression frequencies made from 'region 9' which includes the last item in the sentences, to each of the other regions in the sentences. As a measure of analysis, they analyzed the 'total movements (TM) from region 9' including the total frequency of saccadic movements made from 'region 9' to each other region, including regressive saccades after the initial one. It is indicated that the evidence about the location of the eye movements during reanalysis comes from the fixation points created by regressions in measure for Region 2 (the main verb) and to a great extend from the frequencies and proportions of first-pass and total movements from Region 9. The major point to be mentioned is also their assertion on the determinant of a regression during reading. They state that whether a regression was made from Region 9 to a region around the beginning of the sentence was what dwells in this location (the content of the mentioned region), but not its position in the first line of the sentences. To sum up, in their study Meseguer et al. (2002) found solid evidence for a selective reanalysis process applied by

the readers in two strategies in order to reanalyze the attachment site of an adverb phrase (AdvP) in the target sentences. In one way of strategy, which is the most commonly used one in the study, carried out by the readers, the eye movements have been directly guided to critical parts of the sentence, which has been interpreted as a process of picking up information about the new attachment site of the AdvP. In the need of an overt reanalysis strategy, the readers' eyes generally returns to the main verb of the sentence most probably to gather more information about the new attachment site of the AdvP, and sometimes, going back to the disambiguating location and then back to the main verb more than once. The less commonly used version has been detected to be covert and interpreted as a preference by the reader to retrieve an alternative attachment site for the AdvP from the memory.

Another study which implements the data on regressions besides first pass reading time and total reading time is Pickering et al. (2000). In their study they investigated two frequency based accounts for sentence processing through implementing three eye-tracking experiment on locally ambiguous sentences. In terms of regressive saccade data, regression-path times in milliseconds have been used according to the duration values and first-pass regressions have been evaluated in terms of frequencies of regressions in pre-specified 'regions' (a.k.a. areas of interests – AOIs) in the sentences and their ratios in each condition. It has been proposed throughout the study (for each of the experiment) that if longer reading times are observed in the sentence belonging to a specific condition, it is also possible to observe more regressions on the mentioned items.

In terms of the contribution of regressive saccade analysis to processing studies, Staub (2010) states that, in the analysis of subject and object relative clause processing in English, earlier studies have shown that there is an increasing difficulty in the processing of object relative clauses which is reflected through ascending regressive eye movements out of an object relative clause and a parallel increase in reading times including fixation durations in the course of regressions. In Staub (2010) the questions; whether the difficulty in reading has occurred at the subject of the object relative clause, or at the verb of the object relative

clause, or both; and if there is any observed difficulty on any one of these items, how it has been reflected were answered. It has been found that on both items a difficulty in processing has been observed but as an answer to the second question of the study, the processing difficulty on these mentioned items have not been represented with the same eye movement behavior. While the processing difficulty on the subject of the object relative clause is reflected through large number of regressive saccades from both the determiner and the noun; the difficulty of processing observed on the object relative clause verb is reflected through inflated first pass reading time, not in the form of regressive saccades. The general interpretation of these outcomes is the suggestion of a two probable factors creating the processing difficulty on object relative clauses as the violation of structural expectations and the processes of memory retrieval.

In Trueswell et al. (1993), regression data has also been used as a metric of eye tracking besides first pass reading times, and first fixation durations in order to analyze the effect of verb-specific syntactic information in the processing of matrix verbs typically used with noun phrase complements in comparison to the processing of verbs typically used with sentence complements. How the reading of the disambiguating region has ended when noun phrase-bias sentences with and without complementizers are compared taking into consideration the regressive eye movements at the end of disambiguating verb phrase region. General outcomes of the study have shown that sentences without any complementizer had explicit reanalysis effects (rereads) when the verb was noun phrase-bias contrary to sentence-bias, and sub-categorization information is used almost immediately after the recognition of the verb. The second outcome is elaborated in the study as a counter-argument for the proposal indicating that lexical specific information is used only after the parser has a problem in processing the syntactic information that is inconsistent with the initial parser and thus lexical information is used to guide syntactic misanalysis. When the second outcome is interpreted in parallel with the aims and problem of the present study, it is possible to assert that the outcome favoring the immediate use of sub-categorization information during parsing may also be at work in processing Turkish complex sentence structure. Due to the verb-final property of Turkish, the parser should

wait for the first verb in the sentence to form the syntactic structure of the sentence, and not a prior structure building is available until the verb region since the case-marked DPs in Turkish provides flexibility in word order and the genitive marker *–(n)In* on the second subject in the sentence does not necessarily mark the beginning of an embedded clause, although which may be just an indication of it.

Rayner and Juhasz (2006) state that during normal reading the readers move forward 85% to 90% of the time while the remaining (10% to 15%) of the time is occupied by regressions and it is clear that regressions can be caused either by comprehension problems or error in the locations where the eyes are directed. In psycholinguistic literature, analysis of regression data gathered through eye-tracking recording during reading a written text has been one of the major metrics of evaluation. It has widely been accepted that the existence of a regression is related to some comprehension failures or difficulties (Rayner and Pollatsek, 2006 for long-distance regressions), or related to the parser's strategies for overcoming a processing difficulty (Frenck-Mestre, 2005). The regression rates during reading have been indicated to increase in the disambiguation regions of sentences (Frazier and Rayner, 1982; Trueswell et al. 1993). While much of the research on eye movement and reading has used fixation time data on a word or on a larger part of a text, the regressions from one part to another or skipping a word in a target text are also frequently examined for psycholinguistic study of processing (Rayner and Pollatsek, 2006).

In regard to the studies and the findings proposed through the examination of regressive eye movements during reading, the regressive saccade frequencies of the readers during reading the target sentence in the present study have been used as one of the metrics for analyzing the eye tracking data. The increases and decreases in the regressive saccade frequencies on the related AOIs have been used to discuss the processing strategies of the Turkish readers during reading complex sentences including wh-words with ambiguity. The outcomes and the possible interpretations of these outcomes on processing strategies of the Turkish parser have been analyzed and discussed in the 'analysis and discussion of the findings' section comprehensively.

3.2.2. Fixation Analysis

Rayner and Pollatsek (2006: 614) state that during reading, eyes do not move on the text or screen or etc. smoothly, but make series of rapid movements which are called 'saccades'. Saccades are separated from 'fixations', which refer to the periods of times when the eyes are relatively still. During saccadic movement, readers do not derive new information from the text (Rayner, 1998). New visual information from the text is just encoded during this phase of 'fixation'. 200 – 250 ms duration is stated to be a typical duration for a fixation although individual fixations may alter as 50 ms to 500 ms during reading. When there is a processing difficulty for the readers it is possible to observed more fixations in terms of frequencies and longer fixations in terms of fixation durations (Liversedge and Findlay, 2000). The duration of fixations, besides the saccadic movement of the eyes, directly reflect the reading processes to be executed easily or with difficulty (Garrod, 2006). As also stated above, much of work on word or sentence processing has paid particular attention on fixation time analysis as well as regression data (Rayner and Pollatsek, 2006).

In psycholinguistic literature, it is possible to come up with different types of fixation data being used as the metrics of evaluation of the data. For instance 'first fixation durations', and 'total fixation durations' are commonly used ones to analyze processing strategies of the parser. 'First fixation duration' relates the duration of the first fixation on a word, or on a pre-specified area of interest (Meseguer et al., 2002; Rayner and Pollatsek, 2006); while the 'total fixation time' relates the sum of the durations of all fixations on a word including regressive saccades which means the tome spent rereading the item after the reader left the word (Rayner and Juhasz, 2006; Rayner and Pollatsek, 2006).

For instance, in Frazier and Rayner (1982) besides the regression frequencies, fixation durations are used as a metric for measurement in pointing out the processing strategies of temporarily ambiguous sentences. In their frequently quoted study, 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. For instance in sentence 28

below, the ‘seems like’ provides the resolution of the ambiguity, and it has longer first fixation duration when ‘this’ is not used:

(28) Since Jay always jogs a mile and a half (this) *seems like* a very short distance to him.

One of the major outcomes of Frazier and Rayner (1982) is the suggestion that the immediate and quickly appearing disturbance in the eye movements could reflect a syntactic processing difficulty. Frenck-Mestre (2005) also indicates that it is possible to distinguish first pass measures (which can include first fixation durations) and second pass measures. With the data on first pass measures, the initial parsing preferences may be derived while with second pass measures, information on the re-analysis strategies of the parser can be gathered.

Pickering et al. (2000) also uses regressive eye movement data along with first fixation durations in order to analyze the two frequency-based accounts of processing (serial lexical-guidance and serial-likelihood) via eye-tracking experiments via the examination of sentences with syntactic ambiguity. In their study, it is proposed that the aim for recovering from the misanalysis has been carried out via a combination of re-fixations on previously read material and via longer fixation on the verb itself.

Trueswell et al. (1993) also use eye movement data along with self-paced reading task in order to compare the constraint-based models of parsing with lexical filtering models. In their study the data on fixation on AOIs have been used as first pass reading times and first fixation durations in order to point out initial processing strategies of the language parser. It is indicated that although total reading times give clear evidence on the use of verb subcategory information, it is not available for differentiating initial and secondary processing (re-reads).

In psycholinguistic literature, it is accepted that in garden-path model (which is a two-stage

model) of sentence processing, lexically specific information is most naturally used in the revision stage, while in constraint-based models verbs are though to have immediate effects in initial processing, that's why the information on initial parsing strategies gathered through the analysis of first fixations is important to analyze the proposed methods for processing.

3.3. THE EXPERIMENTS

In the present study, both 'first fixation durations' on the pre-specified AOIs and 'total fixation durations' on the same AOIs have been used as a metric for the analysis of eye-tracking data along with 'regression data'. 'First fixation durations' are used in order to assess the initial parsing strategies of the Turkish readers in a comparative fashion with the 'total fixation durations' and 'regressive saccade' information, which could give valuable information on the reanalysis strategies of the parser.

3.3.1. Experiment 1

The experiment.1 included 60 items (40 target sentences and 20 filler sentences). The 40 target sentences are 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*). The 20 filler sentences are all simple, declarative sentences, which do not include any wh-word.

8 conditions = 2 word orders × 2 embedded verb types × 2 biasing contexts

Each condition included five different sentences, which make a total of 40 target sentences. Each sentence in the same condition differ only in terms of the embedded verbs, main verbs, subjects and the objects used, but the order, the nature of the embedded verb

(transitivity or ditransitivity) and the biasing context (interrogative, declarative) are the same which, thus increases the statistical validity by enhancing the number of the items to be calculated.

The two word orders used in the first experiment are given below:

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

The two embedded verbs used in the first experiment are given below:

transitive embedded verbs: '*görmek*' (to see)
'*kırmak*' (to break)
'*değiştirmek*' (to change)
'*kaybetmek*' (to lose)
'*bitirmek*' (to finish)

ditransitive embedded verbs: '*vermek*' (to give)
'*götürmek*' (to take)
'*açıklamak*' (to explain)
'*göndermek*' (to send, to transmit)
'*yollamak*' (to send)

The organization of the items set of the first experiment is given in table.1 below:

Condition	Order	Context	Embedded Verb Type	Set	Expected Interpretation
1	s1-wh-s2...	Interrogative	Transitive	A	Obligatorily Interrogative
2	s1-wh-s2...	Declarative	Transitive	B	Obligatorily 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*

Table.1 – Eight conditions – (five target sentences for each)

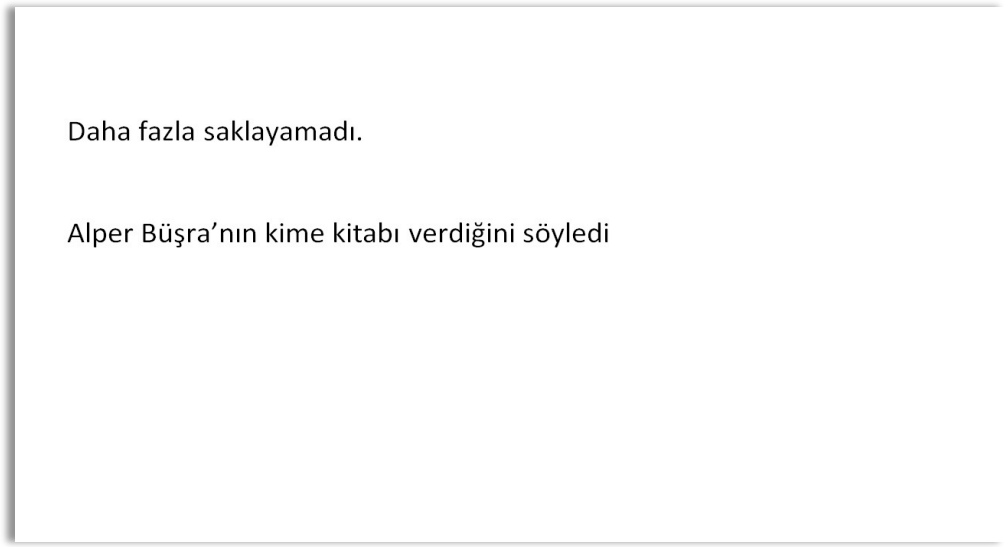
The main verbs used in the experiment are all ditransitive since each item is a complex sentence (composed of two clauses) and are as follow; *söylemek* (to say), *anlatmak* (to tell), *bildirmek* (to notify), *hatırlatmak* (to remind), *duyurmak* (to announce). Each main verb is used with each of the embedded verb type (transitive and ditransitive), and with each biasing context type (interrogative and declarative), and with two different word orders (order.1 and order.2; given above) thus making eight different conditions each of which has been formed with five different main verbs, making a total of 40 trials as the target sentences.

The most prominent part of the experiment.1, which at the same time differentiates it from experiment.2, is the nature of the wh-word. The wh-word used in the first experiment is *kim-e* (who-Dat). Kim (who-Nom) is a wh-argument and arguments need to be licensed in the sub-categorization frames of predicates. In these terms, since complex sentence structure is used (with ditransitive and transitive embedded verbs in embedded clauses) 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-words in complex sentence structure of Turkish.

3.3.1.1. The Procedure of the First Experiment

The first experiment was conducted in two phases in April and May of 2012, at METU HCI lab (Middle East Technical University, Human Computer Interaction Research and Interaction Laboratory) with 30 native speakers of Turkish. The participants were all undergraduates, studying their first, second and third semesters at the department of English Linguistics, University of Hacettepe. The students participated to 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 audio instruction was given to each participant just before the experiment began on the procedure of the experiment session. It was instructed to the participants that they had to read what was appeared on the computer screen silently (first to read the sentence at above, then read the sentence at below) and read it to comprehend. Before the experiment began, each participant's pupils were calibrated with the device. In order to do that, the participants were instructed to follow a red dot appeared on the screen, moving into the far corners. After the calibration session has been completed, the experiment began. During the experiment, the participants saw two sentences on the same screen for each time. The above sentence was the biasing context sentence (either interrogative or declarative biasing) and the below sentence was the target sentence including the wh-word. All the sentences were written on MS word and then converted into jpeg file to be compatible with the eye-tracker software. The characters were written in Calibri font (size 24) in black. The background color was white as seen below:



Out of 40 trial sentences (2 word orders x 2 embedded verb types x 2 biasing contexts = 8 conditions – each condition included five items for enhancing the variability for statistical convenience), 20 filler sentences were used in order to distract the attention of the participants, not to concentrate solely on wh-word configuration. This makes a total of 60 sentences for each participant to read in an experiment session. These 60 sentences were

scattered randomly for each participants' session in order to minimize the effect of cognitive burden to match with the same trial sentences in a strict order, and thus affect the validity of the data.

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 trial 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 direction 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 longest duration for a participant to complete the experiment took 10 minutes and the shortest one took 3 minutes. The mean time of completing the first experiment was 4 minutes 12 seconds. At the end of the experiments session, each value gathered out of the above-mentioned metrics has been transferred to MS Excel (item by item fixation durations, and regression frequencies). Then, independent t-test was applied for the data in order to validate if the discussed outcomes according to the binary divergences between word order type, or embedded verb type, or biasing context type.

3.3.2. Experiment 2

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-word. The wh-word 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 nature of the wh-word are considered. Wh-adjunct does not refer to any entity that exists in the sub-categorization frame of any potential licenser (predicate) and thus helps pointing out the potential influence of the embedded verb type and wh-word interaction during processing, if the processing strategies of the parser has been affected by the sub-categorization of the predicate, and thus a possible tendency to parse the ambiguous complex structure by the help of the predicate, indicating a verb-driven parsing strategy. The items set of the second experiment is composed of 80 items (40 target sentences and 40 filler sentences). The 40 target sentences (trials) are composed of eight conditions as same as the first experiment. The variables are also; 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*). The 20 filler sentences are all simple, declarative sentences, which do not include any wh-word. Eight conditions are derived as seen below;

8 conditions = 2 word orders × 2 embedded verb types × 2 biasing contexts

Each condition included five different sentences, which make a total of 40 target sentences (trials) like the ones in the first experiment. As for the convenience, and in order to provide the coherence among variables, all the embedded (both transitive and di-transitive types) verbs and main verbs in the first experiment also used for the second experiment. Thus, only variable that distinguishes the first and second experiments is the type of the wh-word (wh-argument in the first; wh-adjunct in the second experiment).

The two embedded verbs used in the second experiment are given below:

transitive embedded verbs: ‘*görmek*’ (to see)
‘*kırmak*’ (to break)
‘*değiştirmek*’ (to change)

‘*kaybetmek*’ (to lose)

‘*bitirmek*’ (to finish)

ditransitive embedded verbs: ‘*vermek*’ (to give)

‘*götürmek*’ (to take)

‘*açıklamak*’ (to explain)

‘*göndermek*’ (to send, to transmit)

‘*yollamak*’ (to send)

The organization of the items set of the first experiment is given in table.2 below:

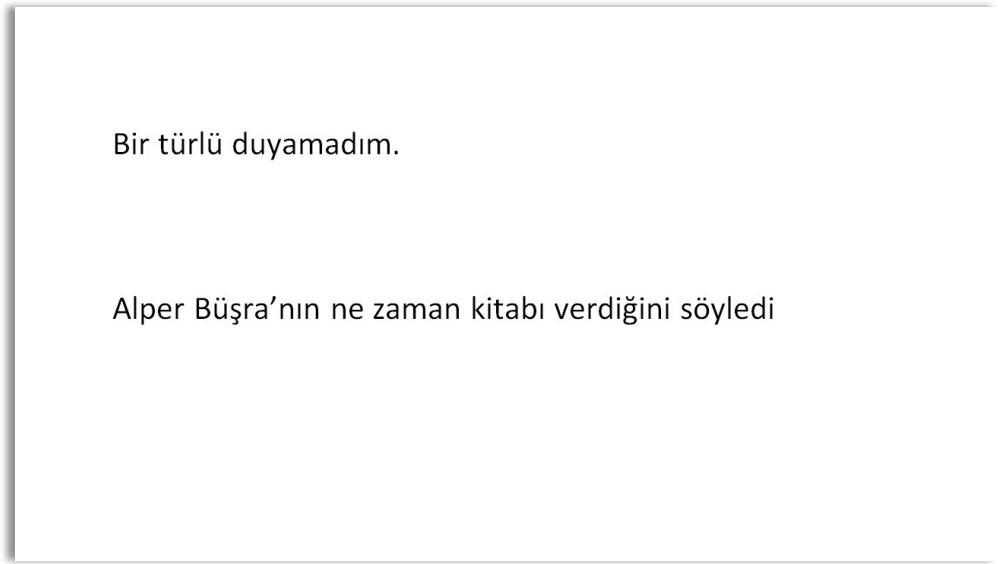
Condition	Order	Context	Embedded Verb Type	Set	Expected Interpretation
1	s1-wh-s2...	Interrogative	Transitive	A	Double
2	s1-wh-s2...	Declarative	Transitive	B	Double
3	s1-wh-s2...	*Interrogative*	*Ditransitive*	*C*	*Double*
4	s1-wh-s2...	*Declarative*	*Ditransitive*	*D*	*Double*
5	s1-s2-wh…	Interrogative	Transitive	A	Double
6	s1-s2-wh…	Declarative	Transitive	B	Double
7	s1-s2-wh…	*Interrogative*	*Ditransitive*	*C*	*Double*
8	s1-s2-wh…	*Declarative*	*Ditransitive*	*D*	*Double*

Table.2 – Eight conditions – (five target sentences for each)

The main verbs used in the second experiment are *söylemek* (to say), *anlatmak* (to tell), *bildirmek* (to notify), *hatırlatmak* (to remind), *duyurmak* (to announce). Each main verb is used with each of the embedded verb type (transitive and ditransitive), and with each biasing context type (interrogative and declarative), and in two different word orders (order.1 and order.2; given above) thus making eight different conditions each of which has been formed with five different main verbs, making a total of 40 trials as the target sentences.

3.3.2.1. The Procedure of the Second Experiment

The second experiment has been accomplished at the same laboratory (METU HCI lab – Middle East Technical University, Human Computer Interaction Research and Interaction Laboratory) in November 2012 in two different sessions. As for the first experiment, 30 undergraduates studying at the Department of English Linguistics, University of Hacettepe administered for the experiment. None of the participants in the first experiment took part for the second one. This inhibited a bias for the trials. The procedure applied in the first experiment was also put into operation for the second experiment. The same script size, font and background color was used for the second experiment (calibri, 24 in size, black colored, white background) as seen below:



Out of 40 target trials, 40 filler sentences have been used to distract the attention of the participants from sentences, which include wh-phrases. The filler sentences include the non-wh-word versions of the target trials. Instead of wh-words (ne zaman (when)), the adverb counterparts for the wh-adjuncts; and noun phrase counterparts for the wh-arguments have been used in the same orders without any biasing context sentence on top of it. This served for both aims. First, the distracter sentence necessity was accomplished, and second, the eye-tracking data on these sentences were gathered through the same areas of interests in order to compare them with the wh-word including trial sentences. By this

way, an availability to understand if the eye-tracking data divergence has been occurred due to the existence of the wh-word or to some other irrelevant factor, have been examined.

CHAPTER 4
ANALYSIS AND DISCUSSION

4.1. ANALYSIS AND DISCUSSION OF THE OUTCOMES OF THE FIRST EXPERIMENT

The experiment is composed of:

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 types of embedded verbs; transitive and ditransitive

two types of biasing contexts; interrogative and declarative.

Condition	Order	Context	Embedded Verb Type	Set	Expected Interpretation
1	s1-wh-s2...	Interrogative	Transitive	A	Obligatorily Interrogative
2	s1-wh-s2...	Declarative	Transitive	B	Obligatorily 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*

Table.3 Eight conditions in the first experiment

As it was indicated in chapter 1, the data collection tool includes 40 target sentences. 20 of these sentences are formed in the first word order, while the other 20 have been formed in the second.

The analysis section will be divided into sub titles each of which will analyze the outcomes of the experiment in terms of the word order effect, and the embedded verb effect. As it was previously indicated in the methodology section, the metrics used in order to analyze

and interpret the findings are regression rates (from source to target regions), total of fixation times and the total of first fixation times.

4.1.1. The Effect of Word Order and the Embedded Verb Type on Interpretation

Although the word order difference is a major determinant on the licensing of the fronted wh-phrases, it is not possible to handle the issue of final interpretation of ambiguous sentences in isolation from the the interaction of the embedded verb type and the biasing context. As it is seen in the table 4 below, the sentences in the first word order have naturally 'obligatorily interrogative – [Q]' and 'double' readings (which have been biased in the study with interrogative and declarative contexts). The divergence between the interpretations of the sentences, although they have the same order, stems from the sub-categorization frame of the embedded verb (transitive or ditransitive), which is another topic being discussed in the study.

Condition	Order	Context	Embedded Verb Type	Expected Interpretation
1	s1-wh-s2...	Interrogative	Transitive	Obligatorily Interrogative
2	s1-wh-s2...	Declarative	Transitive	Obligatorily Interrogative
3	*s1-wh-s2...*	*Interrogative*	*Ditransitive*	*Double*
4	*s1-wh-s2...*	*Declarative*	*Ditransitive*	*Double*

Table.4 Four conditions in the first order of the first experiment

In the first word order, the wh-word is located before the subject of the embedded clause (subject 2). The sentences 29 and 30 given below belong to the group of the first word order, the first of which is formed with a transitive embedded verb while the second one is constructed with a ditransitive one in the embedded clause.

29. Ahmet kime Ayşe'nin kitabı gördüğünü söyledi
Ahmet-nom who-dat Ayşe-gen book-acc see-pst-ind-3rd say-pst-3rd

30. Uğur kime İnci'nin raporu yolladığını duyurdu
Uğur-nom who-dat İnci-gen report-acc send-pst-ind-3rd announce-pst-3rd

In the first word order, in which the wh-word *kime* (who-dat) is located before the embedded clause subject, the scope of the wh-word is inevitably the matrix clause when the embedded verb is a transitive one.

In the second word order, in which the wh-word is located after the embedded clause subject (subject.2), the two versions of the sentences create different final interpretations as seen in the table given below.

Condition	Order	Context	Embedded Verb Type	Set	Expected Interpretation
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*

Table.5 Four conditions in the second order of the first experiment

When the sentence is formed with a transitive embedded verb, it is not an acceptable Turkish sentence (ungrammatical) as seen in sentence 31 below;

31. *Cemal Demet'in kime kitabı gördüğünü söyledi
Cemal-nom Demet-gen who-dat book-acc see-pst-ind-3rd say-pst-3rd

On the other hand, when the embedded verb is a ditransitive one, the sentence is totally grammatical having an ambiguous reading between a matrix question [Q] and declarative [D] interpretations, which is not resolved even at the end of the sentence as seen below;

32. Faruk Esra'nın kime raporu yolladığını duyurdu
Faruk-nom Esra-gen who-dat report-acc send-pst-ind-3rd announce-pst-3rd

As it is seen through the examples and the tables given above, the word order difference, i.e. the place of the wh-word in complex sentence structure, plays a major role in the final interpretations of the sentences having an interaction with the sub-categorization frame of the embedded verb. This divergence should also be reflected on the processing strategies of language users during reading of the mentioned sentences. In order to point out how native Turkish language users process these sentences, eye-tracking data on regression patterns and fixation behaviors will be analyzed.

4.1.2. Analysis of Regressive Saccade Frequency Patterns

The outcomes on regression patterns from main verb to the embedded verb (mv – ev), from main verb to the wh-word (mv – wh), from embedded verb to the object (ev – obj), from embedded verb to the wh-word (ev – wh) and from main verb to the second subject of the sentence (mv – s2) will be given in numbers in a sentence by sentence fashion. Total of 40 target sentences, structured in two different word order types, with two different embedded verb types, and biased with two different contexts will be presented one by one. Each of eight different conditions, as given above, includes five target sentences making a total of 40 different target sentences. The order of presentation of results will be organized according to the order of eight conditions, as from the first condition, to the eighth one. After the raw data on regression patterns in terms of regression frequencies made by the participants from one region to another in a sentence are given, detailed comparative analysis among conditions, i.e. comparison of regression frequencies across word order types, embedded verb types and biasing context types, will be given with analysis and discussion of the outcomes.

The most peculiar divergence on the outcomes according to the word order difference are from main verb to wh-word (mv – wh), from main verb to embedded verb (mv – ev) and from embedded verb to wh-word (ev – wh). Before getting into a comprehensive analysis, it is needed to state that observing the most peculiar divergence on the predicates and the regression behavior from predicates to the wh-word seem to be important for explaining further the processing strategies of complex sentences with wh-words in Turkish.

Sentence by sentence analysis and the outcomes according to regression region types is given below. The first 20 sentences belong to the condition.1, 2, 3, and 4 in which the word order is '*subject.1 – wh-word – subject.2 – object – embedded verb – main verb*'.

Sentence 1 Ahmet kime Ayşe'nin kitabı gördüğünü söyledi

Ahmet-nom who-dat Ayşe-gen book-acc see-pst-ind-3rd say-pst-3rd

Condition: 1

Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Obligatorily interrogative independent from the biasing context

The 30 participants made a total of nine regressions from main verb to embedded verb (mv – ev), 10 regressions from main verb to wh-word (mv – wh), 13 regressions from embedded verb to object (ev – obj), three regressions from embedded verb to wh-word (ev – wh) and three regressions from main verb to subject 2 (mv – s2) in sentence 1.

Sentence 2 Ali kime Aslı'nın oyuncağı kırdığını anlattı
Ali-nom who-dat Aslı-gen toy-acc break-pst-ind-3rd tell-pst-3rd
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Obligatorily interrogative independent from the biasing context

The number of total regressions made by 30 participants during reading sentence 2 is as follows; regression from main verb to embedded verb (mv – ev) is two, regressions from main verb to wh-word (mv – wh) is seven, regressions from embedded verb to object (ev – obj) is eight, regressions from embedded verb to wh-word (ev – wh) is one, and finally regressions from main verb to subject 2 (mv – s2) is eight.

Sentence 3 Mustafa kime Emel'in soruyu değiştirdiğini bildirdi
Mustafa-nom who-dat Emel-gen question-acc change-pst-ind-3rd notify-pst-3rd
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]

Interpretation: Obligatorily interrogative independent from the biasing context

The number of regressions from main verb to embedded verb (mv – ev) in sentence three is 10, regressions from main verb to wh-word (mv – wh) is six, from embedded verb to object is 10 and regression numbers from embedded verb to wh-word (ev – wh) is four while the regression numbers from main verb to the second subject (mv – s2) is also 10.

Sentence 4 Burak kime Burcu'nun mektubu kaybettiğini hatırlattı
Burak-nom who-dat Burcu-gen letter-acc lose-pst-ind-3rd remind-pst-3rd
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Obligatorily interrogative independent from the biasing context

In sentence four, the participants made 10 regressions from main verb to embedded verb (mv – ev), seven regressions from main verb to the wh-word (mv – wh), six regressions from embedded verb to object (ev – obj), two regressions from embedded verb to wh-word (ev – wh) and finally 11 regressions from main verb to the second subject (mv – s2).

Sentence 5 Can kime Pınar'ın raporu bitirdiğini duyurdu
Can-nom who-dat Pınar-gen report-acc complete-pst-ind-3rd anounce-pst-3rd
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Obligatorily interrogative independent from the biasing context

In sentence 5, it is observed that the participants made 13 regressions from main verb to embedded verb (mv – ev), six regressions from main verb to the wh-word (mv – wh), eight

regressions from embedded verb to object (ev – obj), three regressions from embedded verb to wh-word (ev – wh) and finally 11 regressions from main verb to the second subject (mv – s2).

If we sum up the total regression number made in the five target sentences belonging to the first condition (among a total of eight conditions), in which the word order is '*subject.1 – wh-word – subject.2 – object – embedded verb (transitive) – main verb*', the biasing context is '*interrogative [Q]*' and the embedded verb type is '*transitive*', it is seen that the main verb to embedded verb (mv – ev) total regressions is 44, main verb to wh-word (mv – wh) total regressions is 36, embedded verb to object (ev – object) total regressions is 45, embedded verb to wh-word (ev – wh) total regression numbers is 13, and finally main verb to the second subject (mv – s2) total regression number is 43.

Condition 1 regression totals: *mv – ev: 44; mv – wh: 36; ev – obj: 45; ev – wh: 13; mv – s2: 43*.

Condition.1|s1-wh-s2-obj-ev-mv Embedded verb: transitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	44	36	45	13	43

Table.6 – Total number of regressions in five target sentences in condition1

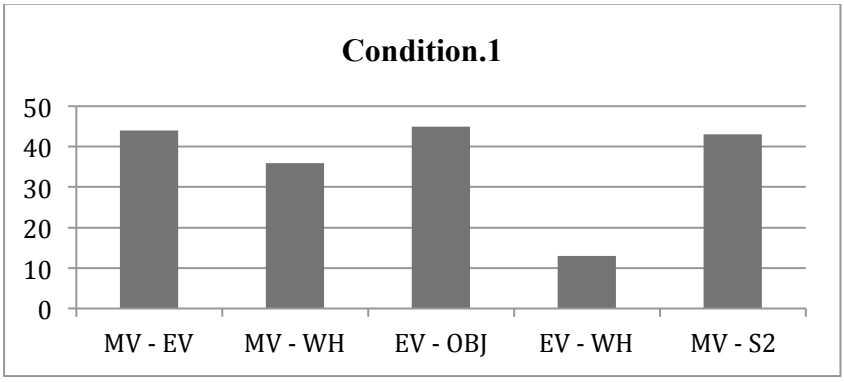


Figure.1 – Total regression frequencies in condition1

Sentence 6 Ahmet kime Ayşe'nin kitabı gördüğünü söyledi
Ahmet-nom who-dat Ayşe-gen book-acc see-pst-ind-3rd say-pst-3rd

Condition: 2

Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Obligatorily interrogative independent from the biasing context

As it is seen above, the sentences belonging to the condition 2 are differentiated from the ones in condition 1 only in terms of the biasing context. While the biasing context is interrogative in condition.1 sentences, it is declarative in the second one. In sentence six above, the main verb to embedded verb (mv – ev) regression frequency is nine, it is seven for main verb to wh-word (mv – wh) regression number, the number of the embedded verb to object (ev – obj) regressions is also seven, while the number of regressions from embedded verb to wh-word (ev – wh) is one; and finally the number of regressions from main verb to the second subject (mv – s2) in the sentence is six.

Sentence 7 Ali kime Aslı'nın oyuncağı kırdığını anlattı
Ali-nom who-dat Aslı-gen toy-acc break-pst-ind-3rd tell-pst-3rd
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Obligatorily interrogative independent from the biasing context

In sentence 7 above, the participants made six regressions from main verb to the embedded verb (mv – ev), five regression from main verb to the wh-word (mv – wh), 11 regressions from embedded verb to the object (ev – obj), three regressions from embedded verb to the wh-word (ev – wh) and eight regressions from main verb to the second subject (mv – s2).

Sentence 8 Mustafa kime Emel'in soruyu değiştirdiğini bildirdi
Mustafa-nom who-dat Emel-gen question-acc change-pst-ind-3rd notify-pst-3rd
Condition: 2

Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Obligatorily interrogative independent from the biasing context

In sentence 8 above, the participants made 11 regressions from main verb to the embedded verb (mv – ev), four regressions from main verb to the wh-word (mv – wh), five regressions from embedded verb to the object (ev – obj), five regressions from embedded verb to the wh-word (ev – wh), and finally six regressions from main verb to the second subject (mv – s2).

Sentence 9 Burak kime Burcu'nun mektubu kaybettiğini hatırlattı
Burak-nom who-dat Burcu-gen letter-acc lose-pst-ind-3rd remind-pst-3rd
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Obligatorily interrogative independent from the biasing context

In sentence 9 given above seven regressions from main verb to the embedded verb (mv – ev) have been made by the participants. The number of the regressions from main verb to the wh-word (mv – wh) is 11, while it is five for embedded verb to the object (ev – obj) regressions frequency. The number of regressions from main verb to the second subject of the sentence (mv – s2) is seven. Finally, it is observed that the participants made no regressions from embedded verb to the wh-word (ev – wh) in sentence 9.

Sentence 10 Can kime Pınar'ın raporu bitirdiğini duyurdu
Can-nom who-dat Pınar-gen report-acc complete-pst-ind-3rd anounce-pst-3rd
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb

Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Obligatorily interrogative independent from the biasing context

In sentence 10 above, the participants made eight regressions from main verb to the embedded verb (mv – ev), five regressions from main verb to the wh-word (mv – wh), 10 regressions from embedded verb to the object (ev – obj), three regressions from embedded verb to the wh-word (ev – wh), and finally seven regressions from main verb to the second subject of the sentence.

When we have a general look at the total regression numbers made in the five target sentences belonging to the second condition (among a total of eight conditions), in which the word order is '*subject.1 – wh-word – subject.2 – object – embedded verb (transitive) – main verb*', the biasing context is '*declarative [D]*' and the embedded verb type is '*transitive*', it is seen that the main verb to embedded verb (mv – ev) total regressions is 41, main verb to wh-word (mv – wh) total regressions is 32, embedded verb to object (ev – object) total regressions is 38, embedded verb to wh-word (ev – wh) total regression numbers is 12, and finally main verb to the second subject (mv – s2) total regression number is 34.

Condition 2 regression totals: *mv – ev: 41; mv – wh: 32; ev – obj: 38; ev – wh: 12; mv – s2: 34*.

Condition.2|s1-wh-s2-obj-ev-mv Embedded verb: transitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	41	32	38	12	34

Table.7 – Total number of regressions in five target sentences in condition 2

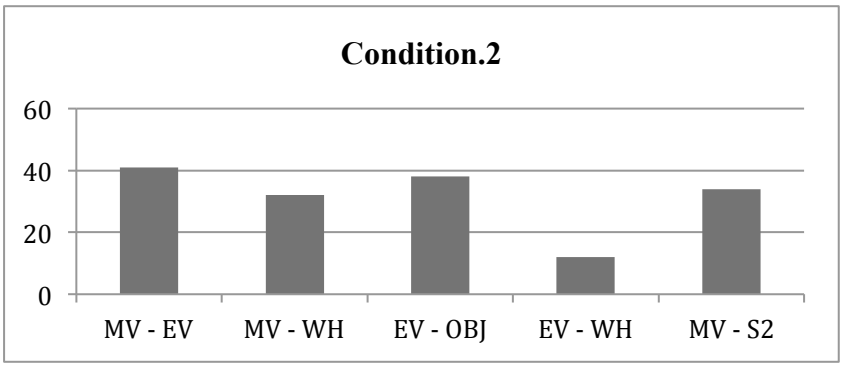


Figure.2 – Total regression frequencies in condition 2

Sentence 11 Can kime Zeynep'in kitabı verdiğini söyledi
Can-nom who-dat Zeynep-gen book-acc give-pst-ind-3rd say-pst-3rd
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double reading

The total regression numbers made by participants in sentence 11 is as follows; regressions form main verb to the embedded verb (mv – ev) is two, from main verb to the wh-word (mv – wh) is seven, from embedded verb to the object (ev – obj) is four, from embedded verb to the wh-word (ev – wh) is four, and finally from main verb to the second subject of the sentence (mv – s2) is nine.

Sentence 12 Emre kime Ece'nin oyuncağı götürdüğünü anlattı
Emre-nom who-dat Ece-gen toy-acc take-pst-ind-3rd tell-pst-3rd
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double reading

In sentence 12, the participants made nine main verb to embedded verb (mv – ev) regressions, six main verb to wh-word (mv – wh) regressions, 12 embedded verb to object (ev – obj) regressions, three embedded verb to wh-word (ev – wh) regressions and seven main verb to subject.2 (mv – s2) regressions in total.

Sentence 13 Barış kime Yeliz'in soruyu açıkladığını bildirdi
Barış-nom who-dat Yeliz-gen question-acc explain-pst-ind-3rd notify-pst-3rd
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double reading

The participants made 13 main verb to embedded verb (mv – ev), five main verb to wh-word (mv – wh), five embedded verb to object (ev – obj), two embedded verb to wh-word (ev – wh), and finally five main verb to the second subject (mv – s2) regressions in sentence 13.

Sentence 14 Murat kime Özge'nin mektubu gönderdiğini hatırlattı
Murat-nom who-dat Özge-gen letter-acc send-pst-ind-3rd remind-pst-3rd
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double reading

In sentence 14 above, it is seen that the participants made main verb to embedded verb (mv – ev) regression for 14 times, from main verb to wh-word (mv – wh) regression for six times, from embedded verb to object (ev – obj) regression for seven times. The number of

from embedded verb to wh-word (ev – wh) regression frequencies is one, while the regression numbers from main verb to subject.2 (mv – s2) is eight.

Sentence 15 Uğur kime İnci'nin raporu yolladığını duyurdu
Uğur-nom who-dat İnci-gen report-acc send-pst-ind-3rd anounce-pst-3rd
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double reading

In sentence 15 above, the participants made form main verb to embedded verb (mv – ev) regression for 10 times, from main verb to wh-word (mv – wh) regression for nine times, from embedded verb to object (ev – obj) regression for two times, from embedded verb to wh-word (ev – wh) regression for three times and finally the main verb to the second subject (mv – s2) regression for five times in total.

Through a general look at the total regression numbers produces in the five target sentences formed in condition three, in which the word order is '*subject.1 – wh-word – subject.2 – object – embedded verb (ditransitive) – main verb*', the biasing context is '*interrogative [Q]*' and the embedded verb type is '*ditransitive*', it is observed that the main verb to embedded verb (mv – ev) total regression frequency is 48, main verb to wh-word (mv – wh) total regression numbers is 33, the embedded verb to object (ev – obj) total regression numbers is 30, the embedded verb to wh-word (ev – wh) total regression frequencies is 13 and finally the total of regressions from main verb to the second subject of the sentence (mv – s2) is 34.

Condition 3 regression totals: *mv – ev: 48; mv – wh: 33; ev – obj: 30; ev – wh: 13; mv – s2: 34*.

Condition.3|s1-wh-s2-obj-ev-mv Embedded verb: ditransitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	48	33	30	13	34

Table.8 – Total number of regressions in five target sentences in condition 3

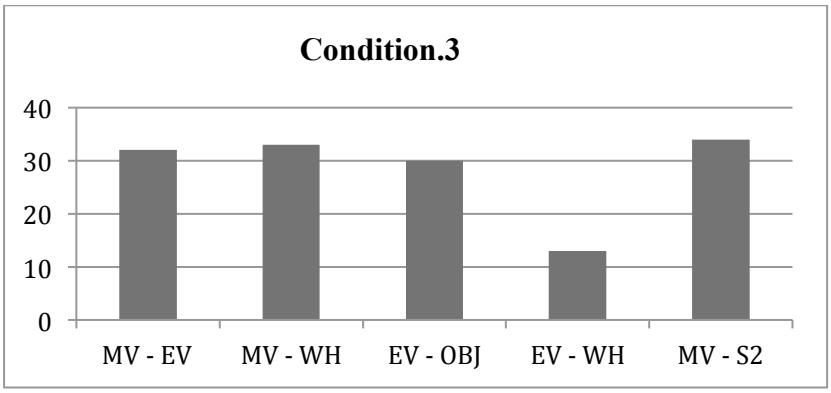


Figure.3 – Total regression frequencies in condition 3

Sentence 16 Can kime Zeynep'in kitabı verdiğini söyledi
Can-nom who-dat Zeynep-gen book-acc give-pst-ind-3rd say-pst-3rd

Condition: 4

Word order: s1 – wh-word – s2 – object – embedded verb – main verb

Embedded verb type: Ditransitive

Biasing context: Declarative [D]

Interpretation: Double reading

In sentence 16 above, which belongs to the fourth condition, the participants made four main verb to embedded verb (mv – ev) regressions, seven main verb to wh-word (mv – wh) regressions, nine embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions and finally four main verb to subject 2 (mv – s2) regressions in total.

Sentence 17 Emre kime Ece'nin oyuncağı götürdüğünü anlattı
Emre-nom who-dat Ece-gen toy-acc take-pst-ind-3rd tell-pst-3rd

Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double reading

In sentence 17 above, it is observed that the number of regressions from main verb to the embedded verb (mv – ev) is eight, the number of regressions from main verb to the wh-word (mv – wh) is six, while it is seven for embedded verb to object (ev – obj) regression pattern. The frequencies of embedded verb to wh-word (ev – wh) regressions and main verb to the second subject of the sentence (mv – s2) regressions are both two.

Sentence 18 Barış kime Yeliz'in soruyu açıkladığını bildirdi
Barış-nom who-dat Yeliz-gen question-acc explain-pst-ind-3rd notify-pst-3rd
Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double reading

In sentence 18 above, the participants made 11 main verb to embedded verb (mv – ev) regressions, six main verb to wh-word (mv – wh) regressions, five embedded verb to object (ev – obj) regressions, four embedded verb to wh-word (ev – wh) regressions, and finally eight main verb to subject 2 (mv – s2) regressions in total.

Sentence 19 Murat kime Özge'nin mektubu gönderdiğini hatırlattı
Murat-nom who-dat Özge-gen letter-acc lose-pst-ind-3rd remind-pst-3rd
Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive

Biasing context: Declarative [D]
Interpretation: Double reading

The number of the regressions made by the participants from main verb to the embedded verb (mv – ev) in sentence 19 is seven, from main verb to wh-word (mv – wh) is nine, from embedded verb to object (ev – obj) is five, from embedded verb to wh-word (ev – wh) is one and the number of the regressions from main verb to the second subject of the sentence (mv – s2) is three in total.

Sentence 20 Uğur kime İnci'nin raporu yolladığını duyurdu
Uğur-nom who-dat İnci-gen report-acc send-pst-ind-3rd anounce-pst-3rd
Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double reading

In the 20th sentence above, the participants made two main verb to embedded verb (mv – ev) regressions, six main verb to wh-word (mv – wh) regressions, eight embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and finally three main verb to subject 2 (mv – s2) regressions in total.

When we have a look at the total of five sentences belonging to condition four, which has sentences in the following word order; '*subject.1 – wh-word – subject.2 – object – embedded verb (ditransitive) – main verb',* has a *declarative [D]* biasing context, and has a '*ditransitive*' embedded verb type, it is seen that the total number of regressions from main verb to the embedded verb (mv – ev) is 32, from main verb to the wh-word (mv – wh) is 34, from embedded verb to the object (ev – obj) is also 34, from embedded verb to the wh-word (ev – wh) is 10 and finally from main verb to the second subject of the sentence (mv – s2) is 20.

Condition 4 regression totals: *mv – ev: 32; mv – wh: 34; ev – obj: 34; ev – wh: 10; mv – s2: 20.*

Condition.4|s1-wh-s2-obj-ev-mv Embedded verb: ditransitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	32	34	34	10	20

Table.9 – Total number of regressions in five target sentences in condition 4

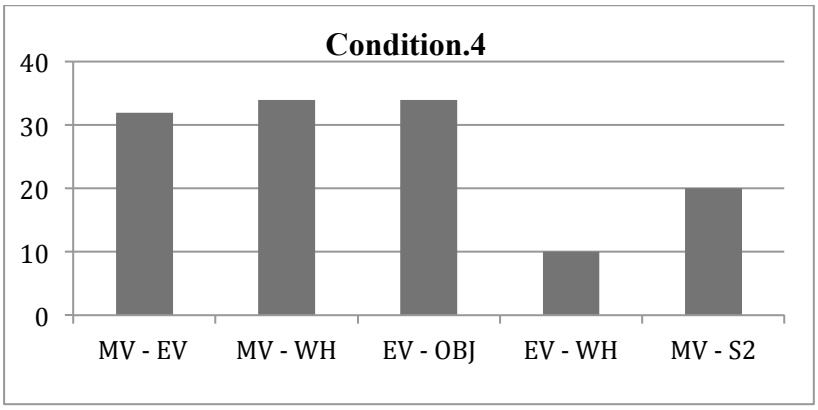


Figure.4 – Total regression frequencies in condition 4

The second set of sentences is composed of 20 sentences (from 21 to 40) belonging to the conditions 5, 6, 7, and 8 with the word order '*subject.1 – subject.2 – wh-word – object – embedded verb – main verb*'. The regression patterns produced during reading of these sentences by 30 participants are given below:

Sentence 21 Cemal Demet'in kime kitabı gördüğünü söyledi
Cemal-nom Demet-gen who-dat book-acc see-pst-ind-3rd say-pst-3rd

Condition: 5

Word order: s1 – s2 – wh-word – object – embedded verb – main verb

Embedded verb type: Transitive

Biasing context: Interrogative [Q]

Interpretation: Ungrammatical

In sentence 21 above, the participants made 10 main verb to embedded (mv – ev) regressions, three main verb to wh-word (mv – wh) regressions, 11 embedded verb to

object (ev – obj) regressions, eight embedded verb to wh-word (ev – wh) regressions, and finally three main verb to subject 2 (mv – s2) regressions in total.

Sentence 22 Mehmet Gülden'in kime oyuncağı kırdığını anlattı
Mehmet-nom Gülden-gen who-dat toy-acc break-pst-ind-3rd tell-pst-3rd
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Ungrammatical

In sentence 22, the total number of regressions made from main verb to the embedded verb (mv – ev) is 10, the number of regressions from main verb to the wh-word (mv – wh) is two, the number of regressions from embedded verb to the object (ev – obj) is 12, the number of regressions from embedded verb to the wh-word (ev – wh) is two and finally the number of regressions from main verb to the second subject of the sentence (mv – s2) is 12.

Sentence 23 Selçuk Eda'nın kime soruyu değiştirdiğini bildirdi
Selçuk-nom Eda-gen who-dat question-acc change-pst-ind-3rd notify-pst-3rd
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Ungrammatical

In sentence 23 above, the participants made three main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, 12 embedded verb to object (ev – obj) regressions, five embedded verb to wh-word (ev – wh) regressions and finally made 12 main verb to subject 2 (mv – s2) regressions in total.

Sentence 24 Özgür Funda'nın kime mektubu kaybettiğini hatırlattı
Özgür-nom Funda-gen who-dat letter-acc lose-pst-ind-3rd remind-pst-3rd
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Ungrammatical

The participants made 10 main verb to embedded verb (mv – ev) regressions, four main verb to wh-word (mv – wh) regressions, eight embedded verb to object (ev – obj) regressions, four embedded verb to wh-word (ev – wh) regressions, and finally 10 main verb to second subject of the sentence (mv – s2) regressions in total during reading sentence 24 given above.

Sentence 25 Serkan Fatma'nın kime raporu bitirdiğini duyurdu
Serkan-nom Fatma-gen who-dat report-acc complete-pst-ind-3rd anounce-pst-3rd
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Ungrammatical

In sentence 25 above, the participants made a total of five main verb to embedded verb (mv – ev), two main verb to wh-word (mv – wh), four embedded verb to object (ev – obj), one embedded verb to wh-word (ev – wh), and finally six main verb to subject 2 (mv – s2) regressions.

When we have a general look at the total outcomes of regression numbers made during reading the five sentences belonging to the condition.5 in which the word order is '*subject.1 – subject.2 – wh-word – object – embedded verb (transitive) – main verb*', the embedded

verb type is '*transitive*' and the biasing context is '*interrogative [Q]*', it is seen that the total number of regressions from main verb to the embedded verb (mv – ev) is 38, the total number of regressions from main verb to the wh-word (mv – wh) is 13, the total number of the regressions from embedded verb to the object (ev – obj) is 47, the total number of the regressions from embedded verb to the wh-word (ev – wh) is 20, and finally the total number of the regressions from main verb to the second subject of the sentence (mv –s2) is 43.

Condition 5 regression totals: *mv – ev: 38; mv – wh: 13; ev – obj: 47; ev – wh: 20; mv – s2: 43*.

Condition.5|s1-s2-wh-obj-ev-mv Embedded verb: transitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	38	13	47	20	43

Table.10 – Total number of regressions in five target sentences in condition 5

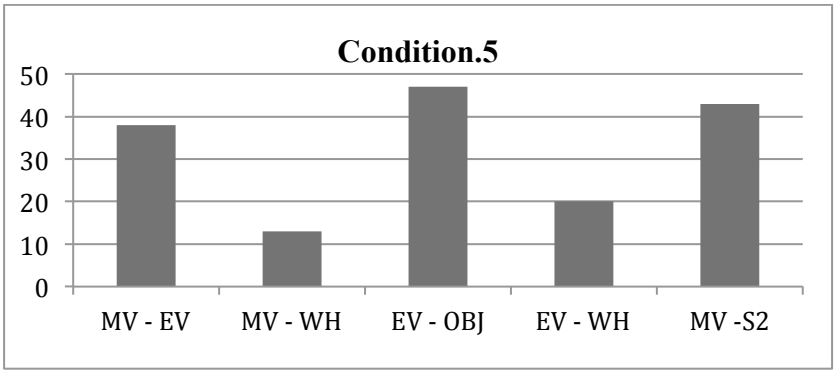


Figure.5 – Total regression frequencies in condition 5

Sentence 26 Cemal Demet'in kime kitabı gördüğünü söyledi
Cemal-nom Demet-gen who-dat book-acc see-pst-ind-3rd say-pst-3rd

Condition: 6

Word order: s1 – s2 – wh-word – object – embedded verb – main verb

Embedded verb type: Transitive

Biasing context: Declarative [D]

Interpretation: Ungrammatical

In sentence 26 above, the participants made 12 main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, 14 embedded verb to object (ev – obj) regressions, five embedded verb to wh-word (ev – wh) regressions, and finally, seven main verb to subject 2 (mv – s2) regressions in total.

Sentence 27 Mehmet Gülden'in kime oyuncağı kırdığını anlattı
Mehmet-nom Gülden-gen who-dat toy-acc break-pst-ind-3rd tell-pst-3rd
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Ungrammatical

The participants made seven main verb to embedded verb (mv – ev) regression in sentence 27 above. The number of the regressions from main verb to the wh-word (mv – wh) is four, embedded verb to object (ev – obj) is 11, embedded verb to wh-word (ev – wh) is seven, and finally the number of the regressions made from main verb to the second subject of the sentence (mv – s2) is eight.

Sentence 28 Selçuk Eda'nın kime soruyu değiştirdiğini bildirdi
Selçuk-nom Eda-gen who-dat question-acc change-pst-ind-3rd notify-pst-3rd
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Ungrammatical

In sentence 28 above, the participants made six main verb to embedded verb (mv – ev) regressions, three main verb to wh-word (mv – wh) regressions, 11 embedded verb to

object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and finally, 10 main verb to second subject (mv – s2) regression in total.

Sentence 29 Özgür Funda'nın kime mektubu kaybettiğini hatırlattı
Özgür-nom Funda-gen who-dat letter-acc lose-pst-ind-3rd remind-pst-3rd
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Ungrammatical

The number of main verb to embedded verb (mv – ev) regressions made by the participants in sentence 29 is seven, while the number of regressions from main verb to the wh-word (mv – wh) is three, the number of regressions from embedded verb to the object (ev – obj) is 12, the number of regressions from embedded verb to the wh-word (ev – wh) is one and finally the number of regressions from main verb to the second subject of the sentence (mv – s2) is seven.

Sentence 30 Serkan Fatma'nın kime raporu bitirdiğini duyurdu
Serkan-nom Fatma-gen who-dat report-acc complete-pst-ind-3rd anounce-pst-3rd
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Ungrammatical

The participants made six main verb to embedded verb (mv – ev), four main verb to the wh-word (mv – wh), nine embedded verb to object (ev – obj), three embedded verb to wh-word (ev – wh) and finally 10 main verb to subject.2 regressions in sentence 30 given above.

If we have a general look at the total numbers of regressions made during reading the five sentences belonging to the condition.6, in which the word order is '*subject.1 – subject.2 – wh-word – object – embedded verb (transitive) – main verb*', the embedded verb type is '*transitive*' and the biasing context is '*declarative [D]*', it is seen that the total number of regressions from main verb to the embedded verb (mv – ev) is 38, the total number of regressions from main verb to the wh-word (mv – wh) is 16, the total number of the regressions from embedded verb to the object (ev – obj) is 57, the total number of the regressions from embedded verb to the wh-word (ev – wh) is 17, and finally the total number of the regressions from main verb to the second subject of the sentence (mv –s2) is 42.

Condition 6 regression totals: *mv – ev: 38; mv – wh: 16; ev – obj: 57; ev – wh: 17; mv – s2: 42*.

Condition.6|s1-s2-wh-obj-ev-mv Embedded verb: transitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	38	16	57	17	42

Table.11 – Total number of regressions in five target sentences in condition 6

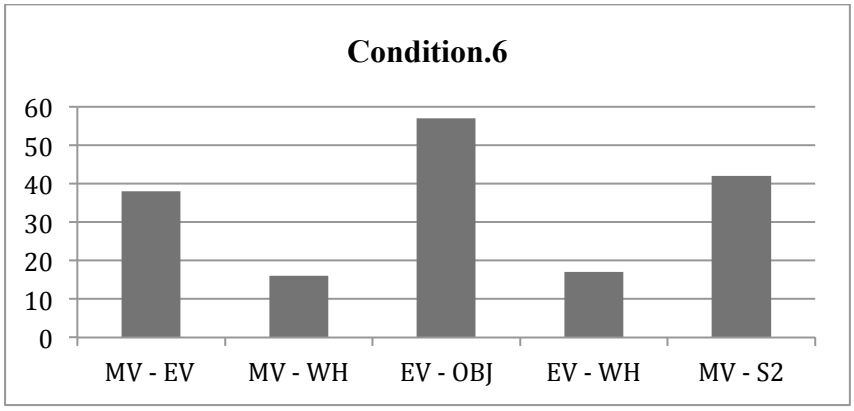


Figure.6 – Total regression frequencies in condition 6

Sentence 31 Alper Büşra'nın kime kitabı verdiğini söyledi
Alper-nom Büşra-gen who-dat book-acc give-pst-ind-3rd say-pst-3rd

Condition: 7

Word order: s1 – s2 – wh-word – object – embedded verb – main verb

Embedded verb type: Ditransitive

Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 31, the participants made three main verb to embedded verb (mv – ev) regression, six main verb to wh-word (mv – wh) regression, four embedded verb to object (ev – obj) regression, three embedded verb to wh-word (ev – wh) regression, and finally, seven main verb to the second subject of the sentence regression in total.

Sentence 32 Fatih Sevgi'nin kime oyuncağı götürdüğünü anlattı
Fatih-nom Sevgi-gen who-dat toy-acc take-pst-ind-3rd tell-pst-3rd
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 32 above, the number of regressions from main verb to the embedded verb (mv – ev) is seven, the number of regressions from main verb to the wh-word (mv – wh) is six, from embedded verb to the object (ev – obj) is 13, from embedded verb to the wh-word (ev – wh) is two and finally the number of regressions made by the participants from main verb to the second subject of the sentence (mv – s2) is nine.

Sentence 33 Gökhan Seda'nın kime soruyu açıkladığını bildirdi
Gökhan-nom Seda-gen who-dat question-acc explain-pst-ind-3rd notify-pst-3rd
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 33 above, the participants made three main verb to embedded verb (mv – ev) regressions, seven main verb to wh-word (mv – wh) regressions, 10 embedded verb to object (ev – obj) regressions, four embedded verb to wh-word (ev – wh) regressions and finally three main verb to subject.2 (mv – s2) regressions in total.

Sentence 34 Mert Ezgi'nin kime mektubu gönderdiğini hatırlattı
Mert-nom Ezgi-gen who-dat letter-acc send-pst-ind-3rd remind-pst-3rd
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

The participants made five main verb to embedded verb (mv – ev) regressions, three main verb to wh-word (mv – wh) regressions, seven embedded verb to object (ev – obj) regressions, three embedded verb to wh-word (ev – wh) regressions, and finally seven main verb to subject 2 (mv – s2) regressions in sentence.37 above in total.

Sentence 35 Faruk Esra'nın kime raporu yolladığını duyurdu
Faruk-nom Esra-gen who-dat report-acc send-pst-ind-3rd anounce-pst-3rd
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 35 above, the participants made two main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, three embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions and finally seven main verb to second subject of the sentence (mv – s2) regressions in total.

Through a general look at the total numbers of regressions the participants made during reading the five sentences belonging to the 7th condition, in which the word order is '*subject.1 – subject.2 – wh-word – object – embedded verb (ditransitive) – main verb*', the embedded verb type is 'di*transitive*' and the biasing context is '*interrogative [Q]*', it is observed that the total number of regressions from main verb to the embedded verb (mv – ev) is 20, the total number of regressions from main verb to the wh-word (mv – wh) is 21, the number of regressions made from embedded verb to the object (ev – obj) is 37, the total number of regressions from embedded verb to the wh-word (ev – wh) 14 and finally, the total number of regressions made from main verb to the second subject of the sentences (mv – s2) is 36.

Condition 7 regression totals: *mv – ev: 20; mv – wh: 21; ev – obj: 37; ev – wh: 14; mv – s2: 36*.

Condition.7|s1-s2-wh-obj-ev-mv Embedded verb: ditransitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	20	21	37	14	36

Table.12 – Total number of regressions in five target sentences in condition 7

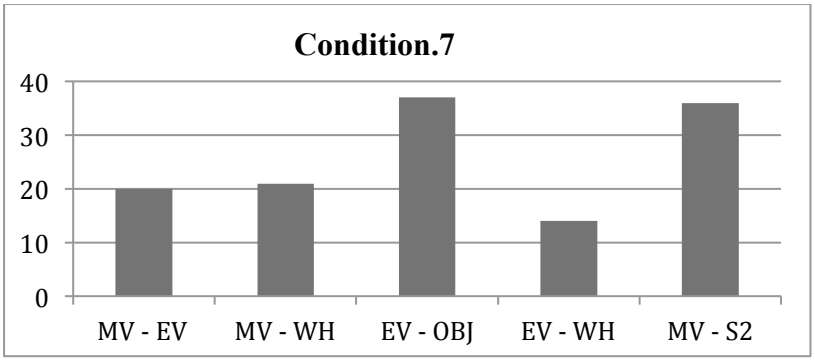


Figure.7 – Total regression frequencies in condition 7

Sentence 36 Alper Büşra'nın kime kitabı verdiğini söyledi
Alper-nom Büşra-gen who-dat book-acc give-pst-ind-3rd say-pst-3rd

Condition: 8

Word order: s1 – s2 – wh-word – object – embedded verb – main verb

Embedded verb type: Ditransitive

Biasing context: Declarative [D]
Interpretation: Double

The participants made four main verb to embedded verb (mv – ev) regressions, one main verb to wh-word (mv – wh) regression, six embedded verb to object (ev – obj) regression, four embedded verb to wh-word (ev – wh) regression, and finally three main verb to subject.2 (mv – s2) regression in total, during reading sentence 36 in the experiment.

Sentence 37 Fatih Sevgi'nin kime oyuncağı götürdüğünü anlattı
Fatih-Nom Sevgi-Gen who-Dat toy-Acc take-Pst-Ind-3rd tell-Pst-3rd
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 37 above, the number of the regressions made from main verb to the embedded verb (mv – ev) is eight, made from main verb to the wh-word (mv – wh) is three, made from embedded verb to the object (ev – obj) is eight, made from embedded verb to the wh-word (ev – wh) is two, and finally the regressions made from main verb to the 2nd subject of the sentence (mv – s2) is six.

Sentence 38 Gökhan Seda'nın kime soruyu açıkladığını bildirdi
Gökhan-Nom Seda-Gen who-Dat question-Acc explain-Pst-Ind-3rd notify-Pst-3rd
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 38 above, the participants made 13 main verb to embedded verb (mv – ev) regressions, five main verb to wh-word (mv – wh) regressions, 11 embedded verb to object (ev – obj) regressions, three embedded verb to wh-word (ev – wh) regressions, and finally three main verb to subject 2 (mv- s2) regressions in total.

Sentence 39 Mert Ezgi'nin kime mektubu gönderdiğini hatırlattı
Mert-Nom Ezgi-Gen who-Dat letter-Acc send-Pst-Ind-3rd remind-Pst-3rd
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

The participants made seven main verb to embedded verb (mv – ev) regressions, five main verb to wh-word (mv – wh) regressions, four embedded verb to object (ev – obj) regressions, and six main verb to subject.2 (mv – s2) regressions in sentence 39 above. No regression from embedded verb to the wh-word (ev – wh) was observed during reading sentence 39.

Sentence 40 Faruk Esra'nın kime raporu yolladığını duyurdu
Faruk-Nom Esra-Gen who-Dat report-Acc send-Pst-Ind-3rd anounce-Pst-3rd
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 40 above, the participants made seven main verb to embedded verb (mv – ev) regressions, five main verb to wh-word (mv – wh) regressions, four embedded verb to

object (ev – obj) regressions, and six main verb to subject 2 (mv – s2) regressions while they did not make any regression from embedded verb to the wh-word (ev – wh).

After checking all the regression patterns of five target sentences belonging to condition.8 which has the following word order; '*subject.1 – subject.2 – wh-word – object – embedded verb (ditransitive) – main verb*', has a *'ditransitive'* embedded verb in the embedded clause, and has a *'declarative [D]'* biasing context, it is seen that the total number of regressions made from main verb to the embedded verb (mv – ev) is 34, the frequency of regressions made from main verb to the wh-word (mv – wh) is 18, the total number of regressions from embedded verb to the object (ev – obj) is 36, the total number of regressions from embedded verb to the wh-word (ev – wh) is nine, and finally the total number of regressions from main verb to the second subject of the sentence (mv – s2) is 24.

Condition 8 regression totals: *mv – ev: 34; mv – wh: 18; ev – obj: 36; ev – wh: 9; mv – s2: 24*.

Condition.7|s1-s2-wh-obj-ev-mv Embedded verb: ditransitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	34	18	36	9	24

Table.13 – Total number of regressions in five target sentences in condition 8

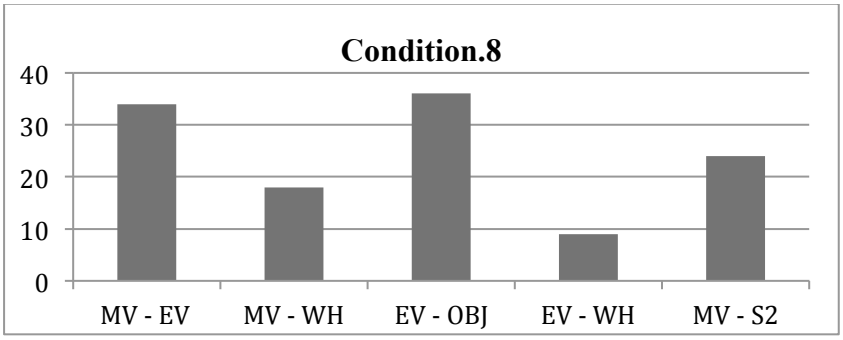


Figure.8 – Total regression frequencies in condition 8

The tables 14 and 15 given below show the regression frequencies in experiment 1 in total, which have been shown above, in terms of each target sentence belonging to each of eight conditions one by one. The given numbers in each table indicate the total number of

regressions made in five target sentences belonging to the same condition, formed in the first and the second word order by 30 participants, respectively.

Experiment.1 – wh-argument 'kim-E / who-Dat' – Order.1 | [s1 – wh – s2 – obj – ev – mv]					
	ev – obj	**ev – wh**	**mv – ev**	**mv – wh**	**mv – s2**
Condition.1	45	13	44	36	43
Condition.2	38	12	41	32	34
Condition.3	30	13	48	33	34
Condition.4	34	10	32	34	20
Total numbers	**147**	**48**	**165**	**135**	**131**

Table.14 Total regression numbers in word order 1

Experiment.1 – wh-argument 'kim-E / who-Dat' – Order.2 | [s1 – s2 – wh – obj – ev – mv]					
	ev – obj	**ev – wh**	**mv – ev**	**mv – wh**	**mv – s2**
Condition.5	47	20	38	13	43
Condition.6	57	17	38	16	42
Condition.7	37	14	20	21	36
Condition.8	36	9	34	18	24
Total numbers	**177**	**60**	**130**	**68**	**145**

Table.15 Total regression numbers in word order 2

- *ev – obj: Regression from embedded verb to object*
- *ev – wh: Regression from embedded verb to wh-word*
- *mv – ev: Regression from main verb to embedded verb*
- *mv – wh: Regression from main verb to wh-word*
- *mv – s2: Regression from main verb to subject.2*

Through a very general look at the regressions frequencies to the wh-word region, it is seen that the first and the second word orders relate dramatically divergent outcomes which may indicate a signature for an order-based tendency of the language processor in terms of ambiguous sentence processing including wh-phrases in and out of the embedded clause. In the first word order, the total of regressions to the wh-word from both main verb (mv – wh) and the embedded verb (ev – wh), including the two embedded verb types (*transitive and ditransitive*) and the two biasing contexts (*interrogative and declarative*) is 183, while it is

128 for the second word order. The difference between two word orders in terms of wh-regression is statistically valid as given below:

Independent Samples Test

		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
direction_wh	Equal variances assumed	,009	1,37500	,51402
	Equal variances not assumed	,009	1,37500	,51402

Table.16 – t-test outcome of the word order difference on regressions towards the wh-phrase

As it has previously been indicated in the present study, the regressive eye movements were related to a part of linguistic material which is thought to be problematic for the parser and related to ambiguity resolution process, as for instance, Frazier and Rayner (1982) state that they have observed the dominant type of regressive saccades to be mainly based on the ones going back to the ambiguous region of the text in their study, and the participants were going back to the portion of the text in order to accomplish the selective reanalysis; also Kennedy and Murray (1987) indicate that regressive eye movements' address is the target word; also, Mitchell et al. (2008) state that the fact that regressive eye movements are associated with difficulties in syntactic processing have been demonstrated in psycholinguistic literature for many times. The reason that the regressive eye movements to the wh-phrase has been taken into consideration is that, as it is indicated above, the aim of regressive eye-movements have been regarded to be closely related to the location of sentences which have the ambiguity, or the source of ambiguity. It is clear that the existence of wh-phrase in complex sentence structure in Turkish, especially in the positions given in the sentences above, create the matrix question or declarative reading ambiguity, and it is not resolved at any part of the sentence. So, if the word order difference causes the participants' regressive eye-movements to choose the wh-phrase as the target in a considerably divergent manner, it would mean that although both of the word order types create ambiguity in final interpretations of the sentences, the placement of the wh-word has a role in the processing strategies of native Turkish speakers. In the first word order the wh-word is located before the subject of the embedded clause (*s1 – wh – s2 – obj – ev – mv*),

while the wh-word is located inside the embedded clause in the second word order (*s1 – s2 – wh – obj – ev – mv*), and the frequency of regressive eye-movements to the wh-word region in the first word order outnumbers the ones in the second word order. This may relate that the nearer is a wh-word to the first predicate (the embedded verb) the easier it is for the processor to process the sentence, because the processor does not need to get back to the wh-phrase (at least not as frequent as) in the second word order as it does in the first one, which then seems to favor a predicate oriented analysis in order to resolve the ambiguity. The reader reaches the end of the sentence, and then makes regressions to the wh-phrase region in the first word order in which the wh-word is located farer from the first potential predicate more frequently than the second word order in which the wh-word is located inside the embedded clause, i.e. nearer to the first predicate.

After a very general outlook on the word order difference through the regressive movements created towards the wh-word region (both from main and embedded verbs), it is also very clear that the outcomes gathered through the first word order is very divergent from the ones in the second word order in terms of main verb to wh-word (mv – wh). While the participants made 135 regressions to the wh-word from main verb in the first word order, they have made 68 regressions to the wh-word region in the second word order, which creates a statistically significant value for difference as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
mv_wh_regression_order_difference	Equal variances assumed	38	,000	3,35000
	Equal variances not assumed	36,989	,000	3,35000

Table.17 – t-test outcome of the word order difference on main verb to wh-phrase regressions

Besides the total regressions frequencies with taking into consideration both embedded verb types and biasing contexts, the groupings according to the embedded verb type also give similar results. If the results on main verb to wh-word regressions are compared by transitive to transitive (conditions 1, 2 and conditions 5, 6) and ditransitive to ditransitive

(conditions 3, 4 and conditions 7, 8) conditions, it is observed that the regression frequencies in the first word order (*s1 – wh – s2 – obj – ev – mv*) from main verb to wh-word region outnumbers the frequencies gathered in the second word order (*s1 – s2 – wh – obj – ev – mv*). The conditions 1 and 2 (*transitive embedded verb – order.1*) have 68 main verb to wh-word regressions in total, while conditions 5 and 6 (*transitive embedded verb – order 2*) have 29 in total; and the conditions 3 and 4 (*ditransitive embedded verb – order.1*) have 67 main verb to wh-word regressions, while conditions 7 and 8 (*ditransitive embedded verb – order.2*) have 39 total regressions from main verb to the wh-word both of which relate statistically significant values for divergence as given below respectively:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
mv_wh_transitive_verb_orderdifference	Equal variances assumed	18	,000	3,90000
	Equal variances not assumed	11,779	,000	3,90000

Table 18 – t-test outcome of the word order difference on main verb to wh-phrase regressions in sentences with transitive embedded verbs

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
mv_wh_ditransitive_verb_orderdifference	Equal variances assumed	18	,001	2,80000
	Equal variances not assumed	16,376	,001	2,80000

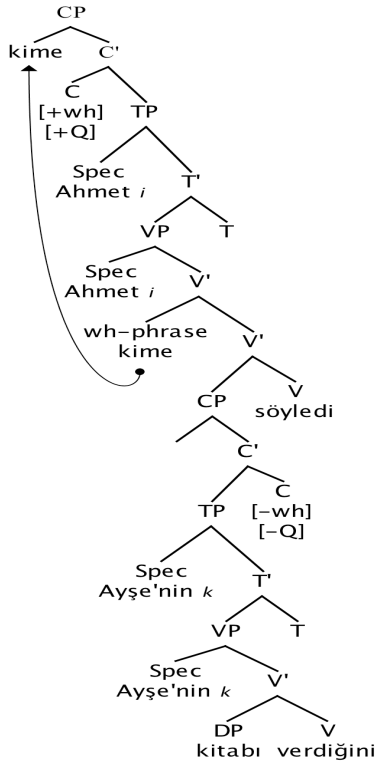
Table 19 – t-test outcome of the word order difference on main verb to wh-phrase regressions in sentences with ditransitive embedded verbs

These outcomes seem to relate the processor's aim at creating the filler – gap dependency on a linear distance basis. For instance when conditions 1, 2 and 3, 4 are checked, it is seen that the interpretation of condition 1 and 2 sentences are obligatorily interrogative [Q], while it is possible to derive double reading through condition 3 and 4 sentences. The place of the wh-word is the same in these sentences and the variable is the type of the embedded verb (condition 1 and 2 transitive; condition 3 and 4 ditransitive). The regression patterns in

these two groupings towards the wh-word are 68 and 67 respectively which means that the linear word order and the regression pattern show a similarity although the final interpretations may indicate a divergence. In the double reading pattern it is possible to license the scope of the wh-phrase inside the embedded clause to derive a declarative [D] reading while in the interrogative reading [Q] the wh-phrase should be raised to Spec-CP, which means to be more distant structurally. But the regression pattern seems to be affected by the linear distance alone in that case reflected on the parallel regression frequencies from main verb to the embedded verb.

When the results obtained from main verb to wh-word (mv – wh) regressions on conditions 3 and 4 on the one hand, and conditions 7 and 8 on the other are compared, it may be stated that the results indicate a possible effect of the linear distance on processing, which seems to be parallel with 'linear distance hypothesis (LDH)' originally developed for defining the learning and interpreting difficulties in relative clauses. In Hawkins (1989), it is found that French L2 learners do not make use of accessibility hierarchy but form rules taking into consideration the linear ordering of the units of restrictive relative clauses in surface configurations. This approach then formulated by O'Grady et al. (2003) as the 'linear distance hypothesis (LDH)'. In the mentioned hypothesis, what matters as a difficulty in processing is the linear distance between the head of the clause and the gap. On the other hand, the 'structural distance hypothesis (SDH)' has been formulated by O'Grady et al. (2003) following, Hamilton (1995) and Hawkins (1999), as the difficulty in learning or interpreting a relative clause structure is bound to the differences in the depth of the embedding of the gap, which denotes the importance of the structural distance between the head of a relative clause and the gap position of the gap. The divergence in the linear order of sentences although they have the same types of interpretations may provide an examination of the processing strategy of the Turkish processor in terms of structural and linear distance hypotheses. The sentences belonging to these four conditions (conditions 3, 4 and 7, 8) all have double interpretations as either interrogative matrix question [Q], or declarative matrix reading [D], two samples of which are given below in tree diagrams. Sentence 34 is an instance of condition 3 and 4 sentences. The wh-phrase precedes the

embedded clause subject, and the embedded verb is ditransitive, while sentence 35 exemplifies condition 7 and 8 sentences, in which the wh-phrase is located inside the embedded clause formed with a ditransitive embedded verb. In condition 3 and 4 sentences, in order to form a matrix question reading, the wh-phrase moves to Spec-CP at LF, and base generated position should be the pre-initial position of the main verb which creates a long linear distance between the gap and the filler. But this constructs a syntactically shorter distance, since the wh-phrase did not originate inside the deeply embedded clause as seen in the tree diagram below. So, it may be asserted that, the linear distance between the gap and the filler is longer than the structural distance between the two.



33. Tree diagram of condition 3 and 4 sentences in the first experiment

34.Spec CP*i* [Ahmet [kime *i* Ayşe'nin kitabı verdiğini] *ti* söyledi]

LF

Ahmet-nom who-dat Ayşe-gen book-acc give-3rd-sing-ind say-3rd-sing-pst

'To whom did Ahmet say that Ayşe gave the book?'
'Ahmet said to whom Ayşe gave the book.'

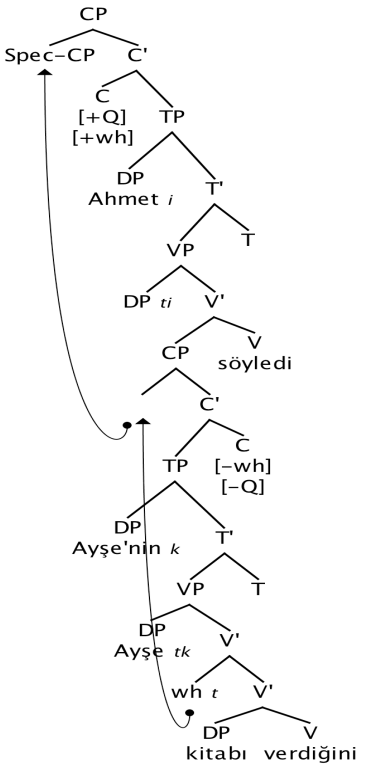
On the other hand, condition 7 and 8 sentences are also capable of forming interrogative sentences, in which the wh-phrase originates inside the embedded clause and then moves to the Spec-CP at LF. This creates a contradiction with condition 3 and 4 sentences. In condition 7 and 8 sentences, the linear distance between the gap and the filler is shorter than the one in condition 3 and 4 sentences. Moreover, the structural distance between the gap and the filler is longer in condition 7 and 8 sentences than as it is in condition 3 and 4 sentences as seen in sentence 35 and the tree diagram 36 given below:

35. Spec CP*i*[Ahmet [Ayşe'nin kime *i* kitabı *ti* verdiğini] söyledi]

LF

Ahmet-nom Ayşe-gen who-dat book-acc give-3rd-sing-ind say-3rd-sing-pst

'To whom did Ahmet say that Ayşe gave the book?'
'Ahmet said to whom Ayşe gave the book.'



36. Tree diagram of condition 7 and 8 sentences in the first experiment

The difference in the regressive saccadic eye movement frequencies between the two sentence types with different linear orders according to the place of the wh-phrase and also with different structural organizations show that when the linear distance between the filler and the gap is longer (condition 3 and 4 sentences) the regressive saccadic movements increase dramatically, although the structural distance for the fronted wh-phrase in order to reach the Spec-CP at LF is shorter, on the contrary when the linear distance between the filler and the gap is shorter, and in a parallel fashion when the structural distance is longer, the regressive saccade frequencies decrease in a significant manner, which denotes that it is the linear distance between the fronted item and the gap position which affects the processing of complex sentence structure with fronted wh-phrases in Turkish.

When we have a look at the short-distance regressive eye movements like the ones from embedded verb to the object (ev – obj) and main verb to the embedded verb (mv – ev), it is observed that although there is a difference between the frequencies of the regressions in terms of word orders, the differences in total do not seem to be statistically salient. For instance, the participants made 147 embedded verb to object (ev – obj) regressions for the first order in total, while the frequency for the second order between the same regions (ev – obj) is 177. The difference is also not significant enough when the two embedded verb types have been taken into consideration and compared cross conditionally. The only exception to this situation comes from the comparison of the second and the sixth conditions. In these conditions, the embedded verb types are transitive, and the biasing contexts are declarative. The only difference between them is the word order. According to Mitchell et al. (2008) the portion of the text which is physically closest to the launch site of the regression may be programmed by a proximity based system and thus may not be indicating a syntactically driven (the ambiguity of the item, or its potential power to resolve the ambiguity) type of behavior. The regressions of this kind may be characterized in 'time out' terms as 'making the smallest possible regression'. If this is the case, the participants' regressions from embedded verb to the object, which is located just before the embedded verb may have been stemmed from the effect of proximity based system, and may not be indicating anything about the processing mechanism fulfilling any syntactic or semantic requirement. The results, which do not seem to be statistically significant, although the order is altered, may support this claim in terms of this study. But the exception for conditions two and six seems to be valid enough to speculate on. Both types of sentences are formed with *transitive embedded verbs* (one object position in their argument structure) and the biasing contexts are *interrogative*. While the sentences in condition two are obligatorily interrogative, the ones in condition six are ungrammatical for Turkish since the wh-word is located inside the embedded clause. The embedded clause verb is transitive, and the object position of the embedded verb is already occupied by a DP-object. Thus, the wh-argument cannot be licensed and so, the derivation crashes. This seems to be reflected on the embedded verb to object (ev – obj) regression patterns of the readers. The total regression numbers from embedded verb to the object in condition two sentences is 38,

while it is 57 in condition six sentences. This may indicate that the wh-word has been tried to be licensed with the first verb being encountered (the transitive embedded clause verb) but since the argument structure of the embedded verb has already been occupied by the two DPs - the subject of the embedded clause and the object inside the embedded clause - the processor failed for matching the wh-argument with a licenser, thus causing an increased number of regressions for the 2nd word order. The difference between the two conditions is statistically significant as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ev_obj_regr_cond_2_6_order_difference	Equal variances assumed	8	,034	-3,80000
	Equal variances not assumed	6,871	,039	-3,80000

Table.20 – t-test outcome of the word order difference on embedded verb to object regressions in conditions 2 and 6

The same divergence between word orders in terms of embedded verb to object (ev – obj) regression patterns is not observed in ditransitive verbs. This implies the importance of word order divergence on processing difficulty to be in cooperation with the sub-categorization frame of the embedded verb. When the embedded verb is a ditransitive one, an alteration in the embedded verb to object (ev – obj) regression frequencies stemming from the word order difference have not been observed (condition 3 – 30 regressions, condition 7 – 37 regressions; condition 4 – 34 regressions, condition 8 – 36 regressions). So, the potential of the first possible predicate to assign the theta role and the case to the wh-argument plays an essential role in creating or removing processing difficulties which is reflected on regression patterns. Trueswell et al. (1993) state that when the sub-categorization information of the verb is accessed and used, it provides important implications for parsing. If a parser makes use of information provided by the sub-categorization frame of a predicate in accomplishing initial syntactic commitments, it will necessarily make fewer mistakes than a parser, which uses sub-categorization information as a filter for evaluating commitments made neglecting the verb-specific information use. The important point here to be indicated is the unexpected behavior of the processor in

condition 1 and condition 5 in terms of embedded verb to object (ev – obj) regression pattern. Although both of them have been formed with transitive embedded verbs like the ones in condition 2 and condition 6, the same alteration between word orders has not been observed in them. These two conditions include sentences with an interrogative biasing context, whereas the ones, which denote a divergence between word orders have been formed with declarative biasing contexts. This may mean that, when the biasing context is declarative [D], the processor tends to license the wh-argument inside the embedded clause, but when it is realized that in order 2 (condition 6) the embedded verb can assign only one object role (since it is transitive) and thus a high frequency of (57) embedded verb to object regression pattern is observed, whereas the same pattern has not been observed in condition 2, which has the same type of embedded verb (transitive) and same biasing context (declarative [D]). This signals the preference of word order, since the wh-argument is located outside of the embedded clause in condition 2, and thus, it is not an intervening item inside the sub-categorization frame of the embedded verb, which needs an argument role to be satisfied.

In terms of the effect of word order difference on regressions patterns, although the total amount of main verb to embedded verb (mv – ev) regressions (regarding the embedded verb type and biasing context difference as a whole) do not show statistically valid differences, the main verb to embedded verb (mv – ev) regressions in condition 3 (*order 1, ditransitive embedded verb, interrogative biasing context*); and condition 7 (*order 2, ditransitive embedded verb, interrogative biasing context*) show a dramatic alteration (condition 3 – 48; condition 7 – 20) as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
mv_ev_condition_3_7_word_order_difference	Equal variances assumed	8	,040	5,60000
	Equal variances not assumed	5,390	,055	5,60000

Table.21 – t-test outcome of the word order difference on main verb to embedded verb regressions in conditions 3 and 7

Condition 3 and condition 7 sentences are composed of the ones having ditransitive embedded verbs and interrogative [Q] biasing contexts; the only variable that differentiates them is the word order. In condition 3, the wh-word is located before the embedded clause subject, whereas it is located inside the embedded clause in condition 7. The number of regressions in condition 3 outnumbers the ones in condition 7. When the wh-word is located outside the embedded clause, and the embedded verb is a ditransitive one, the readers tended to make regressions more frequently than the case in which the wh-word is inside the embedded clause. This may be due to the interaction of the place of the wh-word with the embedded verb type (ditransitive). The processor had more trouble with processing the embedded clause when the wh-word is not located inside the embedded clause and tended to make regressions back to the embedded verb much more frequently. In the second word order (*s1 – s2 – wh – obj – ev – mv*) the ditransitive verb needed two arguments in its sub-categorization frame, and this has already been satisfied with the DP object and the wh-argument, but in the first word order (*s1 – wh – s2 – obj – ev – mv*) the wh-word is located far from the first potential predicate, which is a ditransitive one having a need for two arguments. The sub-categorization frame of the predicate has not been fully satisfied, thus the processor had problem during processing the embedded clause, reflected on the main verb to embedded verb (mv – ev) regression pattern. The processor first tends to license the wh-word with the first predicate in the order (embedded verb), if the wh-word is in the same clause with the first potential predicate, the processor has made less regressions from main verb to wh-word (mv – wh) or from main verb to embedded verb (mv – ev). In Trueswell et al. (1993), it is observed that as soon as a verb is encountered, the subcategorization information is accessed and has immediate effects on the processing of information following the verb. Since Turkish is a verb final language, the subcategorization effect imposed by the predicate is effective only after the first and second predicates (which are the two final elements in the sentences given in the study) are encountered. Thus, the regression patterns gathered through the examination of eye-tracking data give the related implications about the processing difficulty stemmed from the word order / embedded verb type interaction.

In terms of regression patterns, although the observed statistical divergences between conditions given above have not all been observed in each of the conditions taking into consideration one variable at a time, it is important to mention the correlation between the regression frequencies from main verb to embedded verb (mv – ev) and from embedded verb to object (ev – obj) patterns in regard to embedded verb types and word orders. It is observed that the embedded verb to object (ev – obj) regression numbers tend to decrease when the wh-argument is located outside the embedded clause formed with a transitive embedded verb, while the frequency of regressions on the same units tend to increase when the wh-word is inside the embedded clause with a transitive embedded verb. In relation to this outcome, the number of regressions from main verb to embedded verb tends to increase when the wh-argument is located outside the embedded clause when the embedded clause verb is a ditransitive one, while it tends to decrease when it is inside the embedded clause with the same type of embedded verb. These two outcomes, which have been analyzed one by one above, seem to indicate the same rationale in a coordinated way. When the embedded verb is a ditransitive one, it needs two arguments in its argument structure; and when this is satisfied with a wh-argument inside the embedded clause, the tendency for the reader to make regressions on the embedded verb region decreases; on the contrary, when the embedded verb is a transitive one, the existence of the wh-argument outside of the embedded clause provides a less problematic processing phase. This analysis supports the previously mentioned claim that the licensing of the wh-word in Turkish is affected with the linear order of the items in the sentence, favoring the first possible item to create and satisfy the filler – gap chain. Since Turkish is a verb-final language, the processor waits for the first predicate to license the prepositioned wh-argument. The divergence in the regression frequencies affected by the type of the embedded verb (*transitive – ditransitive*) seems to support this fact.

In terms of the embedded verb type difference, it is not possible to detect a wide range of divergences across regression frequencies on the mentioned regions of the sentences, the peculiar differences observed occur in the 2nd word order (*s1 – s2 – wh – obj – ev – mv*). First divergence in the regression frequencies is at the embedded verb to object (ev – obj)

regression pattern. While the participants made a total of 104 regressions in condition 5 and 6 (*transitive embedded verb*), the total number of regressions in condition 7 and 8 (*ditransitive embedded verb*) is 73. The difference between the two is statistically significant:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
order_2_ev_obj_regression_ verbtypedifference	Equal variances assumed	18	,035	3,10000
	Equal variances not assumed	17,581	,035	3,10000

Table.22 – t-test outcome of the verb type difference on embedded verb to object regressions in the 2nd word order

The outcome indicating a divergence between the two embedded verb types to occur in the 2nd word order in which the wh-argument is located inside the embedded clause is not surprising. It is previously indicated that the first possible predicate is stated to be the first possible position in Turkish to license the wh-argument with the needed thematic role and the case, thus, Turkish is thought to have a verb-driven parsing strategy, at least in terms of ambiguous complex sentences including wh-phrases. In that respect, the processor's aim at regressing back to the object in the 2nd word order seems to be highly correlated with the tendency to license the wh-argument with its deepest clause (the embedded clause) with the nearest predicate possible. Since the argument structure of the embedded verb has an effect on the regression patterns (when the embedded verb is transitive, the regressions from embedded verb to the object outnumbers the situation in which the embedded verb is a ditransitive) and this effect is observed in the 2nd word order, it can directly be interpreted as the processor's aim at licensing the wh-argument with the first possible predicate in the same clause. The transitive embedded verb causes difficulty for the processor since the argument position for the verb is already occupied by a DP-object, whereas the same effect has not been observed when the same sentences have been formed with a ditransitive verb in the embedded clause. The ditransitive predicate has two empty argument positions in its sub-categorization frame, one of them is occupied by the DP-object, and the other position is to be occupied with the wh-argument. So, the processor has a much less, statistically

significant, divergence in difficulty on processing the same structure. A similar decreasing tendency in the regression rates for the 2nd word order is observed for embedded verb to wh-word (ev – wh) regression numbers but the divergence between these two (conditions 5 and 6 have 37 regressions in total, while conditions 7 and 8 have 23 in total) is not statistically significant as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ev_wh_order2_verb_type_difference	Equal variances assumed	18	,146	1,40000
	Equal variances not assumed	14,111	,150	1,40000

Table.23 – t-test outcome of the verb type difference on embedded verb to wh-phrase regressions in the 2nd word order

Moreover, when we have a broader look at the regression patterns, it is observed that in the sentences belonging to the first word order (s1 – wh – s2 – obj – ev – mv), in which the wh-argument is located before the embedded clause subject, none of the conditions provided statistically valid differences in terms embedded verb type comparison. Although the regressions frequencies show a decrease when the embedded clause verb is a ditransitive one in all kinds of regression metrics as follows; *ev – obj*: transitive types 83, ditransitive types 64; *ev – wh*: transitive types 25, ditransitive types 23; *mv – ev*: transitive types 85, ditransitive types 80; *mv – wh*: transitive types 68, ditransitive types 67; *mv – s2*: transitive types 77, ditransitive types 54; the difference between the values are not statistically significant.

But when the second word order is examined it is seen that, the two of the regression patterns (ev – obj, and mv – s2) give statistically divergent results in terms of comparing the embedded verb types. The embedded verb to object (ev – obj) regression patterns has been discussed above. The mv – s2 (main verb to subject 2) regression pattern shows that the number of regressions in both of the conditions (5, 6) formed with a transitive embedded verb is 85, while it is 60 for conditions 7 and 8 which have been constructed

with ditransitive embedded verbs, and the difference between these two is statistically significant as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
order2_mv_s2_reg_verb_type_dif	Equal variances assumed	18	,049	2,50000
	Equal variances not assumed	17,623	,050	2,50000

Table.24 – t-test outcome of the verb type difference on main verb to subject 2 regressions in the 2nd word order

This outcome indicates the correlation of the word order with the embedded verb type in processing of complex sentences in Turkish. The word order seems to be the major determinant in parsing strategies while the embedded verb type seems to be more effective in a distinguished word order, the one in which the wh-argument is located inside the embedded clause. Although the results indicate a verb specific tendency for licensing the wh-filler in a complex sentence structure in Turkish, the strategy of the parser seems to be clause sensitive in some sense. When the participants come up with the second subject of the sentence (s2) before reading the wh-word, they must have been alerted with the existence of a clause boundary (although a genitive marked DP does not necessarily dictate the existence of an embedded clause, it may be a sign of it). After the wh-filler, which has been detected after the second subject (s2) in the sentence with a genitive marker *–(n)In*, the processor tends to have more regressions when a mismatch occurs as a result of a clash with the argument number in the clause and the potential argument licensing availability of the embedded verb in the same clause. In other words, when the wh-argument is inside the embedded clause, situated just before the DP-object – which also occupies an argument position in the sub-categorization frame of the embedded verb – and in case the embedded verb is a transitive one – allowing only one DP-object to license – the participants tended to make more regressions in the sentence which denotes a processing difficulty. But the same effect has been observed in a slighter manner in the first word order, at least not statistically significant, which indicates the processor's aim at licensing the wh-filler with the first verb

in the sentence. This is observed through the secondary regressions after the reader comes at the end of the sentence.

4.1.3. Fixation Analysis

The target sentences have been analyzed in terms of the first and total fixations of the units during reading. The first fixation values are given in order to figure out the initial processing strategies of the Turkish parser which may be affected by word order, more specifically the place of the wh-phrase in the sentence, and the existence of the accusative marked DP objects in the sentences which can relate that the sentence being processed is a complex one. Since Turkish is a verb final language, the potential power of the verbs on licensing the wh-phrase comes clear at the end of each sentence. The 'first fixation durations' may indicate whether the processor is affected by the word order and the placement of the wh-phrase (in or out of the embedded clause) before coming up with any predicate in the sentence. This may also either provide support or refute the natural verb-based processing strategy of the Turkish parser together with if the parser makes an initial syntactic parsing of the sentence during the initial stage of processing or does not make any kind of initial analysis until come up with the verb and thus, uses the syntactic and semantic information provided by the verb together.

Besides the 'first fixation durations', the 'total fixation durations' of the same units in the target sentences will also be analyzed and discussed respectively. The total fixation durations need to be considered due to the verb final nature of Turkish. Since the processor will meet the predicate(s) at the end of the sentence, the strategy carried out by the parser is obliged to be evaluated considering the whole reading times of the units and the regressions from the last unit in the sentence back to previously read items. The sentences used as targets are ambiguous between interrogative [Q] and declarative [D] readings, and the ambiguities are not locally resolved, thus the processor will necessarily get back to previously problematic locations in the sentence to resolve the ambiguity. Since the 'total reading times' in an eye-tracking study give the total time spent on each area of interest, it

seems to be a crucial metric of study in order to speculate on ambiguity resolution strategies in Turkish.

As it has been discussed in Chapter 3, the eye-tracking data on fixation times is a crucial point of research in psycholinguistic endeavor. The fixation times of a compartmentalized unit of a sentence give important data on processing strategies of the parser. Longer fixation times on a region in a sentence indicate the difficulty in processing about the region under discussion. Moreover, it is accepted that since vision is inhibited during saccades, the information through a text being read is only obtained during fixations (Rayner, 1998). Frenck-Mestre (2005) states that one can evaluate the number of first-pass fixations and re-fixations in a region of interest (ROI) – *as counterpart of 'area of interest' (AOI) in the previous study* – as well as the pattern of regressions in order to derive valuable information about the processing difficulty. As stated above, the eye-movement measurements can be varied as regression frequencies, first and total fixations in an area of interest on a target sentence or text. This variability, more specifically in terms of fixation measurement, seems to necessitate the study to include both 'first fixation times' and 'total fixation times' in the present study due to the syntactic property of Turkish. The head is finally occurred and the reader obligatorily will need to get back to a previous item in the sentence in order to resolve the ambiguity given in target sentences, which makes the use of 'total fixation times' and 'regression frequencies' as a crucial way of measurement besides 'first fixation times'. The reason of evaluating the 'first fixation duration' on an area of interest stems from the need to observe if the Turkish parser is affected from the existence of the accusative marked object DP, which indicates that the sentence is a complex one. This will give information on the initial processing strategy of the Turkish parser before coming up with the first and second (embedded and main verbs respectively) possible argument assigners in the sentence and if the parser is sensitive to clause boundary which may cause to build an initial syntactic analysis or not. The regression analysis given above indicated that the processor is affected from, first, the place of the wh-word and second, the type of the embedded verb together. This is derived from majorly the regression rates from the main verb/embedded verb to wh-word region in the sentences. The measurement of

‘first fixation durations’ is to be discussed in terms of the initial parsing strategies of the readers before reading the potential argument assigners in the sentence due to the verb-final nature of Turkish, and ‘total fixation durations’ will provide information on the processor’s total reading times spent on the pre-determined areas of interests in the sentence.

4.1.3.1. The Analysis and Discussion of the First Fixation Duration Results

In this section, the raw data on the ‘first fixation durations’ of the areas of interests (AOI) in the sentences will be given first, then the outcomes will be discussed in terms of the compartmentalization of the sentences into ‘areas of interests (AOI)’ with statistical information about the obtained duration values in milliseconds (ms). The analysis and discussion of the outcomes will be based on, as it has been carried out while the regression analysis is examined, the comparison of the data according to the word order difference (the place of the wh-argument) and the embedded verb types (transitive / ditransitive). Each grammatical unit in the sentence represents one area of interest (AOI) for analysis as given below:

Order.1: subject1 (AOI1), wh (AOI2), subject 2 (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

Order.2: subject1 (AOI1), subject 2 (AOI2), wh (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

The raw ‘first fixation duration’ data will be given in the following tables. The numerical values in the tables are given in *seconds, milliseconds*. Each condition represents the total values of ‘first fixation durations’ made by 30 participants in total on each area of interest. The data have been gathered through the recordings of five target sentences belonging to the same condition.

Experiment.1 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.1	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	5,98	5,61	5,53	4,46	5,81	5,68
2	1,82	7,46	5,58	4,59	6,63	5,99
3	6,05	6,91	5,66	4,79	5,21	6,60
4	5,69	6,12	4,85	4,61	4,97	6,83
5	2,87	5,38	5,77	6,11	7,10	5,78
Total	**22,41**	**31,48**	**27,39**	**24,56**	**29,72**	**30,88**

Table.25 First fixation durations in the first condition sentences

The data in the table 25 given above belong to the total duration times of 'first fixation durations' of 5 target sentences constructed in the 1st condition, which has the word order as; s1 – wh – s2 – obj – ev – mv; transitive embedded verb, and interrogative biasing context. Each column represents an area of interest (AOI) in the experiment and the data given below each column represents the total of 'first fixation durations' made by 30 participants in each of the five target sentences belonging to the same condition. As it is seen the participants made 22.41 seconds of first fixation for the subject 1, 31.48 seconds of first fixation for the wh-word, 27.39 seconds of first fixation for the subject 2, 24.56 seconds for the object, 29.72 seconds for the embedded verb, and 30.88 seconds for the main verb in total of five target sentences belonging to the first condition.

Experiment.1 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.2	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	4,87	4,81	4,99	4,88	5,96	4,86
2	2,18	6,51	6,81	4,59	6,33	5,25
3	6,10	4,29	6,15	4,94	4,82	5,43
4	4,38	4,95	5,48	5,52	6,13	6,14
5	3,59	6,85	5,47	5,80	5,65	5,57
Total	**21,12**	**27,41**	**28,90**	**25,73**	**28,89**	**27,25**

Table.26 First fixation durations in the second condition sentences

The table 26 given above gives the outcomes of the second condition, which has a word order as; s1 – wh – s2 – obj – ev – mv; transitive embedded verb, and a declarative [D] biasing context. It is observed that the participants made 21.12 seconds of first fixation on subject 1, 27.41 seconds of first fixation duration on the wh-word, 28.90 seconds of first fixation on the subject 2, 25.73 seconds of first fixation on the object, 28.89 seconds of first

fixation on the embedded verb and finally 27.25 seconds of first fixation on the main verb in total of five target sentences.

Experiment.1 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.3	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	2,56	7,24	5,04	5,19	7,10	4,92
2	4,11	6,47	5,60	5,56	5,35	6,11
3	4,93	5,04	4,98	5,61	5,58	5,30
4	6,39	5,32	5,91	4,59	5,04	6,17
5	3,84	7,14	6,15	5,53	5,58	6,78
Total	**21,83**	**31,21**	**27,68**	**26,48**	**28,65**	**29,28**

Table.27 First fixation durations in the third condition sentences

In table 27 above, the first fixation data of the 3rd condition sentences is given. The order of the 3rd condition is s1 – wh – s2 – obj – ev – mv; the embedded verb type is ditransitive and the biasing context is interrogative [Q]. The total of first fixations on the 1st subject is 21.83 seconds, on the wh-word 31.21 seconds, on the 2nd subject 27.68 seconds, on the object 26.48 seconds, on the embedded verb 28.65 and finally, the total of first fixation durations on the main verb is 29.28 seconds.

Experiment.1 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.4	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	2,92	5,43	4,83	4,88	6,92	6,71
2	3,85	6,55	5,46	6,36	5,75	6,33
3	4,51	7,47	4,90	5,43	5,74	6,38
4	5,51	5,61	4,88	4,86	5,18	7,00
5	4,01	6,04	5,70	4,74	5,25	5,66
Total	**20,80**	**31,10**	**25,77**	**26,27**	**28,84**	**32,08**

Table.28 First fixation durations in the fourth condition sentences

Table 28 given above relates the data on the first fixation durations of the five target sentences in condition 4 in which the word order is s1 – wh – s2 – obj – ev – mv; the embedded verb type is ditransitive and the biasing context is declarative [D]. The total of first fixation durations made by 30 participants is 20.80 seconds for the first subject, 31.10 seconds for the wh-word, 25.77 seconds for the subject of the sentence, 26.27 seconds for the object, 28.84 seconds for the embedded verb and finally 32.08 seconds for the main verb.

Experiment.1 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.5	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	5,27	5,12	5,08	6,04	5,59	4,15
2	5,52	5,44	4,01	5,53	7,35	5,01
3	5,62	5,74	4,44	4,62	5,92	7,40
4	6,20	5,34	5,42	5,16	5,75	6,94
5	6,37	5,56	4,52	4,50	5,94	6,29
Total	**28,98**	**27,20**	**23,47**	**25,85**	**30,55**	**29,79**

Table.29 First fixation durations in the fifth condition sentences

Table 29 given above shows the first fixation durations of the five target sentences belonging to the 5th condition which has the following word order; s1 – s2 – wh – obj – ev – mv; transitive embedded verb and interrogative [Q] biasing context. As it is seen above, the 30 participants made a total of 28.98 seconds first fixation for the subject 1, 27.20 seconds for the 2nd subject, 23.47 seconds for the wh-word, 25.85 seconds for the object, 30.55 seconds for the embedded verb and finally 29.79 seconds in total for the main verb.

Experiment.1 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.6	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	4,87	5,78	5,46	5,79	6,63	4,11
2	5,45	5,91	5,95	6,56	7,68	5,73
3	5,70	5,46	4,50	5,26	5,97	7,25
4	5,19	6,03	4,62	5,05	5,56	6,63
5	7,30	5,87	4,75	5,64	6,26	7,22
Total	**28,51**	**29,05**	**25,28**	**28,30**	**32,10**	**30,94**

Table.30 First fixation durations in the sixth condition sentences

The outcomes of the first fixation durations gathered through the five target sentences belonging to the 6th condition is given in table 30 above. It is seen that the first fixation durations of five target sentences on subject 1 is 28.51 seconds, on the 2nd subject 29.05, on wh-word 25.28 seconds, on the object 28.30 seconds, on the embedded verb 32.10 seconds and finally 30.94 seconds on the main verb.

Experiment.1 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.7	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	3,84	5,77	5,24	5,64	6,16	5,88
2	5,26	5,75	4,60	5,04	6,18	5,85
3	6,94	5,58	4,57	5,56	5,69	6,48
4	3,56	5,54	4,95	5,57	5,56	6,34
5	5,22	5,41	5,36	5,94	5,83	5,84
Total	**24,82**	**28,05**	**24,72**	**27,75**	**29,42**	**30,39**

Table.31 First fixation durations in the seventh condition sentences

In condition 7, as it is seen above, the participants made a total of 24.82 seconds first fixation duration on the first subject, 28.05 seconds first fixation duration on the 2nd subject, 24.72 seconds on the wh-word, 27.75 seconds of first fixation duration on the object, 29.42 seconds on the embedded verb and 30.39 seconds of first fixation duration on the main verb region.

Experiment.1 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.8	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	3,45	4,65	5,14	5,60	6,24	4,54
2	4,12	5,26	5,15	5,48	5,40	5,28
3	7,02	5,22	4,31	5,14	5,41	6,55
4	3,12	5,86	5,14	4,85	5,72	6,18
5	5,51	5,38	5,30	4,86	6,72	7,21
Total	**23,22**	**26,37**	**25,04**	**25,93**	**29,49**	**29,76**

Table.32 First fixation durations in the eighth condition sentences

Table 32 given above gives the total of first fixation durations of the five target sentences belonging to the 8th condition in which the word order is s1 – s2 – wh – obj – ev – mv, the embedded verb is ditransitive, and the biasing context is declarative. It is seen that the total of first fixation durations on the first subject of the sentence is 23.22 seconds, on the second subject 26.37 seconds, on the wh-word 25.04 seconds, on the object 25.93 seconds, on the embedded verb 29.49 seconds, and on the main verb 29.76 seconds.

In regard to the analysis of 'first fixation durations' made on the units given above, it is crucial to indicate that due to the verb-final nature of Turkish, it is expected that the processor will not have any divergence until come up with the first possible predicate in

order to license the wh-phrase linearly. If a divergence would occur at the initial stages of parsing, it may occur due to a possible clause-sensitivity of the Turkish parser which might come out as a result of the existence of an accusative marked object DP, which signals that the sentence is complex. This means that when the wh-word is located before and after the second subject of the sentence, although the processor has not yet come up with the first predicate in the sentence, the processor may be affected with the presence of the wh-word either inside or outside of the embedded clause. This has the potential to signal a clause-sensitive licensing strategy of the Turkish parser in ambiguous sentences including wh-phrases. When we have a general look at the 'first fixation durations' recorded on the areas of interest given above, it is seen that the only statistically valid divergence is on the wh-region if the word order difference is considered as follows:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ffd_wh_intotal_order_dif	Equal variances assumed	38	,000	1,13450
	Equal variances not assumed	27,973	,000	1,13450

Table.33 – t-test outcome of the order difference on 'first fixation durations' recorded on the wh-phrase

The statistical divergence indicates the 'first fixation durations' on the wh-region in the first and second word orders in total. In the first word order, the wh-word is located before the subject 2 (*s1 – **wh** – s2 – obj – ev – mv*), while it is located inside the embedded clause in the second word order (*s1 – s2 – **wh** – obj – ev – mv*). The total duration of first fixations on wh-word in order 1 is 121,2 seconds, while it is 98,51 seconds in the second word order. The processor had more difficulty on reading the wh-word when it is located before the second subject of the sentence. In other words, when the wh-word is read after completing the reading of the 2nd subject marked with the genitive marker *'(n)In',* which may signal that an embedded clause is beginning, the processor has processed the wh-word more easily. This may, when evaluated together with the supportive regression data discussed earlier in the chapter (more regression frequencies to the wh-word region is observed in the first word order than the second one) be interpreted as the processor may be sensitive to the

clause boundary before coming up with the predicate in the sentence. When the wh-word is located after the clause boundary, it may give a clue to the processor that the item to license the wh-word (the predicate) is coming up in line, but when the wh-word is located before the second subject of the sentence, the same availability has not been provided for the processor. This divergence in the 'first fixation durations' on wh-word region between the two word orders is also observed when the embedded verb types are evaluated separately, i.e. when the conditions 1 and 2; and 5 and 6 are compared, all of which are formed with transitive embedded verbs, it is seen that the first fixation durations are statistically divergent between two word orders. The durations in the first word order outnumbers the ones in the second word order as respectively; 58,68 seconds; and 48,75 seconds. The statistical difference is given below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ffd_wh_order_diff_trans_verbs_conds_12and56	Equal variances assumed	18	,015	1,01400
	Equal variances not assumed	14,200	,018	1,01400

Table.34 – t-test outcome of the word order difference of 'first fixation durations' recorded on the wh-phrase in sentences with transitive embedded verbs

Also, the same divergence is observed when the conditions formed with ditransitive embedded verbs (condition 3, 4 and 7, 8) belonging to two different word orders. The 'first fixation durations' recorded on wh-word region in the first word order outnumbers the ones in the second word order as respectively; 62,31 seconds, 49,76 seconds. The divergence is also statistically valid:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ffd_wh_cond34_78_ditrans_order_dif	Equal variances assumed	18	,001	1,25500
	Equal variances not assumed	11,955	,001	1,25500

Table.35 – t-test outcome of the word order difference of 'first fixation durations' recorded on the wh-phrase in sentences with ditransitive embedded verbs

But a similar divergence in the 'first fixation durations' on the other areas of interests has not been observed. This may apparently be related to the verb-final nature of Turkish. The 'first fixation durations' include the very first fixations made on the related areas of interests, which do not include the secondary regressions. Since in Turkish the verb comes through the end of the sentence, the licensing of the wh-argument should directly be related to the word order parameter, and it is only when the location of the wh-word is altered in relation to its distance to the first verb in the sentence, a divergence is observed on wh-region reading times. This is a clear indication of first, the verb-based licensing of filler-gap dependency in the case of fronted wh-phrases, and second, the Turkish processor may make use of the possible linear closeness of the fronted wh-phrase to the base – generated position specifying the genitive marked subject DP as the clause boundary in licensing the wh-word. The nearer it is to a potential licenser (the first predicate linearly) the easier it is for the parser to process it which was also proposed by Just and Carpenter (1992) and Gibson (1998) stating that the farther the gap is from its antecedent, the more difficult and longer it is to be processed. Besides this, the flexible word order tendency of Turkish in terms of a case-marked DP to scramble in the sentence seems to have been affected with the existence of a secondary clause in the sentence. For instance, Miyamoto and Takahashi (2004) state that although Japanese is a verb-final language, which is highly different from English in that respect, it is still possible to observe a FGE (filled gap effect) when a fronted wh-phrase is detected, since Japanese readers should insert a gap for the scrambled constituent as soon as permissible in terms of its grammar. They consider that dative-accusative order is canonical in a ditransitive Japanese clause, and thus the readers must posit a gap for the accusative DP after reading the dative DP and should have a similar construction as follows:

37. Ueitoresu-wa [kokku-o]$_i$ rejigakari-ni <gap$_i$>
waitress-top cook-acc cashier-dat

It is critically assumed that in order to posit a gap, a verb is not needed to exist, which provides a discussion ground for Turkish in a similar fashion, and the representation of the sentence is constructed on the case markers of the DPs. The first fixation duration measures

gathered out of the results of the present study seem to indicate the behavior of the parser in a similar fashion in some sense, but the similarity is not in a reaction towards a rigid order of case marked DPs, like the case in Japanese, since in Turkish, in a ditransitive clause it is not necessary to order the DPs in an accusative-dative, or dative-accusative order as seen below:

38. Can kitabı Ali'ye verdi
Can-nom book-acc Ali-dat give-pst-3rd-sing

39. Can Ali'ye kitabı verdi
Can-nom Ali-dat book-acc give-pst-3rd-sing

Both 38 and 39 are fully grammatical, and the difference between them is only the preference in terms of the information structure of the sentences. The comparison of the outcomes of the first fixation durations on wh-regions indicates sensitivity to linear distance between the wh-filler and the first verb in the order for Turkish. It is found that when the wh-word is located inside the embedded clause, following the genitive marked subject of the sentence (the 2nd subject from left, the subject of the embedded clause) the readers processed the wh-word much faster than the order in which it has been located before the genitive marked subject in the sentence, favoring a reaction time for the placement of the wh-word before coming up with the first predicate. But the other measurement metrics do not give statistically valid divergences to mention a strong claim about the parsing strategy of the Turkish parser just taking the clause boundary conditions into consideration, neglecting the role of the predicate. Moreover, in Miyamoto and Takahashi (2004), the experiment design included sentences only formed with VP-internal scrambling, or to the periphery of the clause, and it is indicated that whether all scrambling conditions should be processed in the same way needs to be investigated.

The results on the 'first fixation durations' observed in the items may also indicate the non-preference for an initial syntactic analysis, which is basically stated to be a major

characteristic of garden-path theory of sentence processing. Turkish is verb-final and has a flexible order for case-marked DPs. This makes it for the parser impossible to build an initial syntactic analysis before coming up with the first verb in the sentence. In the set of target sentences for the first experiment, the conditions 5 and 6 produce ungrammatical sentences, while conditions 7 and 8 produce grammatical double readings (either declarative [D] or interrogative [Q]). The difference between conditions 5 and 6 on the one hand, and conditions 7 and 8 on the other, is the type of the embedded verb. Conditions 5 and 6 are formed with transitive embedded verbs while conditions 7 and 8 are constructed with ditransitive embedded verbs. The place of the wh-word in these four conditions is the same: following the embedded clause subject DP. If the parser built an initial syntactic analysis – which is a property of garden-path theory due to the structure of the sentence – to process ambiguous complex sentences in Turkish, we could have expected the processor to have trouble after coming up with the first verb (embedded verb) in the sentence according to the type of the verb. Conditions 5 and 6 produce ungrammatical sentences due to the transitivity of the embedded verb. The fronted wh-argument is inside the embedded clause in these conditions, the embedded clause also host another DP as the object as a result of which the embedded clause verb should be ditransitive to host two object DPs in the same clause (one is the wh-argument to get case and thematic role and the other is the already existing DP object). Sentence 40 given below is an example of the condition 5 and 6 sentences in the first experiment:

40.	Cemal	Demet'in	kime	kitabı	gördüğünü	söyledi
	Cemal-nom	Demet-gen	who-dat	book-acc	see-pst-ind-3rd	say-pst-3rd

Since the 'first fixation durations' on the items under discussion should reflect the immediate initial analysis, it is needed to check if there is a divergence on the 'first fixation durations' on the embedded verb which could either be problematic for the processor as condition 5 and 6 sentences would necessitate, or it couldn't cause any trouble for the parser as in the case in condition 7 and 8 sentences which have been constructed with ditransitive embedded verbs and create 'double' interpretetions (either interrogative [Q] or declarative [D]) as seen in sentence 41 below:

41. Mert Ezgi'nin kime mektubu gönderdiğini hatırlattı
Mert-Nom Ezgi-Gen who-Dat letter-Acc send-Pst-Ind-3rd remind-Pst-3rd

In conditions 5, 6, 7, and 8 sentences, when the word order is considered, it is not possible for the parser to create a structure until the accusative marked DP object is read. If the parser builds an immediate syntactic analysis of the sentence, it should expect for a complex sentence after reading the following order; [Mert Ezgi'nin kime mektubu _____ '*Mert-Nom Ezgi-Gen who-Dat letter-Acc* _____*'*] which, in a parallel fashion, dictates the existence of a ditransitive embedded verb following the accusative marked DP. So, this could mean that if the parser is building an immediate syntactic structure to process these types of sentences, the 'first fixation durations' on the embedded verb should show divergence when conditions 5, 6 and conditions 7, 8 are compared since the former ones are formed with transitive embedded verbs while the latter ones are constructed with ditransitive embedded verbs. An obstruction, or a difficulty is expeced to be observed on the 'first fixation durations' on the embedded verb region of condition 5 and 6 sentences in comparison to condition 7 and 8 sentences. When the results on 'first fixation data' are compared it is seen that the difference between these two values are statistically non-significant (*the two-tailed P value equals 0.1798*). This is clearly an indication of a non – preference for an initial syntactic analysis of the structure, which is one of the major components of garden – path theory in processing sentences with fronted fillers. Also, this may relate that Turkish complex sentences with fronted wh-phrases are processed – mostly due to the verb final property of Turkish – in a parallel fashion which considers the syntactic and semantic information provided by the embedded and main verbs respectively, at the end of each sentence. Although the structure makes it possible for the processor to build a preferred syntactic analysis, the 'first fixation analysis' on the resolution region does not indicate that an initial syntactic analysis is made through the initial stage of parsing. Also, when the 'first fixation durations' on the embedded verb regions of the first word order sentences are compared (conditions 1, 2, 3, and 4) due to embedded verb type difference, a divergence has not been observed when the parser comes up with a transitive

verb, which in total is a supportive finding for an absence of initial syntactic parsing strategy.

As a validation for the 'first fixation duration' comparisons to be linguistically oriented but not affected by just an item by order influence, the first fixation durations on the second and the third items in the sentences have been compared. The first comparison is between the second item of the first order (wh-word) and the second item of the second order (subject 2). The statistical divergence between the first fixation values of the mentioned items is given below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ffd_2nd_unit_in_sent_wh_vs_s2_order_dif	Equal variances assumed	38	,025	,52650
	Equal variances not assumed	23,416	,028	,52650

Table.36 – t-test outcome of the word order difference of 'first fixation durations' recorded on the wh-phrase and the subject 2/the second items in each word order

The second comparison is between the third items of the sentences. The third item of the first order sentences is the second subject, while it is the wh-word in the second order of sentences. The statistical divergence is shown below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ffd_2nd_unit_in_sent_wh_vs_s2_order_dif	Equal variances assumed	38	,001	,56150
	Equal variances not assumed	37,657	,001	,56150

Table.37 – t-test outcome of the word order difference of 'first fixation durations' recorded on the wh-phrase and the subject 2/the third items in each word order

The aim of this comparison is to point out that the divergences between the first fixation durations do not stem from the place of the item by chance (i.e. not from the ordinary location separated for the item in the sentence), but by the existence of the mentioned items in locations being discussed. Comparing the first fixation durations of the second and third

items by left in terms of order difference validate that the divergence between the durations stem from the linguistic features carried by the items, not just because of oculo-motor tendencies.

4.1.3.2. The Analysis and Discussion of the Total Fixation Duration Results

In this section, the raw data on the 'total fixation durations' of the areas of interests (AOI) in the sentences will be given first, then the outcomes will be discussed in terms of the units of the sentences with statistical information about the obtained duration values in milliseconds (ms). The analysis and discussion of the outcomes will be based on, as it has been carried out while the regression, and first fixation duration analyses are examined, the comparison of the data according to the word order difference (the place of the wh-argument) and the embedded verb types (transitive / ditransitive). Each grammatical unit in the sentence represents one area of interest (AOI) for analysis as given below:

Order.1: subject1 (AOI1), wh (AOI2), subject 2 (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

Order.2: subject1 (AOI1), subject 2 (AOI2), wh (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

The raw 'total fixation duration' data will be given in the following tables. The numerical values in the tables are given in *seconds, milliseconds*. Each condition represents the total values of 'total fixation durations' made by 30 participants in total, on each area of interest. The data have been gathered through the recordings of five target sentences belonging to the same condition.

Experiment.1 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.1	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	10,56	14,34	13,16	11,33	20,72	8,93
2	3,30	22,19	16,87	12,74	16,42	10,39
3	13,49	15,95	22,72	15,00	21,54	16,15
4	15,50	18,85	23,18	15,99	25,05	18,43
5	4,86	21,44	18,16	14,67	20,78	12,91
Total	**47,71**	**92,77**	**94,09**	**69,73**	**104,51**	**66,81**

Table.38 Total fixation durations in the first condition sentences

Table 38 given above shows the results of the 'total fixation durations' on the units of the five sentences belonging to the first condition which is formed in the first type of word order (*s1 – wh – s2 – obj – ev – mv*), with a transitive embedded verb in the embedded clause, and with an interrogative [Q] biasing context. As it is seen, the total fixation duration on the first subject is 47,71 ms, 92, 77 seconds on the wh-word, 94,09 seconds on the second subject of the sentence, 69,73 seconds on the object, 104,51 seconds on the embedded verb and finally 66,81 seconds on the main verb.

Experiment.1 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.2	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	8,30	15,61	17,45	12,33	18,93	9,89
2	2,18	26,08	23,21	18,13	18,81	8,46
3	13,01	14,39	15,46	12,02	18,42	11,41
4	9,44	14,17	15,51	13,37	19,07	16,88
5	5,26	18,90	16,63	12,06	15,49	11,15
Total	**38,19**	**89,15**	**88,26**	**67,91**	**90,72**	**57,79**

Table.39 Total fixation durations in the second condition sentences

In the table given above, the total fixation durations of five target sentences belonging to the condition 2 is given. The sentences in condition 2 are formed in the first word order, with a transitive embedded verb and a declarative [D] biasing context. As it is seen, the total fixation durations made by 30 participants in five sentences on subject 1 is 38,19 seconds, on wh-word 89,15 seconds, on subject 2 88,26 seconds, on object 67,91 seconds, on embedded verb 90,72 seconds and on the main verb, 57,79 seconds.

Experiment.1 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.3	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	2,72	14,17	17,00	11,08	14,81	7,46
2	10,15	17,18	19,48	18,12	18,84	10,51
3	8,91	19,19	16,51	14,29	16,37	11,98
4	14,31	16,90	20,73	14,55	20,94	16,36
5	7,78	22,53	20,29	12,98	16,93	13,67
Total	**43,87**	**89,97**	**94,01**	**71,02**	**87,89**	**59,98**

Table.40 Total fixation durations in the third condition sentences

In the table give above, the total fixation durations of the units in five target sentences belonging to the third condition is given. The word order of condition three is as follows; s1 – wh – s2 – obj – ev – mv, the embedded verb type is ditransitive, and the biasing context is interrogative [Q]. It is observed that the total duration of the 30 participants' recordings on subject 1 is 43,87 seconds, on wh-word 89,97 seconds, on subject 2 94,01 seconds, on object 71,02 seconds, on embedded verb 87,89 seconds, and finally the total fixation durations on the main verb is 59,98 seconds.

Experiment.1 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.4	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	4,02	16,90	19,94	12,60	15,66	9,59
2	8,18	19,35	14,69	18,48	20,47	13,01
3	7,58	19,52	17,10	11,67	16,55	12,71
4	9,11	13,06	17,59	12,88	19,38	12,63
5	8,57	20,41	14,93	11,54	15,36	11,06
Total	**37,46**	**89,24**	**84,52**	**67,17**	**87,42**	**59**

Table.41 Total fixation durations in the fourth condition sentences

The total fixation durations of five target sentences belonging to the fourth condition is given above. The word order of the sentences in the 4th condition is as follows; s1 – wh – s2 – obj – ev – mv, the embedded verb type is ditransitive, and the biasing context is declarative [D]. As it is seen above, the total of 30 participants' total fixation durations on the first subject of the sentence is 37,46 seconds, it is 89,24 seconds on the wh-word, 84,52 seconds on the second subject of the sentence, 67,17 seconds on the object, 87,42 seconds on the embedded verb and finally 59 seconds on the main verb of the sentence.

Experiment.1 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.5	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	14,17	19,52	13,64	18,38	23,79	9,26
2	12,36	22,13	12,55	19,66	20,49	9,78
3	11,61	16,63	9,53	16,07	21,95	12,27
4	12,67	22,20	14,24	19,02	24,97	16,22
5	12,45	15,19	7,80	11,30	13,83	11,54
Total	**63,26**	**95,67**	**57,76**	**84,43**	**105,03**	**59,07**

Table.42 Total fixation durations in the fifth condition sentences

The table 42 given above indicates that total reading times gathered out of the 30 participants' recordings on the five target sentences belonging to the fifth condition in which the word order is; s1 – s2 – wh – obj – ev – mv; the embedded verb is a transitive one, and the biasing context is interrogative [Q]. The total fixation durations on the first subject of the sentence is 63,26 seconds, it is 95, 67 seconds on the second subject of the sentence, 57,76 seconds on the wh-word, 84,43 seconds on the object, 105,03 seconds on the embedded verb and finally it is 59,07 seconds on the main verb.

Experiment.1 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.6	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	8,85	21,92	15,45	19,92	27,45	7,28
2	9,78	18,57	16,10	25,08	20,22	9,11
3	10,82	16,72	10,43	15,69	27,03	12,46
4	8,73	18,50	9,14	15,69	19,48	12,07
5	12,99	19,38	12,08	14,74	17,71	11,33
Total	**51,17**	**95,09**	**63,20**	**91,12**	**111,89**	**52,25**

Table.43 Total fixation durations in the sixth condition sentences

The table given above shows the total fixation durations of the five target sentences of the sixth condition which has the following word order; s1 – s2 – wh – obj – ev – mv; the transitive verb in the embedded clause, and the declarative [D] biasing context. The total of first fixation durations on the first subject of the sentence is 51,17 seconds, it is 95,09 seconds on the second subject of the sentence, 63,20 seconds on the subject 2, 91,12 seconds on the object, 111,89 seconds on the embedded verb and finally 52,25 seconds on the main verb.

Experiment.1 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.7	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	7,14	19,31	12,08	12,34	14,93	7,10
2	7,04	21,17	8,76	15,87	21,41	11,32
3	9,58	15,65	10,73	17,30	18,31	9,50
4	5,63	21,05	9,15	13,90	16,61	11,58
5	11,50	18,94	9,69	12,26	16,24	10,39
Total	**40,89**	**96,12**	**50,41**	**71,67**	**87,50**	**49,89**

Table.44 Total fixation durations in the seventh condition sentences

The results of the total of first fixation durations of the five target sentences in condition seven is given above in table 44. The sentences in condition seven has the following word order; s1 – s2 – wh – obj – ev – mv; a ditransitive embedded verb in the embedded clause, and an interrogative [Q] biasing context. As it is seen, the total of the first fixation durations on the first subject is 40,89 seconds, it is 96, 12 seconds on the second subject of the sentence, it is 50,41 seconds on the wh-word, 71,67 seconds on the object, 87,50 seconds on the embedded verb, and finally it is 49,89 seconds on the main verb.

Experiment.1 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.8	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	4,16	10,75	8,45	11,69	13,31	6,31
2	6,62	21,04	10,82	16,52	18,83	9,65
3	10,89	14,72	9,46	14,77	18,70	11,70
4	6,93	23,91	13,88	14,06	17,65	11,55
5	7,10	17,29	10,89	9,26	14,52	11,04
Total	**35,70**	**87,71**	**53,50**	**66,30**	**83,01**	**50,25**

Table.45 Total fixation durations in the eighth condition sentences

The table given above shows the total fixation durations of the five target sentences in the eighth condition in which the word order is as follows; s1 – s2 – wh – obj – ev – mv; the embedded verb type is ditransitive, and the biasing context is declarative [D]. As it is seen, the total fixation durations on the first subject of the sentence is 35,70 seconds, it is 87,71 seconds on the second subject, 53,50 seconds on the wh-word, 66,30 seconds on the object, 83,01 seconds on the embedded verb and 50,25 seconds on the main verb.

When we have a look at the 'total fixation durations' comparing the word order differences as a whole, it is observed that like the situation in the 'first fixation durations', it is the wh-region, which creates the major difference between two word orders. The total fixation durations on the wh-word region belonging to the first word order, in which the wh-word is located before the subject of the embedded clause (s2) outnumbers the total fixation durations on the wh-word region in the second word order, in which the wh-word is placed following the embedded clause subject (s2) in the sentence, which means that the wh-word is inside the embedded clause, nearer to the first possible predicate to assign the theta-role

and the case to the wh-argument. The difference between the values is statistically significant as given below;

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
wh_tfd_order_difference	Equal variances assumed	38	,000	6,81300
	Equal variances not assumed	34,188	,000	6,81300

Table.46 – t-test outcome of the word order difference on 'total fixation durations' recorded on the wh-phrase

This finding is also in harmony with the outcomes of the 'first fixation durations' on the wh-word region due to word order comparison. Moreover, the regression analysis also supports the same divergence in terms of both fixation metrics. In the first word order, the reader makes longer first fixations, and longer total fixations on the wh-region, and also makes more frequent regressions to the wh-word region than the comparable values in the second word order in terms of the same measurement metrics. When the wh-word is located outside of the embedded clause, and farther from the first potential predicate the processor has spent more time to process the same type of wh-word. The fact that this finding is also supported by the 'first fixation durations' indicates the existence of a clause-boundary sensitivity of the parser for processing the wh-word together as mentioned beforehand in the present study; moreover the regression rates from the end of the sentence, and the total fixation durations indicate a solid processing difficulty with the structure creating the same ambiguity. Trueswell et al. (1993) state that the constraints related to verbs are perhaps the most influential lexically specific constraints since verbs provide both semantic and syntactic constraints on arguments and the types of complements. Since in Turkish the verb comes after the processor comes up with the arguments, and with possible adjuncts, it is truly acceptable for the processor to make the licensing decision of the fronted wh-phrase after reading the possible predicate in line. The difference between the total fixation durations on the wh-word region in two word orders relate the fact that the processor seems to be sensitive first with the place of the wh-word, i.e. if it is inside the embedded clause, it is processed faster, then, the type of the embedded verb plays an important role in licensing the fronted wh-phrase with the needed theta features due to the

subcategorization frame of the verb itself. Moreover, the impact of the word order type and the place of the wh-word in the sentence seem to be observed on the total fixation durations of the items following the wh-word. The total fixation durations on the 'object' and the 'embedded verb' tend to increase in the second word order (total fixation durations on the 'object'*; condition1: 69,73 seconds, condition2: 67,91 seconds, condition3: 71,02 seconds, condition4: 67,17 seconds (conditions1, 2, 3, and 4 belong to the first word order)*; *condition5: 84,43 seconds, condition6: 91,12 seconds, condition7: 71,67 seconds, condition8: 66,30 seconds (conditions 5, 6, 7, and 8 belong to the second word order)*; total fixation durations on the 'embedded verb'*; condition1: 104,51 seconds, condition2: 90,72 seconds, condition3: 87,89 seconds, condition4: 87,42 seconds, condition5: 105,03 seconds, condition6: 111,89 seconds, condition7: 87,50 seconds, condition8: 83,01 seconds*) while the total fixation durations on the 'main verb' region tend to decrease in the same (2^{nd}) word order in comparison with the first word order (total fixation duration on the 'main verb'*; condition1: 66,81 seconds, condition2: 57,79 seconds, condition3: 59,98 seconds, condition4: 59 seconds; condition5: 59,07 seconds, condition6: 52,25 seconds, condition7: 49,89 seconds, condition8: 50,25 seconds*). This is to be interpreted as follows; when the wh-word is inside the embedded clause, the total fixation durations of the object and the embedded verb are higher since the processor tries to license the wh-word inside the embedded clause, with the nearest predicate in the same clause, on the other hand, when the wh-word is outside of the embedded clause, the total fixation durations on the object and the embedded verb are lower due to the same reasons. The processor detects the wh-word out of the domain of the embedded verb, i.e. out of the domain of the embedded clause and needs to be interpreted in the domain of the main verb. This is supported with the higher amount of total fixation recordings on the main verb in the first word order, in which the wh-word is outside of the embedded clause. This also has been supported by the regression frequencies from main verb to wh-word region as given and discussed in detail in the first section of the present chapter.

Besides the outcomes in regard to the total fixation durations on the wh-word in terms of word order difference in general, it is also possible to observe the effect of the word order

type in terms of the embedded verb type classification. The total fixation durations on the wh-word region in conditions 1 and 2, in which the embedded verb type is transitive are clearly higher than the total fixation durations on the wh-word in conditions 5 and 6 in which the embedded verb is also transitive. Thus, the only variable differentiating these four conditions is the word order. When the wh-word is located before the embedded clause subject, the participants had more trouble in processing the wh-word than the order in which the wh-word is inside the embedded clause. The divergence between them is also significantly valid as seen;

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
wh_tfd_cond12_56_difference	Equal variances assumed	18	,001	6,09600
	Equal variances not assumed	16,055	,001	6,09600

Table.47 – t-test outcome of the word order difference on 'total fixation durations' recorded on the wh-phrase in sentences with transitive embedded verbs

The same divergence between the word orders is also observed between conditions 3, 4 and conditions 7, and 8. The conditions 3 and 4 are formed with ditransitive embedded verbs like the conditions 7 and 8. The variable differentiates these two sets is the word order. When the wh-word is out of the embedded clause, the total fixation durations are higher than the order in which the wh-word is located inside the embedded clause. The type of the embedded verb does not seem to be highly influential over the word order. The difference between the total fixation durations on the wh-word in sentences formed with ditransitive embedded verbs belonging to the first and second word orders is statistically significant as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
wh_tfd_cond34_78_difference	Equal variances assumed	18	,000	7,53000
	Equal variances not assumed	14,442	,000	7,53000

Table.48 – t-test outcome of the word order difference on 'total fixation durations' recorded on the wh-phrase in sentences with ditransitive embedded verbs

Another significant influence of the word order type on the total fixation durations of the units is observed on the object of the sentence when the sentences formed with transitive embedded verbs are examined. The conditions, which include sentences constructed with transitive embedded verbs are 1 and 2 (the first word order), and 5 and 6 (the second word order). The total fixation durations on the 'object' of the second word order sentences (conditions 5 and 6) with transitive embedded verbs are statistically higher than the total fixation durations on the object of the first word order sentences (conditions 1 and 2) with transitive embedded verbs as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
obj_tfd_cond12_56_difference	Equal variances assumed	18	,012	-3,79100
	Equal variances not assumed	14,359	,014	-3,79100

Table.49 – t-test outcome of the word order difference on 'total fixation durations' recorded on the object in sentences with transitive embedded verbs

The same divergence on the total fixation durations on the object (at least statistically significant one) is not observed in the sentences formed with ditransitive embedded verbs. This relates the impact of the word order in relation to the importance of the subcategorization frame of the embedded verb. When the wh-word is inside the embedded clause it is processed faster than the situation when it is outside of the embedded clause but vice versa is valid for the object of the sentence; when the wh-word which is an argument is inside the embedded clause, the processor had more trouble with processing the object just following the wh-argument when the embedded verb is a transitive one. The transitive predicate has one empty category for object theta-role and it seems to be occupied by the wh-argument, so the second DP in the same clause creates problem for the processor, but the same problem does not seem to occur when the embedded verb is a ditransitive one since both of the wh-argument and the other DP in the same clause can be licensed with theta-roles due to the permission of the subcategorization frame of the embedded clause

predicate. The increase of the total fixation durations on the object in the second word order and the simultaneous decrease of the total fixation duration on the wh-word in the same group of sentences clearly favor a linearly clause oriented, and in relation to this, predicate constrained analysis of wh-phrases in complex sentence structure in Turkish.

Besides the effect of the word order type, i.e. the impact stemmed from the place of the wh-argument in the sentence, the influence of the embedded verb type on the processing of these types of ambiguous complex sentences are observed through the examination of the comparison of conditions including transitive and ditransitive embedded verbs. The total fixation durations on both the 'object' and the 'embedded verb' show clear divergence between conditions formed with transitive and ditransitive embedded verbs in the 2nd word order. The fact that this divergence has not been observed between embedded verb types in the 1st word order is also a topic of concern discussed just below. But first, the total fixation durations on the 'object' and the 'embedded verb' regions will be analyzed and discussed. When we compare the total fixation durations on the 'object' of the sentences in conditions 5 and 6 (transitive embedded verb) with the ones in conditions 7 and 8 (ditransitive embedded verb), we see that the durations recorded in the first set outnumbers the ones in the second set (*Condition 5: 84,43 seconds, condition 6: 91,12 seconds; condition 7: 71,67 seconds, condition 8: 66,30 seconds*). The difference is statistically significant as seen:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
obj_tfd_order2_cond56_78_ difference	Equal variances assumed	18	,016	3,75800
	Equal variances not assumed	15,571	,018	3,75800

Table.50 – t-test outcome of the embedded verb type difference on 'total fixation durations' recorded on the object in sentences belonging to the second word order

As stated beforehand, the wh-word is located after the subject of the embedded clause in the second word order (conditions 5, 6, 7, and 8). The outcomes gathered through the comparison of the conditions formed with transitive and ditransitive embedded verbs indicate a difficulty on the 'object' region for the processor in the conditions formed with

transitive embedded verbs, and the same processing difficulty is also observed on the 'embedded verb' region in the same sentence types. When the sentences formed with transitive embedded verbs have the following total fixation durations on the embedded verb region; condition 5: 105,03 seconds, condition 6: 111,89 seconds; the sentences formed with ditransitive embedded verb have the following recordings as total fixation durations on the embedded verb region: condition 7: 87,50 seconds, condition 8: 83,01 seconds. The difference is statistically valid as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
ev_tfd_order2_cond56_78_difference	Equal variances assumed	18	,008	4,64100
	Equal variances not assumed	14,258	,009	4,64100

Table.51 – t-test outcome of the embedded verb type difference on 'total fixation durations' recorded on the embedded verb in sentences belonging to the second word order

As it is seen, the processor had much more trouble during processing the 'object' and the 'embedded verb' when the wh-word is inside the embedded clause with a transitive embedded verb, but the same difficulty has not been observed in sentences with ditransitive embedded verbs with the wh-word inside the embedded clause. These findings both support the role of the verb in terms of the argument structure that it dictates and the linear order of the wh-phrase in processing complex sentences. If the results had indicated a non-significant divergence in terms of the embedded verb type, the discussion favoring the predicate-constrained tendency of the processing strategies for Turkish complex sentence structure with ambiguity could not be validated. The 'total fixation durations' on both the object and the embedded verb increased when the wh-word is located inside the embedded clause formed with a transitive verb. The wh-word used in the first experiment is an argument and thus needs to get its theta role in the predicate's subcategorization frame. When the possible predicate (the verb of the embedded clause) allowed two DPs to be in the object position (the ditransitive verb) the processor did not have total fixation durations on the object and the embedded verb as long as the ones recorded when the embedded verb is a transitive one. This clearly indicates that the processor tries to license the embedded-

clause-inside wh-argument with the linearly the nearest verb. If the nearest transitive predicate's subcategorization frame is filled with another DP (the object), the processor had more difficulty in processing the object and the embedded verb region, but when the predicate in the same clause with the wh-argument allowed two DPs (arguments) to occupy the object positions, the processor did not have the same trouble regardless of the place of the wh-word.

In Miyamoto and Takahashi (2002) it is reported that main clause wh-questions were read more slowly than embedded clause wh-questions in cases which no Q-particle is attached to te embedded verb. This is discussed to be an indiator of a dependency between a wh-word and a related Q-particle in wh-in-situ languages, which resembles the dependency between a wh-filler and its gap position in wh-movement languages. Moreover, this dependency creates an expectance for the Japanese readers to see a Q-particle after they read a wh-word, and if this expectance is not satisfied, as in matrix wh-questions in their study, matrix wh-questions are read more slowly than embedded wh-questions. Also, Aoshima et al. (2004) state that Japanese (an SOV language like Turkish) readers prefers to interpret a fronted wh-filler within the embedded clause, since the wh-phrase is related to the first verb which readers come up with. On the matter of licensing scrambled wh-phrases Ueno and Kluender (2003) report through an ERP experiment that their findings are consistent with a wh-Q expectation hypothesis and further, both filler-gap dependencies and wh-Q dependencies evoke anterior negativity (R)AN in the form of slow potentials. Finally, it has been hypothesized that the anterior negative slow potentials is the result of working memory load caused by the dependency between a wh-unit and its related Q-particle which resembles the situation in wh-movement languages in which the parser needs to maintain actively a wh-filler until it is associated with its gap. In the present study, the 'total fixation durations' on fronted wh-phrases show a divergence cross conditions related to the placements of the wh-phrases. The more distant wh-phrases from the first verb in the sentence are processed more difficultly which is also supported via the regression frequencies from main verb to the wh-words in the related sentence types. This may be due

to a possible working memory load created as a result of the linear distance between the scrambled wh-phrase and the first verb in the sentence.

4.1.3.3. General Discussion on the Outcomes of the First Experiment

In the analysis of the first experiment three eye-tracking measurements metrics have been used; the 'regression frequencies' inside the sentences, the 'first fixation durations' on the areas of interests in the sentences and the 'total fixation durations' on the same areas of interests in the sentences. Among the measurement metrics, it is found out that the most satisfying outcomes have come from regression frequencies and the total fixation durations. Although the first fixation durations seem not to provide robust outcomes to speculate on, the first fixation duration records on the wh-word region, which are the only results that give statistically significant differences between word orders, are in parallel with the outcomes of the regression and total fixation duration analysis. The reasons why first fixation durations may not be very useful in the case of Turkish processing issue have been interpreted in line with the verb-final and flexible-scrambling nature of Turkish. The processor needs to reach the end of the sentence in order to finalize the licensing issues since the verb(s) are located at the end of a Turkish sentence, and moreover the distribution of case-marked DPs in Turkish are not rigidly classified which could help the processor expect for a suitable or unsuitable location for the place of the fronted wh-filler to be linked with its gap position. The only criterion to manipulate the processor seems to be the accusative marked object DPs in the sentences by signaling that the following sentence should be a complex one. This may have an effect on processing realizing itself on the clause-sensitivity of the parser, which seems to be also supported with the outcomes of the regression frequencies and the total fixation durations on the wh-region, object, and the embedded verb region. Although the 'first fixation durations' do not seem to give comprehensive outcomes on the final interpretations of the complex sentences with fronted wh-phrases, they give an important clue on the initial parsing strategies of Turkish and also give support for the linear distance hypothesis for Turkish case as explained in detail in above sections and as summarized below.

The outcomes gathered through the examination of the 'first fixation durations' on the wh-words indicate peculiar outcomes in terms of word order variability in a general sense. The divergence in the 'first fixation durations' on the specified areas of interests is observed only on the 'wh-word' itself when the word order types are compared. It is seen that the farther the wh-word is located from the first verb, the more difficult it is to be processed, which is reflected on longer fixation times. The divergence signals the processor's aim at parsing the sentence taking the linear distance of the wh-filler to its base generated position into consideration supporting the findings gathered through main verb to wh-word (mv – wh) regressive saccade patterns. In the first word order (*s1 – wh – s2 – obj – ev – mv*) the wh-word precedes the genitive marked subject, which means that it is located out of the embedded clause, and it attracted more first fixation duration than the wh-word in the second order which follows the genitive marked subject, which means that the wh-word is inside the embedded clause. Since the first fixation durations on the wh-words give the times spent on the mentioned items before coming up with the first verb in the sentence, there is no other option than interpreting this divergence as stemming from the place of the wh-word and clause-sensitivity of the parser. In Miyamoto and Takahashi (2002) it is observed that in Japanese, matrix clause wh-questions are processed more slowly than embedded clause wh-questions if there is no Q-particle, which licensed the scope of the wh-word, attached to the embedded clause verb. Japanese readers are thought to expect a Q-particle as soon as they see a wh-word; and if this is not satisfied, typing mismatch effect (TME) occurs which is reflected through longer reading times. In the present study, only condition 1 and 2 sentences in the first experiment (implemented wh-argument as the fronted wh-word) have obligatory interrogative readings (matrix question). Although conditions 3 and 4 have the same word order they have double readings (either matrix question or embedded question (declarative reading)) due to the type of the embedded verb (ditransitive). The difference between condition 1, and 2 and condition 3, and 4 sentences cannot be realized by the Turkish readers until they read the embedded verb, and thus the divergence on the 'first fixation durations' on the wh-word stems from the location of the wh-word and not affected with the final interpretation of the sentence since it is not realized

yet due to the verb-final order of Turkish. The readers realize the sentence to be interpreted as a matrix question or a declarative sentence when the verb(s) are processed in a complex Turkish sentence, since like the case in Japanese, Turkish does not have a Q-particle to mark the scope of the fronted wh-word, or does not have a rigid order of DPs according to their case markers in a complex sentence structure. So, the readers have no other choice to wait for the first predicate in the sentence to license the wh-word, and due to the results on the 'first fixation durations' on the wh-word, the linear distance makes it easier for the fronted wh-word to be processed faster which means that Turkish parser has a tendency to license and interpret the fronted wh-word in the deepest clause, i.e. embedded clause.

Also the first fixation durations on the 'embedded verb region' give clear information on whether Turkish processor applies an initial syntactic analysis (in a garden – path model of processing) or it processes the fronted wh-fillers making use of the verbal information provided at the embedded verb and main verb regions. In the target sentences used in the present study, although the genitive marked subject DPs may give a clue on the complex structure of the upcoming sentence, the existen of genitive marked subject DPs does not necessarily dictate that the sentence structure is bi – clausal. The only element relating that the sentence should be a complex one is the accusative marked object DP. It is though that if the processor makes an initial syntactic parsing, it should be realized after reading the accusative marked object DP that the following item (if it is a verb) should be ditransitive one, since it should host the DP and the wh-argument. In that respect, the sentences belonging to conditions 5, 6 on the one hand, and conditions 7, 8 on the other are compared in terms of the 'first fixation durations' on the 'embedded verb regions'. It is seen that the difference between them is not statistically significant, which means that the processor did not have any trouble with 'transitive' embedded verb following the accusative marked object DP. This is a clear indication that the processor does not expect a 'ditransitive' embedded verb in the upcoming string of words, which is a clear indication of the fact that the processor does not make an initial syntactic analysis during processing, but makes use of the verbal information in a constraint – based sense.

Another general outcome of the first experiment it is true to indicate that the Turkish processor is sensitive to the linear placement of the wh-argument in complex sentence structure. When the wh-argument is located before the embedded clause subject, the processor makes more regressions to the wh-word region and the total and the first fixation durations on the wh-word region is higher than the position in which the wh-argument is located inside the embedded clause. When the wh-word is inside the embedded clause the processor tries to license it with the same predicate in the same clause, reflected on the fixation durations and regression frequencies. As it has comprehensively been discussed in '*4.1.2. Analysis of Regressive Saccade Frequency Patterns*', when condition 3, 4 and 7, 8 sentences are compared in terms of the main verb to wh-word (mv – wh) regressions it is observed that when the linear distance between the gap and the fronted filler is longer, as in the case of condition 3 and 4 sentences, the regressive saccadic eye movements increase dramatically, even though the structural distance is shorter for the wh-phrase to raise to the Spec-CP at LF in the mentioned sentences. Contra to this, when the structural distance is longer and the linear distance is shorter (condition 7 and 8 sentences) the regression frequencies from main verb to wh-word decreases in a significant sense. This is an indication of the importance of the linear distance between the fronted wh-filler and its potential gap site, which in processing the complex sentence structures with fronted wh-phrases.

Through examining the outcomes of the first experiment in a general perspective, it can be stated that the processing of the ambiguous complex sentences with wh-phrases in Turkish is sensitive to the linear distance of the fronted wh-phrase with its gap position, and an initial syntactic analysis is not observed since the processing strategy is majorly based on the subcategorization frame features dictated by the embedded verb. When, the wh-argument is located inside the embedded clause, the total fixation durations and the regression frequencies increase if the embedded clause verb is a transitive one, which indicates a violation of the theta-role assignment for the mentioned wh-argument, but the same discrepancy has not been observed, at least as strong as the one just mentioned, in the first word order in which the wh-word is located before the embedded clause subject, which

is an indication of the preliminary importance of the place of the wh-word above the type of the embedded verb.

4.2. ANALYSIS AND DISCUSSION OF THE OUTCOMES OF THE SECOND EXPERIMENT

The variables of the second experiment are all the same with the first experiment. The only difference between the structures of the two experiments is the type of the wh-word. While the wh-word used in the first experiment is a wh-argument, the wh-word used in the second experiment is a wh-adjunct '*ne zaman*' (when).

The second experiment is composed of:

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 types of embedded verbs; transitive and ditransitive,

two types of biasing contexts; interrogative and declarative.

Condition	**Order**	**Context**	**Embedded Verb Type**	**Set**	**Expected Interpretation**
1	s1-wh-s2...	Interrogative	Transitive	A	Double
2	s1-wh-s2...	Declarative	Transitive	B	Double
3	*s1-wh-s2...*	*Interrogative*	*Ditransitive*	*C*	Double
4	*s1-wh-s2...*	*Declarative*	*Ditransitive*	*D*	Double
5	s1-s2-wh…	Interrogative	Transitive	A	Double
6	s1-s2-wh…	Declarative	Transitive	B	Double
7	*s1-s2-wh…*	*Interrogative*	*Ditransitive*	*C*	Double
8	*s1-s2-wh…*	*Declarative*	*Ditransitive*	*D*	Double

Table.52 Eight conditions in the second experiment

The data collection tool includes 40 target sentences. 20 of these sentences are formed in the first word order (*s1 – wh – s2 – obj – ev – mv*), while the other 20 have been formed in the second (*s1 – s2 – wh – obj – ev – mv*).

The analysis section will be divided into parts each of which will analyze the outcomes of the experiment in terms of the word order effect and the embedded verb effect. As it was previously indicated in the methodology section, the metrics used in order to analyze and interpret the findings are regression rates (from source to target regions), total of fixation durations and the total of first fixation durations.

4.2.1. The Effect of Word Order and the Embedded Verb Type on Interpretation

Although the analysis in this section will majorly be based on the word order difference, the interaction of the embedded verb type and the context on the processing strategies of the participants will also be mentioned. As it is seen in the table (?) below, the sentences in the first word order have all naturally 'double' readings, i.e. it is possible to derive both interrogative [Q] and declarative [D] readings through the same structure without having any overt difference. Although the embedded verb type differs across conditions (conditions 1 and 2 are formed with transitive embedded verbs, conditions 3 and 4 are formed with ditransitive embedded verbs) the sentences are still ambiguous between these two readings. Moreover, the four sentence types (four conditions) used in the 2nd experiment are biased with interrogative [Q] and declarative [D] contexts due to the need to create all interpretation types for the participants. Conditions 1 and 3 are biased with interrogative [Q] context while conditions 2 and 4 are biased with declarative [D] contexts as seen below:

Condition	**Order**	**Context**	**Embedded Verb Type**	**Expected Interpretation**
1	s1-wh-s2...	Interrogative	Transitive	Double
2	s1-wh-s2...	Declarative	Transitive	Double
3	*s1-wh-s2...*	*Interrogative*	*Ditransitive*	Double
4	*s1-wh-s2...*	*Declarative*	*Ditransitive*	Double

Table.53 Four conditions in the first order of the second experiment

In the first word order, the wh-word is located before the subject of the embedded clause (subject 2). The sentences 42 and 43 given below are from the first group of sentences constructed in the following word order: *s1 – wh – s2 – obj – ev – mv.* Sentence 37 is

formed with a transitive embedded verb, while sentence 38 is made with a ditransitive verb in the embedded clause:

42. Ahmet ne zaman Ayşe'nin kitabı gördüğünü söyledi
Ahmet-nom when-dat Ayşe-gen book-acc see-pst-ind-3rd say-pst-3rd

43. Uğur ne zaman İnci'nin raporu yolladığını duyurdu
Uğur-nom when-dat İnci-gen report-acc send-pst-ind-3rd announce-pst-3rd

In the first word order, in which the wh-word *ne zaman (when)* is located before the embedded clause subject, the scope of the wh-word is either the main verb or the embedded verb regardless of the type of the embedded verb.

Also in the second word order, in which the wh-word is located after the embedded clause subject (subject 2), the sentences create both readings as matrix question reading or the embedded clause reading as given in the table below:

Condition	**Order**	**Context**	**Embedded Verb Type**	**Set**	**Expected Interpretation**
5	s1-s2-wh…	Interrogative	Transitive	A	Double
6	s1-s2-wh…	Declarative	Transitive	B	Double
7	*s1-s2-wh…*	*Interrogative*	*Ditransitive*	*C*	Double
8	*s1-s2-wh…*	*Declarative*	*Ditransitive*	*D*	Double

Table.54 Four conditions in the second order of the second experiment

Sentence 44 below belongs to the second group of sentences formed in the following word order; s1 – s2 – wh – obj – ev – mv.

44. *Cemal Demet'in ne zaman kitabı gördüğünü söyledi
Cemal-nom Demet-gen when-dat book-acc see-pst-ind-3rd say-pst-3rd

The sentence given above shows that the scope of the wh-word may be either the embedded clause or the main clause, leading to two different interpretations respectively; declarative [D] and interrogative [Q].

The fact that the same order causes two different interpretations does not differ when the embedded verb is a ditransitive one as seen below;

45.	Alper	Büşra'nın	ne zaman	kitabı	verdiğini	söyledi
	Alper-nom	Büşra-gen	when-dat	book-acc	give-pst-ind-3rd	say-pst-3rd

As it is seen through the examples and the tables given above, although the place of the wh-word (wh-adjunct in the second experiment) shifts between the two word orders, the interpretation derived out of the sentences are all 'double' between an interrogative [Q] and a declarative [D] one. The situation shows a divergence between the two experiments in that sense. In experiment one, in which the wh-word is a wh-argument, all the sentences do not give the same 'double' readings in all circumstances. The divergence between the interpretations of the same ordered sentences may give important clues about the interaction between the embedded clause subject, the place of the wh-word and the argument/adjunct nature of the wh-word in processing. Moreover, for the second experiment, the fact that the alteration of the place of the wh-word does not affect the dualism in the final interpretations of the sentences may favor the predicate-based analyses of processing filler-gap dependencies in terms of Turkish complex sentence structure with ambiguity stemming from the licensing of the wh-word.

In order to point out the processing strategies of the Turkish readers, an eye-tracking study has been carried out with wh-adjunct in the second experiment. As it was stated before, the variables used in the first experiment remain the same (the word order types, the embedded verb types and the biasing contexts) but the type of the wh-word has been changed from wh-argument to wh-adjunct. This will provide to speculate on the relation between the subcategorization frame of the embedded verb and the wh-word, and the possible effect of this relation on processing fronted wh-phrase and its gap dependency.

4.2.2. Analysis of Regression Patterns

In this section, the results of the regressions patterns gathered through each target sentence in the study will be given. The regression patterns that will be given are main verb to embedded verb (mv – ev), main verb to the wh-word (mv – wh), embedded verb to the object (ev – obj), embedded verb to the wh-word (ev – wh), and main verb to the second subject (mv – s2). As stated beforehand, the data collection tool includes eight different conditions each is diverged from the other with either the word order, or the embedded verb type or the biasing context. Each condition included five different (having the same structure with various DPs in subject (s), and object positions) target sentences, making the sum of 40 target sentences in eight conditions. The order of the section will be organized according to the eight conditions, as from the first condition to the eighth one. At first stage, the raw data gathered through the eye-tracking recordings of the 30 participants will be given in terms of the regression patterns on the above-mentioned units in the sentences for each of the 40 target sentences. After the raw data have been presented, detailed comparative analysis and the discussion of the results will be given according to the variables in the experiment, i.e. the effect of the word order type, the effect of the embedded verb type in accordance with all biasing context types. The discussion will be carried out together with the presentation of the statistical data of each item under discussion.

As it has been applied in the analysis and discussion of the first experiment, the regression paths to be analyzed and discussed for the second experiment are also the ones from main verb to the embedded verb (mv – ev), main verb to the wh-word (mv – wh), embedded verb to object (ev – obj), embedded verb to the wh-word (ev – wh), and main verb to the second subject of the sentence (mv – s2). Before presenting the sentence by sentence regression outcomes it is suitable to state that for the second experiment, the most peculiar outcomes on regression paths are observed on main verb to embedded verb (mv – ev), main verb to wh-word (mv – wh), and from embedded verb to object (ev – obj) regions. The details are given below.

The first 20 target sentences are formed in the first word order as follows; *subject1 – wh-word – subject2 – object – embedded verb – main verb*, and they belong to the conditions 1, 2, 3, and 4.

Sentence 1 Ahmet ne zaman Ayşe'nin kitabı gördüğünü söyledi
Ahmet-Nom when Ayse-Gen book-Acc see-Ind-Acc say-Past-3rdSing
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 1 above, the 30 participants made 18 main verb to embedded verb (mv – ev) regressions, eight main verb to wh-word (mv – wh) regressions, 10 embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and finally six main verb to subject 2 (mv – s2) regressions.

Sentence 2 Ali ne zaman Aslı'nın oyuncağı kırdığını anlattı
Ali-nom when Aslı-gen toy-acc break-ind-acc tell-past-3rdSing
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

The participants made a total of nine regressions from main verb to the embedded verb (mv – ev), three regressions from main verb to the wh-word (mv – wh), 10 regressions from embedded verb to the object (ev – obj), two regressions from embedded verb to the wh-

word (ev – wh), and finally four regressions from main verb to the second subject of the sentence (mv – s2), in sentence 2 above.

Sentence 3 Mustafa ne zaman Emel'in soruyu değiştirdiğini bildirdi
Mustafa-nom when Emel-gen question-acc change-ind-acc notify-past-3rdSing
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 3 above, the participants made 10 main verb to embedded verb (mv – ev) regressions, five main verb to wh-word (mv – wh) regressions, five embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions and finally six main verb to subject 2 (mv – s2) regressions in total.

Sentence 4 Burak ne zaman Burcu'nun mektubu kaybettiğini hatırlattı
Burak-nom when Burcu-gen letter-acc lose-ind-acc remind-past-3rdSing
Condition: 1
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

The participants made 12 main verb to embedded verb (mv – ev), eight main verb to wh-word (mv – wh), 11 embedded verb to object (ev – obj), one embedded verb to wh-word (ev – wh), and finally four main verb to the second subject of the sentence (mv – s2) regressions in total for the fourth target sentence in the study.

Sentence 5 Cem ne zaman Pınar'ın raporu bitirdiğini duyurdu

Cem-nom when Pınar-gen report-acc complete-ind-acc announce-past-3rdSing

Condition: 1

Word order: s1 – wh-word – s2 – object – embedded verb – main verb

Embedded verb type: Transitive

Biasing context: Interrogative [Q]

Interpretation: Double

In sentence 5 above, the participants made a total of three main verb to embedded verb (mv – ev) regressions, four main verb to wh-word (mv – wh) regressions, three embedded verb to object (ev – obj) regressions, one main verb to second subject of the sentence (mv – s2) regression while no regression from embedded verb to the wh-word (ev – wh) is observed. When we have a general look at the total regression numbers made in the five target sentences belonging to the first condition in which the word order is '*subject.1 – wh-word – subject.2 – object – embedded verb (transitive) – main verb*', the biasing context is *interrogative [Q]*, and the embedded verb type is *transitive*, it is seen that the total frequency of regressions made form main verb to the embedded verb (mv – ev) is 51, total regression numbers made from main verb to the wh-word (mv – wh) is 28, total number of regressions from embedded verb to the object (ev – obj) is 39, the total number of regressions made from embedded verb to the wh-word (ev – wh) is six, and the total number of regressions made from the main verb to the second subject in the sentence (mv – s2) is 21.

Condition 1 regression totals: *mv – ev: 51; mv – wh: 28; ev – obj: 39; ev – wh: 6; mv – s2: 21.*

Condition.1|s1-wh-s2-obj-ev-mv Embedded verb: transitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	51	28	39	6	21

Table 55 – Total number of regressions in five target sentences in condition 1

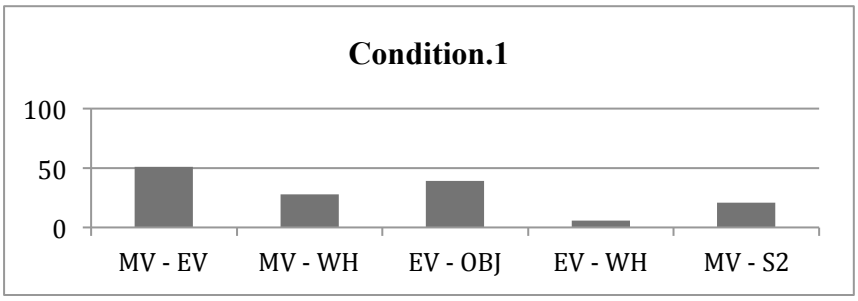


Figure 9 – Total regression frequencies in condition 1

Sentence 6 Ahmet ne zaman Ayşe'nin kitabı gördüğünü söyledi
Ahmet-nom when Ayse-gen book-acc see-ind-acc say-past-3rdSing
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

Sentence 6 given above belongs to the second condition group of sentences. The condition 2 sentences are different from the condition.1 sentences just in terms of the biasing context as indicated above. In sentence.6 above the participants made a total of eight main verb to embedded verb (mv – ev) regressions, five main verb to wh-word (mv – wh) regressions, eight embedded verb to object regressions (ev – obj), three embedded verb to wh-word regressions (ev – wh) and finally one main verb to subject 2 (mv – s2) regression.

Sentence 7 Ali ne zaman Aslı'nın oyuncağı kırdığını anlattı
Ali-nom when Aslı-gen toy-acc break-ind-acc tell-past-3rdSing
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 7 above the participants made a total of three main verb to embedded verb (mv – ev) regressions, seven main verb wh-word (mv – wh) regressions, 10 embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and one main verb to the second subject of the sentence (mv – s2) regression.

Sentence 8 Mustafa ne zaman Emel'in soruyu değiştirdiğini bildirdi
Mustafa-nom when Emel-gen question-acc change-ind-acc notify-past-3rdSing
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 8 above, the total number of regressions made by 30 participants, from main verb to the embedded verb (mv – ev) is 20, the number of regressions from main verb to the wh-word (mv – wh) is three, the number of regressions from embedded verb to the object (ev – obj) is six, the number of regressions from embedded verb to the wh-word (ev – wh) is three and finally the number of regressions from main verb to the second subject of the sentence (mv – s2) is three.

Sentence 9 Burak ne zaman Burcu'nun mektubu kaybettiğini hatırlattı
Burak-nom when Burcu-gen letter-acc lose-ind-acc remind-past-3rdSing
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

The participants made a total of seven main verb to embedded verb (mv – ev) regressions, four main verb to wh-word (mv – wh) regressions, two embedded verb to object (ev – obj)

regressions, two main verb to subject 2 regressions in sentence 9 above while they made no regressions from embedded verb to the wh-word (ev – wh).

Sentence 10 Cem ne zaman Pınar'ın raporu bitirdiğini duyurdu
Cem-nom when Pınar-gen report-acc complete-ind-acc announce-past-3rdSing
Condition: 2
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 10 above, the 30 participants made a total of 10 main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, three embedded verb to object (ev – obj) regressions, four embedded verb to wh-word (ev – wh) regressions, while no regression from main verb to the second subject of the sentence (mv – s2) is observed.

Through a general look at the five target sentences belonging to condition.2 which has the word order as; '*subject.1 – wh-word – subject.2 – object – embedded verb (transitive) – main verb*', *declarative [D]* biasing context, and *transitive* embedded verb, it is seen that the total number of regressions made from main verb to the embedded verb (mv – ev) is 48, the total number of regressions made from main verb to the wh-word (mv – wh) is 26, the total number of regressions made from embedded verb to the object (ev – obj) is 29, the total number of regressions made from embedded verb to the wh-word (ev – wh) is 11 and finally the total number of regressions made from main verb to the subject.2 (mv – s2) is six.

Condition 2 regression totals: *mv – ev: 48; mv – wh: 26; ev – obj: 29; ev – wh: 11; mv – s2: 6.*

Condition.2|s1-wh-s2-obj-ev-mv Embedded verb: transitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	48	26	29	11	6

Table 56 – Total number of regressions in five target sentences in condition 2

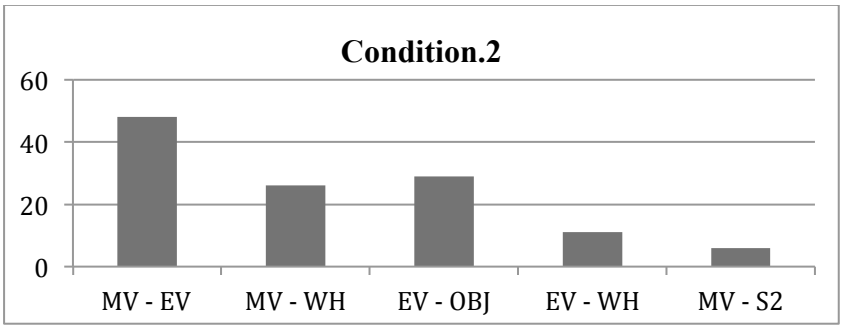


Figure 10 – Total regression frequencies in condition 2

Sentence 11 Can ne zaman Zeynep'in kitabı verdiğini söyledi
Can-nom when Zeynep-gen book-acc give-ind-acc say-past-3rdSing

Condition: 3

Word order: s1 – wh-word – s2 – object – embedded verb – main verb

Embedded verb type: Ditransitive

Biasing context: Interrogative [Q]

Interpretation: Double

Sentence 11 belongs to the condition 3 in which the embedded verb is a ditransitive one. 30 participants made five main verb to embedded verb (mv – ev), six main verb to wh-word (mv – wh), seven embedded verb to object (ev – obj), three embedded verb to wh-word (ev – wh), and one main verb to second subject of the sentence (mv – s2) regressions in total during reading sentence 11.

Sentence 12 Emre ne zaman Ece'nin oyuncağı götürdüğünü anlattı
Emre-nom when Ece-gen toy-acc take-ind-acc tell-past-3rdSing

Condition: 3

Word order: s1 – wh-word – s2 – object – embedded verb – main verb

Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

During reading sentence 12 given above, the 30 participants made 15 main verb to embedded verb (mv – ev), seven main verb to wh-word (mv – wh), 10 embedded verb to object (ev – obj), three embedded verb to wh-word (ev – wh) and finally three main verb to subject 2 (mv – s2) regressions in total.

Sentence 13 Barış ne zaman Yeliz'in soruyu açıkladığını bildirdi
Barış-nom when Yeliz-gen question-acc explain-ind-acc notify-past-3rdSing
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 13, the participants made a total of eight main verb to embedded verb (mv – ev), seven main verb to wh-word (mv – wh), six embedded verb to object (ev – obj), two embedded verb to wh-word (ev – wh), and one main verb to subject.2 (mv – s2) regressions.

Sentence 14 Murat ne zaman Özge'nin mektubu gönderdiğini hatırlattı
Murat-nom when Özge-gen letter-acc send-ind-acc remind-past-3rdSing
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 14 above the total number of regressions from main verb to the embedded verb (mv – ev) is seven, the total number of regressions from main verb to the wh-word (mv – wh) is two, the total number of regressions from embedded verb to the object (ev – obj) is five, the number of regressions from embedded verb to the wh-word (ev – wh) is two and finally the number of regressions from main verb to the second subject of the sentence (mv – s2) is six.

Sentence 15 Uğur ne zaman İnci'nin raporu yolladığını duyurdu
Uğur-nom when İnci-gen report-acc send-ind-acc announce-past-3rdSing
Condition: 3
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

The participants made a total of eight main verb to embedded verb (mv – ev) regressions, a total of eight main verb to wh-word (mv – wh) regressions, a total of seven embedded verb to object (ev – obj) regressions, a total of two embedded verb to wh-word (ev – wh) regressions, and finally a total of four main verb to subject.2 regressions during reading sentence 15 given above.

In five target sentences belonging to the condition 3, in which the word order is '*subject.1 – wh-word – subject.2 – object – embedded verb (ditransitive) – main verb*', the biasing context is *interrogative [Q]*, and the embedded verb is *ditransitive*, the total regressions made from main verb to the embedded verb (mv – ev) is 43, the total regressions made from main verb to the wh-word (mv – wh) is 30, the total number of regressions made from embedded verb to the object (ev – obj) is 35, the total number of regressions made from embedded verb to the wh-word (ev – wh) is 21, and finally the total number of regressions made from main verb to the second subject (mv – s2) is 15.

Condition 3 regression totals: *mv – ev: 43; mv – wh: 30; ev – obj: 35; ev – wh: 21; mv – s2: 15.*

Condition.3|s1-wh-s2-obj-ev-mv Embedded verb: Ditransitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	43	30	35	21	15

Table 57 – Total number of regressions in five target sentences in condition 3

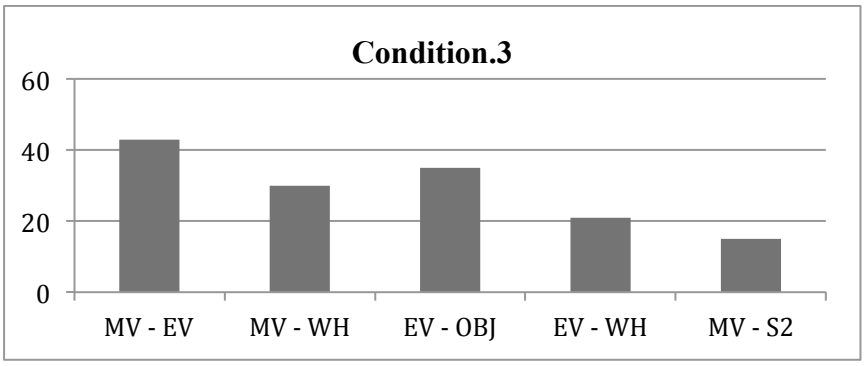


Figure 11 – Total regression frequencies in condition 3

Sentence 16 Can ne zaman Zeynep'in kitabı verdiğini söyledi
Can-nom when Zeynep-gen book-acc give-ind-acc say-past-3rdSing

Condition: 4

Word order: s1 – wh-word – s2 – object – embedded verb – main verb

Embedded verb type: Ditransitive

Biasing context: Declarative [D]

Interpretation: Double

Sentence 16 is the first sentence belonging to the fourth condition in which the embedded verb type is ditransitive and the biasing context is declarative [D] differentiating it from condition 3. In sentence.16 above, the participants made a total of four main verb to embedded verb (mv – ev) regressions, four main verb to wh-word (mv – wh) regressions, 11 embedded verb to object (ev – obj) regressions, three embedded verb to wh-word (ev – wh) regressions and five main verb to second subject of the sentence (mv – s2) regressions in total.

Sentence 17 Emre ne zaman Ece'nin oyuncağı götürdüğünü anlattı
Emre-nom when Ece-gen toy-acc take-ind-acc tell-past-3rdSing
Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 17 above, the number of total regressions made from main verb to the embedded verb (mv – ev) is seven, it is three for the regression totals from main verb to the wh-word (mv – wh), nine for the total regression number from embedded verb to the object (ev – obj), two for the regressions from embedded verb to the wh-word (ev – wh) and finally it is three for the total regression number from main verb to the subject 2 (mv – s2).

Sentence 18 Barış ne zaman Yeliz'in soruyu açıkladığını bildirdi
Barış-nom when Yeliz-gen question-acc explain-ind-acc notify-past-3rdSing
Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 18 above, the participants made a total of nine main verb to embedded verb (mv – ev) regressions, seven main verb to wh-word (mv – wh) regressions, six embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions and finally four main verb to second subject of the sentence (mv – s2) regressions.

Sentence 19 Murat ne zaman Özge'nin mektubu gönderdiğini hatırlattı
Murat-nom when Özge-gen letter-acc send-ind-acc remind-past-3rdSing
Condition: 4

Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 19, the total number of regressions made from main verb to the embedded verb (mv – ev) is 10, while it is nine for the regression number made from main verb to the wh-word (mv – wh). The total number of regressions made by the participants from embedded verb to the object (ev – obj) is five, and it is one from embedded verb to the wh-word (ev – wh). Finally the participants made a total of two regressions from main verb to the subject 2 (mv – s2).

Sentence 20 Uğur ne zaman İnci'nin raporu yolladığını duyurdu
Uğur-nom when İnci-gen report-acc send-ind-acc announce-past-3rdSing
Condition: 4
Word order: s1 – wh-word – s2 – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

Sentence 20 given above is the last target sentence belonging to the fourth condition and also the last target sentence constructed in '*s1 – wh – s2 – obj – ev – mv*' word order, which relates to the conditions 1, 2, 3, and 4. The participants made a total of five main verb to embedded verb (mv – ev) regressions, four main verb to wh-word (mv – wh) regressions, three embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and finally made two main verb to second subject of the sentence (mv – s2) regressions during reading sentence 20.

In five target sentences belonging to the fourth condition in which the word order is; '*subject.1 – wh-word – subject.2 – object – embedded verb (ditransitive) – main verb*', the

biasing context is *declarative [D]*, and the embedded verb is *ditransitive*, the total frequency of regressions made from main verb to the embedded verb (mv – ev) is 35, the total number of regressions made from main verb to the wh-word (mv – wh) is 27, the total number of regressions made from embedded verb to the object (ev – obj) is 34, the total frequency of regressions made from embedded verb to the wh-word (ev – wh) is nine, and finally the total number of regressions made from main verb to the subject.2 (mv – s2) is 16.

Condition 4 regression totals: *mv – ev: 35; mv – wh: 27; ev – obj: 34; ev – wh: 9; mv – s2: 16*.

Condition.4|s1-wh-s2-obj-ev-mv Embedded verb: Ditransitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	35	27	34	9	16

Table 58 – Total number of regressions in five target sentences in condition 4

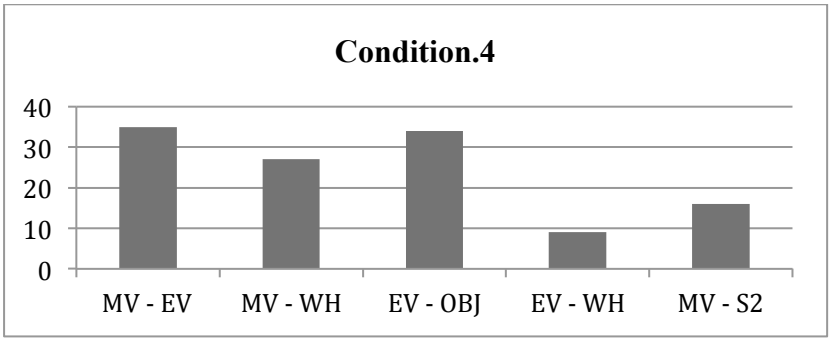


Figure 12 – Total regression frequencies in condition 4

The second set of four conditions (conditions 5, 6, 7, and 8) include 20 target sentences (from 21 to 40) each of which are constructed with the following word order: '*subject.1 – subject.2 – wh-word – object – embedded verb – main verb*'. The regression patterns produced during reading of these sentences by 30 participants are given below:

Sentence 21 Cemal Demet'in ne zaman kitabı gördüğünü söyledi
Cemal-nom Demet-gen when book-acc see-ind-acc say-past-3rdSing

Condition: 5

Word order: s1 – s2 – wh-word – object – embedded verb – main verb

Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 21 above, the 30 participants made four main verb to embedded verb (mv – ev), one main verb to wh-word (mv – wh), four embedded verb to object (ev – obj), four embedded verb to wh-word (ev – wh), and seven main verb to subject.2 (mv – s2) regressions in total.

Sentence 22 Mehmet Gülden'in ne zaman oyuncağı kırdığını anlattı
Mehmet-nom Gülden- gen when toy-acc break-ind-acc tell-past-3rdSing
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 22 above, the total number of regressions made by the 30 participants from main verb to the embedded verb (mv – ev) is four, the frequency of regressions made from embedded verb to the object (ev – obj) is seven, the regressions made from main verb to the second subject of the sentence (mv – s2) is one while the participants made no regression from embedded verb to the wh-word (ev – wh) and from main verb to the wh-word (mv – wh) during reading.

Sentence 23 Selçuk Eda'nın ne zaman soruyu değiştirdiğini bildirdi
Selçuk-nom Eda-gen when question-acc change-ind-acc notify-past-3rdSin
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]

Interpretation: Double

The 30 participants made a total of eight main verb to embedded verb (mv – ev), five main verb to wh-word (mv – wh), two embedded verb to object (ev – obj), one embedded verb to wh-word (ev – wh), and finally made four main verb to subject 2 (mv – s2) regressions during reasing sentence 23.

Sentence 24 Özgür Funda'nın ne zaman mektubu kaybettiğini hatırlattı
Özgür-nom Funda-gen when letter-acc lose-ind-acc remind-past-3rdSing
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 24 above, the 30 participants made a total of nine main verb to embedded verb (mv – ev) regressions, one main verb to wh-word (mv – wh) regression, five embedded verb to object (ev – obj) regressions, three embedded verb to wh-word (ev – wh) regressions and finally 10 main verb to the second subject of the sentence (mv – s2) regressions.

Sentence 25 Serkan Fatma'nın ne zaman raporu bitirdiğini duyurdu
Serkan-nom Fatma-gen when report-acc complete-ind-acc announce-past-3rdSing
Condition: 5
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Interrogative [Q]
Interpretation: Double
Sentence 25 is the last target sentence in condition 5. The participants made a total of eight main verb to embedded verb (mv – ev) regressions, a total of two embedded verb to object

(ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression, a total of five main verb to subject.2 (mv – s2) regressions during reading sentence 25, while no regression is observed made from main verb to the wh-word (mv – wh).

If we have a general look at the five target sentences belonging to the condition.5 in which the word order is; '*subject.1 – subject.2 – wh-word – object – embedded verb (transitive) – main verb*', the biasing context is *interrogative [Q]*, and the embedded verb is a *transitive* one, it is seen that the total frequency of regressions made from main verb to the embedded verb (mv – ev) is 33, while it is seven for the total regressions from main verb to the wh-word (mv – wh). The total number of regressions made from embedded verb to the object (ev – obj) is 20, the total number of regressions made from embedded verb to the wh-word (ev – wh) is nine and finally the total frequency of regressions made from main verb to the second subject in the sentence (mv – s2) is 27.

Condition 5 regression totals: *mv – ev: 33; mv – wh: 7; ev – obj: 20; ev – wh: 9; mv – s2: 27.*

Condition.5|s1-s2-wh-obj-ev-mv Embedded verb: Transitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	33	7	20	9	27

Table 59 – Total number of regressions in five target sentences in condition 5

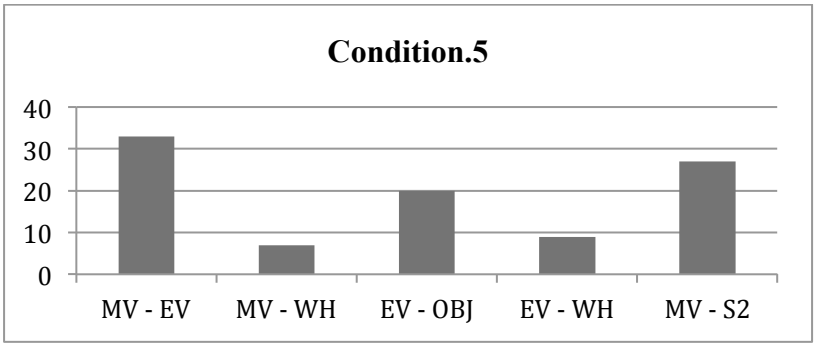


Figure 13 – Total regression frequencies in condition 5

Sentence 26 Cemal Demet'in ne zaman kitabı gördüğünü söyledi
Cemal-nom Demet-gen when book-acc see-ind-acc say-past-3rdSing

Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

Sentence 26 is the first target sentence belonging to the sixth condition. The participants made a total of seven main verb to embedded verb (mv – ev) regressions, a total of two main verb to wh-word (mv – wh) regressions, a total of two embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and finally a total of five main verb to subject 2 (mv – s2) regressions during reading sentence 26.

Sentence 27 Mehmet Gülden'in ne zaman oyuncağı kırdığını anlattı
Mehmet-nom Gülden-gen when toy-acc break-ind-acc tell-past-3rdSing
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 27 above, the participants made two main verb to embedded verb (mv – ev) regressions, one embedded verb to object (ev – obj) regression, and four main verb to subject 2 (mv – s2) regressions. Any regression from main verb to the wh-word (mv – wh) and embedded verb to wh-word (ev – wh) has not been detected. In other words, the participants made no regressions from the two predicates (embedded and the main verbs) of the sentence to the wh-word region.

Sentence 28 Selçuk Eda'nın ne zaman soruyu değiştirdiğini bildirdi
Selcuk-nom Eda-gen when question-acc change-ind-acc notify-past-3rdSing
Condition: 6

Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 28 above, the participants made eight main verb to embedded verb (mv – ev) regressions, three embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression, and three main verb to subject 2 (mv – s2) regressions while no regression from main verb to the wh-word (mv – wh) is observed.

Sentence 29 Özgür Funda'nın ne zaman mektubu kaybettiğini hatırlattı
Özgür-nom Funda-gen when letter-acc lose-ind-acc remind-past-3rdSing
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 29 above, the total number of regressions made from main verb to the embedded verb (mv – ev) is seven, the total number of regressions made from main verb to the wh-word (mv – wh) is six, the total frequency of regressions from embedded verb to the object (ev – obj) is two, the total number of regressions from embedded verb to the wh-word (ev – wh) is one and finally the total frequency of regressions from main verb to the second subject of the sentence (mv – s2) is 10.

Sentence 30 Serkan Fatma'nın ne zaman raporu bitirdiğini duyurdu
Serkan-nom Fatma-gen when report-acc complete-ind-acc announce-past-3rdSing
Condition: 6
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Transitive

Biasing context: Declarative [D]

Interpretation: Double

In sentence 30 above, the 30 participants made a total of six main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, five embedded verb to object (ev – obj) regressions, and six main verb to subject.2 (mv – s2) regressions while no regression from embedded verb to the wh-word (ev – wh) is observed.

When we have a general look at the outcomes gathered through the five target sentence belonging to the condition.6 in which the word order is '*subject1 – subject2 – wh-word – object – embedded verb – main verb*', the biasing context is *declarative*, and the embedded verb is *transitive*, it is seen that the total number of regressions made from main verb to the embedded verb (mv – ev) is 30, the total number of regressions made from main verb to the wh-word (mv – wh) is 10, the total frequency of regressions made from embedded verb to the object (ev – obj) is 13, the total number of regressions made from embedded verb to the wh-word (ev - wh) is three and finally the total number of regressions made from main verb t the second subject of the sentence (mv – s2) is 28.

Condition.6 regression totals: *mv – ev: 30; mv – wh: 10; ev – obj: 13; ev – wh: 3; mv – s2: 28*.

Condition.6|s1-s2-wh-obj-ev-mv Embedded verb: Transitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	30	10	13	3	28

Table 60 – Total number of regressions in five target sentences in condition 6

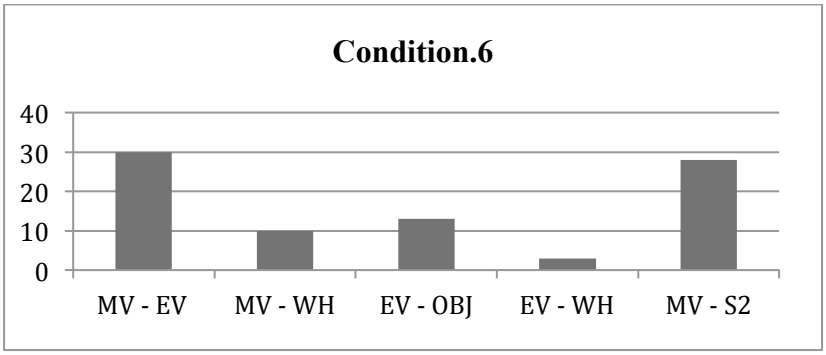


Figure 14 – Total regression frequencies in condition 6

Sentence 31 Alper Büşra'nın ne zaman kitabı verdiğini söyledi
Alper-nom Büşra-gen when book-acc give-ind-acc say-pst-3rd-Sing
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

Sentence 31 is the first target sentence of condition 7. The 30 participants made a total of seven main verb to embedded verb (mv – ev), six main verb to object (mv – obj), four embedded verb to object (ev – obj), one embedded verb to wh-word (ev – wh) and finally four main verb to subject 2 (mv – s2) regressions during reading sentence 31 given above.

Sentence 32 Fatih Sevgi'nin ne zaman oyuncağı götürdüğünü anlattı
Fatih-nom Sevgi-gen when toy-acc take-Ind-acc tell-pst-3rd-sing
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

The participants made a total of 11 main verb to embedded verb (mv – ev) regressions, one main verb to wh-word (mv – wh) regression, 14 embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions and finally seven main verb to the second subject of the sentence (mv – s2) regressions during reading sentence 32.

Sentence 33 Gökhan Seda'nın ne zaman soruyu açıkladığını bildirdi
Gökhan-nom Seda-gen when question-acc explain-ind-acc notify-pst-3rd-Sing
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb

Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

In sentence 33 above, the total number of regressions made from main verb to the embedded verb (mv – ev) is eight, the total number of regressions made from main verb to the wh-word (mv – wh) is three, the total frequency of regressions made from embedded verb to the object (ev – obj) is seven, the total number of regressions made from embedded verb to the wh-word (ev – wh) is one and the total frequency of regressions made from main verb to the second subject of the sentence (mv – s2) is four.

Sentence 34 Mert Ezgi'nin ne zaman mektubu gönderdiğini hatırlattı
Mert-nom Ezgi-gen when letter-acc send-ind-acc remind-pst-3rd-Sing
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]
Interpretation: Double

During reading sentence 34, the 30 participants made a total of seven main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, two embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions, and finally five main verb to subject 2 (mv – s2) regressions.

Sentence 35 Faruk Esra'nın ne zaman raporu yolladığını duyurdu
Faruk-nom Esra-gen when report-acc send-Ind-acc announce-pst-3rd-Sing
Condition: 7
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Interrogative [Q]

Interpretation: Double

The participants made a total of five main verb to embedded verb (mv – ev) regressions, four main verb to wh-word (mv – wh) regressions, two embedded verb to object (ev – obj) regressions, one embedded verb to wh-word (ev – wh) regression and finally nine main verb to second subject of the sentence (mv – s2) regression during reading sentence 35.

Through a general look at the total regression frequencies made by the participants during reading the five target sentences (31, 32, 33, 34, 35) belonging to condition.7 in which the word order is '*subject1 – subject2 – wh-word – object – embedded verb (ditransitive) – main verb*', the biasing context is *interrogative [Q]*, and the embedded verb type is *ditransitive*, it is seen that the total number of regressions made from main verb to the embedded verb (mv – ev) is 38, the total frequency of regressions made from main verb to the wh-word (mv – wh) is 16, the total number of regressions made from embedded verb to the object (ev – obj) is 29, the total number of regressions made from embedded verb to the wh-word (ev – wh) is seven, and finally the total frequency of regressions made from main verb to the second subject of the sentence (mv – s2) is 29.

Condition.7 regression totals: *mv – ev: 38; mv – wh: 16; ev – obj: 29; ev – wh: 7; mv – s2: 29.*

Condition.7|s1-s2-wh-obj-ev-mv Embedded verb: Ditransitive Context type: Interrogative [Q]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	38	16	29	7	29

Table 61 – Total number of regressions in five target sentences in condition 7

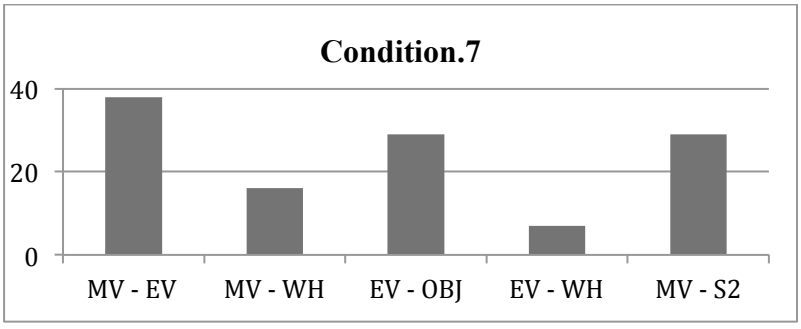


Figure 15 – Total regression frequencies in condition 7

Sentence 36 Alper Büşra'nın ne zaman kitabı verdiğini söyledi
Alper-nom Büşra-gen when book-acc give-Ind-acc say-pst-3rd-Sing
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

Sentence 36 is the first sentence belonging to condition 8. The 30 participants made a total of four regressions from main verb to the embedded verb (mv – ev), six regressions from main verb to the wh-word (mv – wh), six regressions from embedded verb to the object (ev – obj), and five regressions from main verb to the second subject of the sentence (mv – s2), while no regression is observed from embedded verb to the wh-word (ev – wh).

Sentence 37 Fatih Sevgi'nin ne zaman oyuncağı götürdüğünü anlattı
Fatih-nom Sevgi-gen when toy-acc take-Ind-acc tell-pst-3rd-Sing
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 37 above, the total regressions made from main verb to the embedded verb (mv – ev) is 10, the total regressions from main verb to the wh-word (mv – wh) is three, the total frequency of regressions from embedded verb to the object (ev – obj) is two, the total number of regressions made from embedded verb to the wh-word (ev – wh) is three, and finally the total frequency of regressions from main verb to the second subject (mv – s2) is three.

Sentence 38 Gökhan Seda'nın ne zaman soruyu açıkladığını bildirdi
Gökhan-nom Seda-gen when question-acc explain-ind-acc notify-pst-3rd-Sing
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 38 given above, the 30 participants made a total of six main verb to embedded verb (mv – ev) regressions, two main verb to wh-word (mv – wh) regressions, two embedded verb to object (ev – obj) regressions, two embedded verb to wh-word (ev – wh) regressions and finally made a total of two main verb to second subject of the sentence (mv – s2) regressions.

Sentence 39 Mert Ezgi'nin ne zaman mektubu gönderdiğini hatırlattı
Mert-nom Ezgi-gen when letter-acc send-ind-acc remind-pst-3rd-Sing
Condition: 8
Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

In sentence 39, the participants made a total of five main verb to embedded verb (mv – ev) regressions, one main verb to wh-word (mv – wh) regression, two embedded verb to object (ev – obj) regression, one embedded verb to wh-word (ev – wh) regression and six main verb to subject 2 (mv – s2) regressions.

Sentence 40 Faruk Esra'nın ne zaman raporu yolladığını duyurdu
Faruk-nom Esra-gen when report-acc send-ind-3rd-acc announce-pst-3rd-Sing
Condition: 8

Word order: s1 – s2 – wh-word – object – embedded verb – main verb
Embedded verb type: Ditransitive
Biasing context: Declarative [D]
Interpretation: Double

Sentence 40 is the last target sentence in the eighth condition. In sentence 40, the total number of regressions made from main verb to the embedded verb (mv – ev) is five, the total frequency of the regressions made from main verb to the wh-word (mv – wh) is two, the total number of regressions made from embedded verb to the object (ev – obj) is seven. The total frequency of regressions made from main verb to the second subject of the sentence (mv – s2) is eight while no regression from embedded verb to the wh-word (ev – wh) is observed.

When we have a general look at the regression frequencies gathered out of the analysis of five target sentences belonging to condition 8 in which the word order is; '*subject1 – subject2 – wh-word – object – embedded verb – main verb*', the biasing context is *declarative [D]*, and the embedded verb type is *ditransitive*, it is observed that the total regression numbers made from main verb to the embedded verb (mv – ev) is 30, the total regression numbers made from main verb to the wh-word (mv – wh) is 14, the total frequency of regressions made from embedded verb to the object (ev – obj) is 19, the total number of regressions made from embedded verb to the wh-word (ev – wh) is six and finally the total number of regressions made from main verb to the second subject of the sentence (mv – s2) is 24.

Condition 8 regression totals: *mv – ev: 30; mv – wh: 14; ev – obj: 19; ev – wh: 6; mv – s2: 24*.

Condition.8|s1-s2-wh-obj-ev-mv Embedded verb: Ditransitive Context type: Declarative [D]	**mv – ev**	**mv – wh**	**ev – obj**	**ev – wh**	**mv – s2**
	30	14	19	6	24

Table 62 – Total number of regressions in five target sentences in condition 8

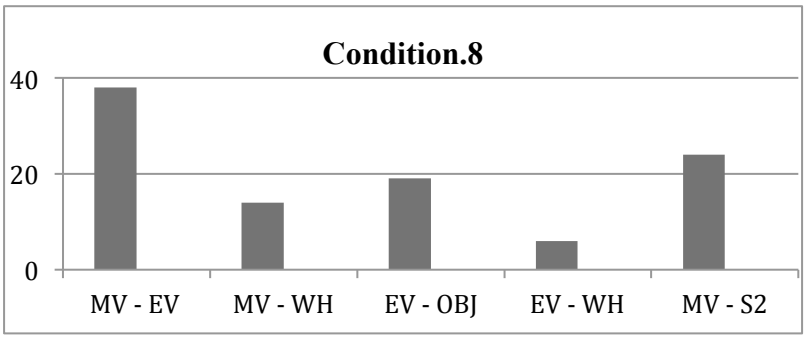


Figure 16 – Total regression frequencies in condition 8

The tables 63 and 64 given below show the total regression numbers made by the 30 participants during reading each of five target sentences belonging to each condition in experiment 2. The given numbers in each table indicate the total number of regressions made in five target sentences belonging to the same condition, formed in the first and the second word order by 30 participants, respectively.

Experiment.2 – wh-adjunct 'ne zaman / when' – Order.1 | [s1 – wh – s2 – obj – ev – mv]					
	ev – obj	**ev – wh**	**mv – ev**	**mv – wh**	**mv – s2**
Condition.1	39	6	51	28	21
Condition.2	29	11	48	26	6
Condition.3	35	12	43	30	15
Condition.4	34	9	35	27	16
Total numbers	**137**	**38**	**177**	**111**	**58**

Table 63 Total regression numbers in word order 1

Experiment.2 – wh-adjunct 'ne zaman / when' – Order.2 | [s1 – s2 – wh – obj – ev – mv]					
	ev – obj	**ev – wh**	**mv – ev**	**mv – wh**	**mv – s2**
Condition.5	20	9	33	7	27
Condition.6	13	3	30	10	28
Condition.7	29	7	38	16	29
Condition.8	19	6	30	14	24
Total numbers	**81**	**25**	**131**	**47**	**108**

Table 64 Total regression numbers in word order 2

- *ev – obj: Regression from embedded verb to object*
- *ev – wh: Regression from embedded verb to wh-word*
- *mv – ev: Regression from main verb to embedded verb*
- *mv – wh: Regression from main verb to wh-word*
- *mv – s2: Regression from main verb to subject 2*

Through a very general look at the regression frequencies considering the difference between the word orders (thus the difference in the place of the wh-word), it is clear that the regressions made to the wh-word region (both taking into consideration the regressions made from main verb and the embedded verb) show a peculiar divergence. The total regressions made to the wh-word region in the first word order in which the wh-word is located before the embedded clause subject is 149, while it is 73 in the second word order in which the wh-word is inside the embedded clause (following the embedded clause subject). The difference between the regression frequencies to the wh-word region in terms of word order comparison is also statistically valid as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
regressions_to_the_wh_word_region	Equal variances assumed	77	,000	1,96923
	Equal variances not assumed	67,600	,000	1,96923

Table.65 – t-test outcome of the word order difference on regressions towards the wh-phrase

As it was previously indicated during the analysis and discussion of the results of the first experiment, the regressive saccades are related with the processor's difficulty with processing, and the target of the regressive saccades are thought to be related with the aim of resolving the ambiguity. As it is stated, all the target sentences in the second experiment create a double reading, i.e. ambiguity in their final interpretations either having an interrogative or declarative reading. When the most general outcomes regarding the regressions to the wh-word region are compared and discussed in terms of the divergence between the outcomes resulted from word order difference, it is seen that the regressive saccades to the wh-word region (wh-adjunct in the 2nd experiment) in the first word order (*s1 – wh – s2 – obj – ev – mv*) outnumbers the regressions made to the wh-word region in the second word order (*s1 – s2 – wh – obj – ev – mv*) in a highly peculiar degree. This outcome is in parallel with the results obtained through the examination of the first experiment in which the wh-word is an argument. Although the ratio of the divergence is not the same between the two experiments, both of them show parallel results in terms of regressive saccades to the wh-word region (The comparative analysis of the outcomes of

the two experiments will be given at the end of the present chapter as a separate section). The parallelism between the results in terms of the regressions to the wh-word region, although the wh-words are not the same in terms of their part of speech features (wh-argument in the first, wh-adjunct in the second experiment) indicate the previously mentioned order based processing strategy (*the impact of the linear distance between the fronted wh-phrase and the potential gap position*) of the Turkish processor when ambiguous complex sentences having wh-words are considered. The processor seems to have much less trouble when the wh-word is nearer to the first predicate in the sentence, as it was observed in the first experiment. The reader reaches the end of the sentence, and then returns back to the wh-word much more frequently when the wh-word is outside of the embedded clause (first word order) than the situation in which it is inside the embedded clause (second word order). This seems to favor a verb-oriented analysis. The fact that Turkish is a verb-final language, and the target sentences are all formed with embedded and main verbs being located at the end of the sentences, the processor has no chance other than waiting for the potential predicate to construct the argument structure of the sentence. Following, Stowe et al. (1991) indicating that verb information is used as soon as the verb is identified which majorly settles the initial interpretation, it is possible to expect for the Turkish case for the processor to construct the filler-gap relation after reaching the end of the sentence, thus the divergent regressive saccades made from the end of the sentence to wh-word region between two word order types makes it possible to speculate on the processing strategy of the Turkish parser being affected with the placement of the wh-word inside or outside of the embedded clause above all other options.

When the regressive saccades to the wh-word region are analyzed separately in regard to the source of regression, it is seen that the regressive eye movements from main verb to the wh-word (mv – wh) also seems to indicate a clear-cut distinction when the two word orders are compared. The total of regressions made from main verb to the wh-word (mv – wh) in the first word order (*s1 – wh – s2 – obj – ev – mv*) is 111, while it is 47 in the second word order (*s1 – s2 – wh – obj – ev – mv*). The difference between the regressive saccades from main verb to the wh-word is statistically significant as seen below;

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
mv_wh_reg_order_dif	Equal variances assumed	38	,000	3,20000
	Equal variances not assumed	37,992	,000	3,20000

Table.66 – t-test outcome of the word order difference on main verb to wh-phrase regressions

The fact that the readers tend to make more regressive saccades to the wh-word from main verb in the first word order than in the second word order is directly related to the place of the wh-word. In the first word order the wh-word is before the embedded clause subject whereas it is inside the embedded clause in the second word order, which means that the processor has more trouble in processing the wh-word when it is outside of the embedded clause. This, at the same time means that the farther the wh-word is from the first predicate (the embedded verb), the harder it is for the processor to process it. In psycholinguistic there is an ongoing debate on the processing of arguments and adjuncts. While some theories state that arguments and adjuncts are processed differently, some others indicate that there is not a qualitative divergence between the processing strategies of them. The theories indicating that arguments and adjuncts are processed differently state that processing of adjuncts and assigning thematic roles to them need more effort than assigning thematic roles to arguments since verbs typically prime agents, patients and instruments but locations (Ferretti et al. 2001). Also Boland and Boehm – Jernigan (1998) indicate that while arguments are specified lexically, adjuncts are specified by global syntactic rules, which mean that argument and adjunct attachments are carried out by totally different mechanisms. It is further indicated that as a result of the divergence in attachment mechanisms, lexically specified mechanisms take priority of importance over attachments licensed by global syntactic rules, resulting a processing load on adjuncts in comparison to arguments. Corresponding theories on the processing of arguments and adjuncts propose that both operations are lexically specified and the difference between them in terms of processing is a result of competence on the basis of their comparative frequencies.

Liversedge et al. (2003) indicate that it is argued by Ferretti et al. (2001) that thematic roles are strongly in relation with schematic knowledge and that predicates are able to provide direct access to a generalized knowledge structure containing information about the situation described by a predicate which seems to be correlated with lexically based theories of language processing.

In the framework of the discussions on the processing strategies of arguments and adjuncts, the comparison will be carried out in the last section of this chapter considering the regression, first fixation and total fixation durations of the Turkish readers during reading the target sentences given in the two experiments, the former one formed with a wh-argument, and the latter one, formed with a wh-adjunct. But presently, it is important to indicate that, in terms of regressive saccades to the wh-word region from main verb and embedded verb together, and in terms of the regressive eye movements to the wh-word region from main verb alone, the Turkish readers seem to show similar results both for wh-argument filler and wh-adjunct filler sentences when the results are solely compared for word order (the place of the wh-word) effects. This general outcome clearly supports, previously mentioned, interpretations favoring a linear distance hypothesis, and the processor's tendency affected with the place of the wh-word and the first potential predicate in the sentence. For both wh-arguments and wh-adjuncts, the nearer is the wh-filler to the first verb, the easier it is for the processor to process the sentence, because when the wh-word is outside of the embedded clause (farther from the first predicate) the more regressive saccades are observed to the wh-word region which causes the ambiguity for final interpretation between interrogative [Q] and declarative [D] readings.

Besides the statistically significant divergence in the outcomes gathered through the examination of the total frequencies of regressive saccades from main verb to the wh-word (mv – wh) with comparison of the two word order types taking into consideration all the embedded verb types and biasing contexts as a whole, it is possible to observe divergence between the word orders when the comparison is handled by carrying out a transitive to transitive (conditions 1, 2 and conditions 5, 6) and ditransitive to ditransitive (conditions 3,

4 and conditions 7, 8) cross-check. It is observed that the regression frequencies in the first word order (*s1 – wh – s2 – obj – ev – mv*) from main verb to wh-word (mv – wh) region outnumbers the frequencies gathered in the second word order (*s1 – s2 – wh – obj – ev – mv*). The conditions 1 and 2 (*transitive embedded verb – order.1*) have 54 main verb to wh-word regressions in total, while conditions 5 and 6 (*transitive embedded verb – order 2*) have 17 in total; and the conditions 3 and 4 (*ditransitive embedded verb – order.1*) have 57 main verb to wh-word regressions, while conditions 7 and 8 (*ditransitive embedded verb – order.2*) have 30 total regressions from main verb to the wh-word both of which relate statistically significant values for divergence as given below respectively:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
E2_mv_wh_cond12_56_order_diff	Equal variances assumed	18	,001	3,70000
	Equal variances not assumed	17,819	,001	3,70000

Table.67 – t-test outcome of the word order difference on main verb to wh-phrase regressions in sentences with transitive embedded verbs

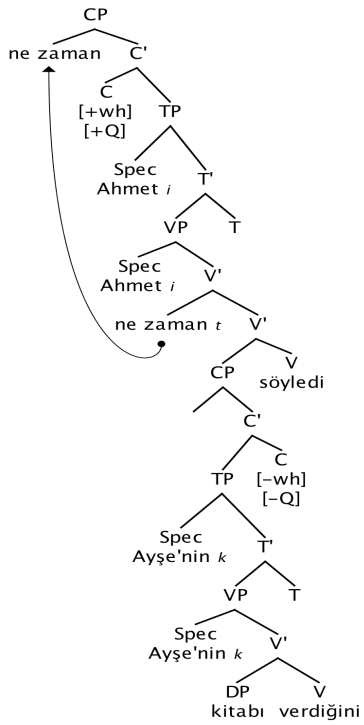
Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
E2_mv_wh_cond34_78_order_diff	Equal variances assumed	18	,010	2,70000
	Equal variances not assumed	17,082	,010	2,70000

Table.68 – t-test outcome of the word order difference on main verb to wh-phrase regressions in sentences with ditransitive embedded verbs

This comparison indicates that irrespective of the type of the embedded verb, the place of the wh-word has a direct impact on the degree of the difficulty of processing ambiguous complex sentences with wh-words in Turkish since the tendency of decrease and increase in regression frequencies from main verb to the wh-word is observed in both condition types formed with different type of embedded verbs (transitive and ditransitive).

The analysis of regressive saccade frequencies made form main verb to the wh-word in terms of word order variability shows a parallel outcome with the first experiment. When the wh-phrase is located farther from the potential gap sites linearly, it is more difficult for the processor to process the sentences, and thus makes more regressive saccades towards the fronted wh-phrase, which is also supported with the 'total fixations durations' on the wh-word region as will be discussed below. The tree diagrams below indicate the possible gap positions and the landing sites of the wh-phrases. Although the distance between the gap positions and the fillers seem to be similar syntactically, the regression frequencies increase dramatically when the wh-fillers landed farther from the potential gap positions (pre – verbal positions).



46. Tree diagram of condition 3 and 4 sentences in the second experiment

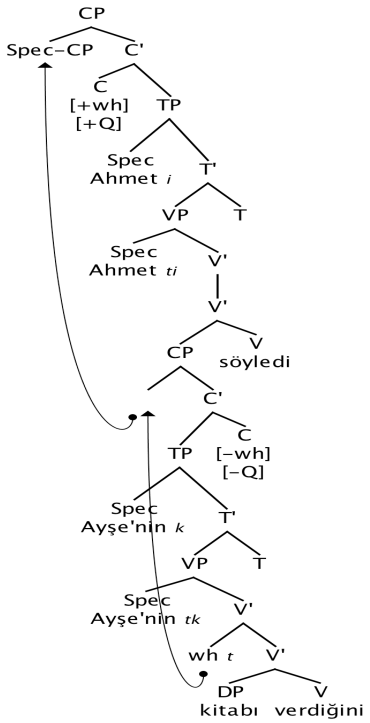
47. Spec CP*i* [Ahmet ne zaman *i* [Ayşe'nin kitabı verdiğini] *ti* söyledi]

LF

Ahmet-nom when Ayşe-gen book-acc give-3rd-sing-ind say-3rd-sing-pst

'When did Ahmet say that Ayşe gave the book?'
'Ahmet said when Ayşe gave the book.'

Both an interrogative [Q] and a declarative [D] interpretation can be derived as through the sentence given above. The wh-phrase can originate from the adverb position of the higher clause and in order to construct a matrix question reading moves to Spec-CP of the main clause at LF, but in order to make a declarative reading, remains in the adverb position. The interrogative interpretation provides a longer linear and a shorter syntactic distance when it is compared with condition 7 and 8 sentences as given below.



48. Tree diagram of condition 7 and 8 sentences in the second experiment

49. Spec CP*i* [Ahmet [Ayşe'nin ne zaman *i* kitabı *ti* verdiğini] söyledi]

LF

Ahmet-nom Ayşe-gen when book-acc give-3rd-sing-ind say-3rd-sing-pst

'When did Ahmet say that Ayşe gave the book?'

'Ahmet said when Ayşe gave the book.'

The particiapants' having more difficulty during processing condition 3 and 4 sentences (shorter syntactic, longer linear distance between the gap and the fillller positions) than condition 7 and 8 sentences (longer syntactic, shorter linear distance) show that, as it has been proposed for the first experiment, the processing of ambiguous complex sentences with fronted wh-phrases are based on the linear distance of the gap and the filler positions. In that regard the importance of the place of the verbs, which are the potential gap sites for the wh-phrases and the derived interpretations, which specify the movement of the wh-phrase at LF, seem to be highly important for both wh-adjuntcs and wh-arguments.

In the analysis and discussion of the first experiment, in terms of embedded verb to object (ev – obj) regressive saccade frequency it has been argued following Mitchell et al. (2008) that the short distance regressions may have been stemmed from a proximity based mechanism and thus may not be telling a story about a syntactically driven type of behavior on processing strategies of the readers. In that respect, it has been stated that the statistically non-significant outcomes gathered through the embedded verb to object (ev – obj) regression frequencies due to (general) word order alteration and embedded verb variability may be the result of this proposal. Contra to this argument, the statistically divergent outcomes between condition two (*first word order, transitive embedded verb, declarative biasing context*) and condition six (*second word order, transitive embedded verb, declarative biasing context*) on embedded verb to object (ev – obj) regressive saccades pattern have been indicated as a sign of divergence in the processing strategies of the readers due to the unique alteration between the two condition types. It was the place of the wh-word creating the difference between the two conditions and it seems that this alteration has caused a divergence in the regression frequencies from embedded verb to object (ev – obj) regions. This divergence has been interpreted as the interaction of the place of the wh-phrase (argument) with the subcategorization frame features of the embedded verb. A stronger support for the effect of processing strategies even on the small-scale regressive saccades comes from the outcomes gathered through the examination of embedded verb to

object (ev – obj) regressions in the 2nd experiment. While the total frequency of regressive saccades from embedded verb to object (ev – obj) is 137 in the four different conditions (conditions 1, 2, 3, and 4) belonging to the first word order (*s1 – wh – s2 – obj – ev – mv*), it is 81 in the other four different conditions (conditions 5, 6, 7, and 8) belonging to the second word order (*s1 – s2 – wh – obj – ev – mv*). When all conditions belonging to two different word orders are considered altogether, the only variable that differentiates them is the place of the wh-word. It is seen that the regressions from embedded verb to object (ev – obj) in the first word order, in which the wh-adjunct is located before the embedded verb subject, outnumbers the regression frequencies in the second word order, in which the wh-adjunct is located inside the embedded clause, following the embedded clause subject and preceding the object DP. The difference between the two word orders is statistically significant as given below;

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
E2_ev_obj_reg_order_diff	Equal variances assumed	38	,005	2,80000
	Equal variances not assumed	37,889	,005	2,80000

Table.69 – t-test outcome of the word order difference on embedded verb – object regressions in all conditions

This divergence in the regressive saccades on the same regions of the sentences is an indication of a linear order based influence on processing. When the wh-adjunct is farther from the first predicate (embedded clause verb) the readers have much more difficulty in processing the sentences which has been reflected on the embedded verb to object (ev – obj) regression frequencies than the situation in which the wh-adjunct is located inside the embedded clause. So the place of the wh-word seems to be a differentiating item in regressive saccade outcome, which entails to neglect a proximity-based system for a short-distance saccadic movement. While it is apparent that this divergence is the natural outcome of the processing strategies of the readers, it is further an indication of the role of the verb and word order interaction in licensing the filler-gap dependency in terms of complex sentence structure with fronted wh-fillers in Turkish. The outcome on embedded

verb to object (ev – obj) regression frequencies show a dramatic alteration between the two experiments. As it has previously been stated, the wh-filler used in the first experiment is a wh-argument while it is a wh-adjunct in the second experiment. The number of regressive saccades from embedded verb to object (ev – obj) in the first word order in the first experiment is less than the number of regressions recorded for the second word order on the same regions (ev – obj regressive saccades; 147 in the first word order, 177 in the second word order). But in the second experiment, the result is vice versa (ev – obj regressive saccades; 137 in the first word order, 81 in the second word order). The divergence between the two experiments (i.e. between the two wh-word types (argument vs. adjunct)) will be discussed at the end of this chapter in the related section on comparative experiment analysis. The important point here to mention is that the decrease in embedded verb to object (ev – obj) regressions recorded in the target sentences belonging to the second word order in which the wh-word is located inside the embedded clause is directly related with the interaction of the subcategorization frame features of the verb and the place of the wh-word in the sentence. While the wh-word is outside of the embedded clause, the regression frequencies from embedded verb to object (ev – obj) outnumber the ones in the second word order, in which the wh-word is inside the embedded clause. The place of the wh-word seems to have a direct impact on the processing difficulty for the readers like the regressive saccade recording from main verb to embedded verb (mv – ev) and main verb to wh-word (mv – wh) regions. The first order regression frequencies outnumber the second order regression numbers. The farther is the wh-word from the first verb, the harder it is for the processor to process the sentence, and thus makes more regressions to the embedded verb, wh-word and object regions from the predicates. Although it is going to be discussed in the final part of the present chapter, it is needed to mention the regressive saccade difference between two experiments. When the wh-word is an argument, the frequency of regressive saccades from embedded verb to object (ev – obj) are observed in a higher degree when the wh-word is inside the embedded clause than the order in which the wh-word is outside of the embedded clause. But for the sentences formed with wh-adjunct, the situation is vice versa. This seems to stem from the argument nature of the wh-word. When there is a wh-argument inside the embedded clause, the processor had more difficulty in processing the

sentence due to subcategorization frame of the embedded verb. The fact that this has been observed when the embedded verb is a transitive one supports this fact in a concrete manner. But when the wh-word is an adjunct, the same difficulty is not observed in the second word order in which the wh-word is inside the embedded clause. This is because the wh-adjunct does not need to be licensed in the subcategorization frame of the predicate, and the existence of an object – DP in the same clause with the wh-word does not create a difficulty for the processor. This divergence between the regressive saccade frequencies in two experiments (*first experiment with wh-argument; second experiment with wh-adjunct*) and in two word orders (*first order: s1 – wh – s2 – obj – ev – mv; second order: s1 – s2 – wh – obj – ev – mv*) clearly indicate the existence of a verb-oriented and linear-proximity sensitive strategy of the Turkish processor during processing complex sentences with wh-words having ambiguity in interrogative [Q] and declarative [D] readings. Since Turkish is a verb-final language, it is a must for the processor to delay parsing strategies until coming up with the first predicate in the sentence in order to license the case and thematic features of the potential DPs and wh-fillers with their gap positions. Following Stowe et al. (1991), the transitivity of a verb has an impact on the possibility of a gap being initially posited in a wh-question; and moreover for transitive preference verbs, it is only after coming up with the verb that a gap is filled; the outcomes regarding the regression frequencies beginning and ending on the items in the embedded clause in two types of sentences with different orders and formed with different wh-words (argument – adjunct) seem to support a predicate oriented analysis for Turkish as stated above.

The same divergence in terms of embedded verb to object (ev – obj) regression pattern is also observed between the conditions formed with transitive embedded verbs when the two word orders (the two different places of the wh-word) are taken into consideration. While the regression rates from embedded verb to object (ev – obj) are higher in the first word order than the second one when the embedded verb is a transitive one, the same alteration is not observed in the sentences formed with ditransitive embedded verbs. Although there is a decreasing tendency in the second word order, the difference between regression rates from embedded verb to object (ev – obj) is not statistically significant as the case for the

sentences formed with transitive embedded verbs. The embedded verb to object (ev – obj) regression frequencies are stated respectively; conditions 1, 2 – 39, 29; conditions 5, 6 – 20, 13. The divergence is statistically significant as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
E2_ev_obj_cond12_56_diff	Equal variances assumed	18	,011	3,50000
	Equal variances not assumed	14,009	,013	3,50000

Table.70 – t-test outcome of the word order difference on embedded verb – object regressions in sentences with transitive embedded verbs

The regression rates from embedded verb to object (ev – obj) for the sentences formed with ditransitive embedded verbs are as follow: conditions 3, 4 – 35, 34; conditions 7, 8 – 29, 19. The divergence is not statistically significant as seen below:

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
E2_ev_obj_cond34_78_diff	Equal variances assumed	18	,166	2,10000
	Equal variances not assumed	15,261	,169	2,10000

Table.71 – t-test outcome of the word order difference on embedded verb – object regressions in sentences with ditransitive embedded verbs

This relates that the existence of the wh-word inside the embedded clause did not cause any difficulty for the processor as expected to occur with an alteration in the word order. The regression rates from and to the same regions in the sentences for the first experiment in which a wh-argument has been used, clearly indicated a processing difficulty stemming from the existence of a wh-argument in the embedded clause, especially when the embedded clause verb is a transitive one, but the same increase in the regression rates from embedded verb to object (ev – obj) has not been observed for the second word order in the second experiment, moreover a powerful decrease has been inspected considering the same areas of interest. This should indicate that the adjunct wh-phrase did not create the same processing difficulty in the embedded clause region, moreover it provided for the readers a

less problematic processing phase inside the embedded clause due to being close to the first predicate in the sentence. This provides, again, a supportive claim for the clause-sensitive verb-based processing strategy for Turkish readers. When the ambiguous wh-word is a wh-adjunct, the prevalence of the place of the wh-word is active again, but when the wh-word is an argument, the processing difficulty occurs due to the subcategorization frame of the first verb in the sentence, and then it becomes more difficult for the processor to process the ambiguous sentence when the wh-word is farther from the first predicate in the sentence.

The difficulty in processing due to the place of the wh-word is also observed via main verb to embedded verb (mv – ev) regression frequencies in its broadest sense. When all the conditions are considered together belonging to the first and second word orders, it is seen that the regression frequencies from main verb to embedded verb (mv – ev) in the first word order (s1 – wh – s2 – obj – ev – mv) outnumbers the regression numbers on the same source and target positions in the sentences belonging to the second word order (s1 – s2 – wh – obj – ev – mv). The regression frequencies from main verb to the embedded verb (mv – ev) belonging to 20 target sentences in four conditions of the first word order (conditions 1, 2, 3, and 4) are 177; while the total of regressions from main verb to the embedded verb (mv – ev) made during reading 20 target sentences in four conditions of the second word order (conditions 5, 6, 7, and 8) are 131. The difference between the two values is also statistically significant as seen below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E2_mv_ev_order_diff_all	Equal variances assumed	3.98	.05	2.06	38.00	.05	2.30	1.11	.05	4.55
	Equal variances not assumed			2.06	28.01	.05	2.30	1.11	.02	4.58

Table.72 – t-test outcome of the word order difference on main verb to embedded verb regressions in all conditions

It is apparent that when the wh-word is located inside the embedded clause, the regression rates, which is an indication of processing difficulty, is significantly less observed than the word order in which the wh-word is located before the embedded clause subject in Turkish complex sentence structure having ambiguity. This outcome is no different from main verb to wh-word (mv – wh), embedded verb to object (ev – obj) and embedded verb to wh-word (ev – wh) regression frequencies when the two word orders are examined as a whole. The results indicate a constant decrease in the regression rates, thus relating a less problematic processing, on the sentences formed in the second word order. The processor has a tendency to relate the wh-word with the first predicate, and the farther the predicate is from the first predicate the harder it is for the processor to process it. This also indicates a clause-sensitive predicate-based tendency for the Turkish processor while processing the ambiguous complex sentences with wh-words.

When we have a look at the regression frequencies that could stem from the embedded verb type difference, it is seen that, as expected, the divergence is not as clear as the divergence observed in the first experiment in terms of verb type difference. This outcome will further be discussed in the last section of analysis and discussion which will solely concentrate on the comparison of the results of the two experiments, but it is needed to indicate that this expected insignificance on regression rates according to the embedded verb type has stemmed from the fact that the wh-word used in the second experiment is a wh-adjunct. Although the processing strategies specified according to the place of the wh-word did not show a divergence in terms of the argument and adjunct nature of the wh-word, it did differ in relation with the place of the wh-word and the adjunct nature when the wh-word is placed inside the embedded clause. The difference on processing is based on the wh-argument and wh-adjunct nature of the fronted wh-phrase. In the first experiment it is observed that in the second word order in which the wh-word is inside the embedded clause, the number of regressions from embedded verb to object (ev – obj) recorded in sentences formed with transitive embedded verbs outnumbers the regression frequencies from and to the same regions in sentences with ditransitive embedded verbs, and the

difference is specified to be statistically significant. But the same alteration according to the embedded verb type is not observed in the second experiment (wh-word is an adjunct questioning the 'time' of the event). This directly seems to be related with the interaction of the wh-word with the subcategorization frame of the verb in the same clause. When the embedded verb is a transitive one and there is a DP object in the same clause, the wh-argument caused a processing difficulty in the embedded clause region, but when the conditions are all the same but the wh-word is a wh-adjunct, the same processing difficulty is not observed. This means that Turkish applies a processing mechanism strongly correlated with the predicate's subcategorization frame. When the wh-word is outside of the embedded clause, the processing difficulty is subtle, but when the wh-word is inside the embedded clause, which means that it is closer to the first predicate, being in the same clause with the first predicate, the subcategorization frame features of the predicate plays the major role for the processing strategies, thus, Turkish employs a verb-based licensing mechanism for the fronted wh-phrases. The number of regressions from embedded verb to object (ev – obj) in conditions 5, and 6 (order.2 – transitive embedded verb) is 20 and13 respectively, while it is 29 and 19 for conditions 7 and 8 (order.2 – ditransitive embedded verb). As it is seen below, the difference between the two variables is not statistically significant:

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E2_ev_obj_c56_c78	Equal variances assumed	3.16	.09	-1.10	18.00	.29	-1.50	1.37	-4.37	1.37
	Equal variances not assumed			-1.10	13.03	.29	-1.50	1.37	-4.45	1.45

Table.73 – t-test outcome of the verb type difference on embedded verb – object regressions in sentences belonging to the second word order

Since the wh-word is an adjunct in the second experiment, the existence of a DP – object in the same clause with the wh-word did not cause the same difficulty for the processor, as it caused when the wh-word is an argument. This may be interpreted as, above all options, the place of the wh-word plays the major role for processing, and then, the difficulty with licensing of the argument affects the processing mechanism because of the interaction with the predicate in the same clause in terms of theta-role assignment. Interestingly, another striking result in terms of the embedded verb type alteration is seen in the regression rates when the sentences belonging to conditions 5, and 6 are compared to sentences in conditions 7, and 8. Although the divergence is not statistically significant, the number of regressions recorded from embedded verb to object (ev – obj) is less in conditions 5 and 6 (transitive embedded verb) than conditions 7 and 8 (ditransitive embedded verbs). The situation is vice versa in the first experiment. The fact that the number of regressions from embedded verb to object (ev – obj) increase when the embedded verb is a ditransitive one is directly related to the adjunct nature of the wh-word, i.e. the controversy with the outcome of the first experiment is due to the argument nature of the wh-word in the first experiment. The number of embedded verb to object (ev – obj) regressions decreased when the embedded verb was a ditransitive one because this provided the wh-argument to be licensed with the embedded verb easily than the situation in which the embedded verb was a transitive one and the unique position for the object argument had been filled with a DP – object. In the second experiment the wh-word is an adjunct and thus does not need to be licensed inside the subcategorization frame of the embedded verb (not an obligatory element). The ditransitive nature of the embedded verb needs two internal arguments in its subcategorization frame since direct and indirect objects are the internal arguments (Carnie, 2007). In the second experiment, there is only one DP – object inside the embedded clause and the other argument position cannot be filled with the wh-word since it is an adjunct indicating time of the action. Although the sentence in Turkish is totally grammatical, the absence of the second internal argument inside the same clause seems to have caused a trouble, at least to be reflected with an increase in the regression frequencies, for processing. When this outcome is discussed with the outcomes of the first experiment, it is

possible to emphasize on the licensing of the wh-word to be clause sensitive, because it is inside the embedded clause, and thus predicate-oriented.

A similar supportive outcome for the issue seems to come from main verb to embedded verb (mv – ev) regression frequencies. The number of regressions on the mentioned regions tends to increase in the sentences formed with ditransitive embedded verbs in he second word order (*s1 – s2 – wh – obj – ev – mv*) in the second experiment (implemented a wh-adjunct), while the regressions from and to the same regions in the first experiment (implemented a wh-argument) tend to decrease in sentences formed with ditransitive embedded verb in the second word order (*s1 – s2 – wh – obj – ev – mv*). The number of regressions in conditions 5 and 6 (transitive embedded verbs) are 33 and 30 respectively, while they are 38 and 30 in conditions 7 and 8 (ditransitive embedded verbs). The difference between the two is not statistically significant but it is important to mention the increasing tendency in the second word order, which gives the same results for embedded verb to object (ev – obj) regression frequency tendencies in two word order types, in two experiments. This outcome again seems to support the role of the adjunct nature of the wh-filler when it is inside the same clause with the first predicate to license the theta roles in the sentence, thus favoring the clause-sensitive predicate-oriented processing strategy for Turkish ambiguous complex sentence structure with fronted wh-words.

4.2.3. Fixation Analysis

The discussion about the role of fixation analysis and its interpretation on the outcomes of the present study has been carried out comprehensively in section 3.1.3 above.

4.2.3.1. The Analysis and Discussion of the First Fixation Duration Results

This section firstly provides the data gathered through the analysis of sentences in terms of ‘first fixation durations’ on each of the areas of interests (AOI), which will be detailed below. Then the analysis will be carried out whether the data on first fixation durations give

clear and statistically significant outcomes in order to comment on the initial processing strategies of the Turkish readers during reading the target sentences. The major component of analysis will be, as it has been on the regression analysis, the comparison of the outcomes according to the word order (the place of the wh-adjunct) and the embedded verb type differences (transitive / ditransitive).

Each grammatical unit in the sentence represents one area of interest (AOI) for analysis as given below:

Order.1: subject1 (AOI1), wh (AOI2), subject 2 (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

Order.2: subject1 (AOI1), subject 2 (AOI2), wh (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

The raw 'first fixation duration' data will be given in the following tables. The numerical values in the tables are given in *seconds, milliseconds*. Each condition represents the total values of 'first fixation durations' made by 30 participants in total on each area of interest. The data are gathered through the recordings of five target sentences belonging to the same condition.

Experiment.2 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.1	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	9,12	6,32	7,02	6,97	7,53	11,68
2	0,34	9,54	7,30	8,04	9,24	10,34
3	8,76	6,39	7,89	7,39	8,58	7,78
4	7,65	6,96	7,75	7,32	7,39	10,71
5	2,91	7,59	7,10	7,56	8,14	8,66
Total	**28,78**	**36,8**	**37,06**	**37,18**	**40,88**	**49,17**

Table 74 – First fixation durations in the first condition sentences

The data in the table 74 given above belong to the total duration times of 'first fixation durations' of five target sentences belonging to the 1st condition which has the word order as; s1 – wh – s2 – obj – ev – mv; transitive embedded verb, and interrogative biasing context. Each column represents an area of interest (AOI) in the experiment and the data given in the 'total' row represents the total of 'first fixation durations' made by 30

participants in each of the five target sentences belonging to the same condition. As it is seen the participants made 28.78 seconds of first fixation for the subject 1, 36.8 seconds of first fixation for the wh-word, 37.06 seconds of first fixation for the subject 2, 37.18 seconds for the object, 40.88 seconds for the embedded verb, and 49.17 seconds for the main verb in total of five target sentences belonging to the first condition.

Experiment.2 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.2	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	8,59	6,46	7,52	6,85	9,27	8,20
2	0,83	9,34	7,94	8,20	8,20	8,19
3	7,83	6,69	7,68	7,46	7,69	10,44
4	7,48	7,45	7,24	7,39	7,81	9,45
5	4,13	9,46	8,14	8,12	8,62	8,47
Total	**28,86**	**39,4**	**38,52**	**38,02**	**41,59**	**44,75**

Table 75 – First fixation durations in the second condition sentences

The data given above in table 75 represents the total of first fixation durations recorded belonging to the five target sentences of condition 2 in which the wh-word is located before the embedded clause subject, the embedded verb is transitive and the biasing context is declarative [D]. As it is seen above, the 30 participants made a total of 28.86 seconds of first fixation duration on the subject.1, 39.4 seconds of first fixation on wh-word, 38.52 seconds on subject 2, 38.02 seconds on the object, 41.59 seconds on the embedded verb and 44.75 seconds of first fixation on the main verb.

Experiment.2 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Diransitive** / Context: **Interrogative [Q]**						
Condition.3	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	2,91	8,81	6,95	8,19	8,50	8,24
2	7,85	7,16	7,37	8,60	7,81	9,97
3	5,29	7,01	7,83	8,21	8,04	9,91
4	8,04	5,97	7,57	8,55	7,50	8,09
5	5,02	6,38	6,78	7,69	8,17	9,72
Total	**29,11**	**35,33**	**36,50**	**41,24**	**40,02**	**45,93**

Table 76 – First fixation durations in the third condition sentences

Table 76 given above indicates the total of first fixation durations belonging to the five target sentence of condition 3 in which the word order is; s1 – wh – s2 – obj – ev – mv; the

embedded verb type is ditransitive and the biasing context is interrogative [Q]. As it is given, the total durations of first fixations made on the subject.1 is 29.11 seconds, it is 35.33 seconds on the wh-word region, 36.50 seconds on the subject.2, 41.24 seconds on the object, 40.02 on the embedded verb and finally it is 45.93 seconds on the main verb region.

Experiment.2 – First fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.4	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	1,42	8,49	6,58	6,52	9,34	8,72
2	6,22	6,64	7,49	8.10	8,49	7,96
3	5,57	7,03	7,22	8,58	8,31	12,84
4	8,76	6,05	6,93	7,43	7,29	7,65
5	5,69	6,91	7,28	7,89	9,80	9,28
Total	**27,66**	**35,12**	**35,5**	**38,52**	**43,23**	**46,45**

Table 77 – First fixation durations in the fourth condition sentences

Table 77 given above shows the firs fixation durations of the five target sentences in condition 4. The word order in condition 4 is as follows; s1 – wh – s2 – obj – ev – mv; the embedded verb type is ditransitive, and the biasing context is declarative [D]. The total duration of first fixations made by 30 participants on subject.1 is 27.66 seconds, it is 35.12 seconds on the wh-word, 35.5 seconds on the subject.2, 38.52 seconds on the object, 43.23 seconds on the embedded verb and 46.45 seconds on the main verb.

Experiment.2 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.5	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	9,82	9,30	8,07	7,05	7,95	9,48
2	7,36	9,24	6,67	8,03	9,79	7,31
3	10,33	8,02	7,00	7,52	7,67	8,72
4	9,58	7,79	6,55	6,95	7,07	9,43
5	11,11	7,91	7,01	8,61	7,98	9,52
Total	**48,2**	**42,26**	**35,3**	**38,16**	**40,46**	**44,46**

Table 78 – First fixation durations in the fifth condition sentences

Table 78 given above indicates that first fixation durations belonging to the five target sentences of condition 5. Condition 5 has been formed with the wh-word inside the embedded clause. The embedded verb of condition 5 is a transitive one and the biasing context is interrogative [Q]. The total duration of first fixations on the first subject in the

sentences is 48.2 seconds, it is 42.26 seconds on the second subject, 35.3 seconds on the wh-word, 38.16 seconds on the object, 40.46 seconds on the embedded verb and finally 44.46 seconds on the main verb region.

Experiment.2 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.6	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	8,61	7,31	6,85	6,70	8,12	7,42
2	10,12	7,56	7,58	8,73	8,61	7,63
3	7,29	7,93	7,64	7,59	8,62	9,09
4	8,40	6,96	7,44	6,89	8,13	10,70
5	8,91	7,88	7,01	7,26	8,02	9,57
Total	**43,33**	**37,64**	**36,52**	**37,17**	**41,50**	**44,41**

Table 79 – First fixation durations in the sixth condition sentences

In the table 79 given above, the first fixation durations of the five target sentences belonging to the condition 6 is given. The word order in condition 6 is as follows; s1 – s2 – wh – obj – ev – mv; the embedded verb type is transitive and the biasing context is declarative [D]. The total duration of first fixations on the first subject of the sentences is 43.33 seconds, the total duration of first fixations on the second subject of the sentences is 37.64 seconds, the total duration of first fixations on the wh-word is 36.52 seconds, it is 37.17 seconds on the object of the sentence, 41.50 seconds on the embedded verb and finally the total duration of the first fixations on the main verb of the sentences is 44.41 seconds.

Experiment.2 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.7	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	10,27	7,34	7,67	7,54	8,39	11,70
2	8,43	7,53	7,60	7,45	7,70	8,22
3	8,49	8,00	7,84	7,67	7,69	9,50
4	6,15	8,41	6,40	6,68	6,72	8,47
5	8,18	7,48	7,21	8,16	8,80	12,10
Total	**41,52**	**38,76**	**36,72**	**37,5**	**39,3**	**49,99**

Table 80 – First fixation durations in the seventh condition sentences

Table 80 given above shows the first fixation durations of the five target sentences in condition 7 in which the word order is s1 – s2 – wh – obj – ev – mv; the embedded verb

type is ditransitive, and the biasing context is interrogative [Q]. As it is seen in the table, the total of first fixation duration made by 30 participants on subject.1 is 41.52 seconds, it is 38.76 seconds on the subject 2 region, it is 36.72 on te wh-word region, 37.50 seconds on the object region, 39.30 seconds on the embedded verb and finally 49.99 seconds on the main verb region.

Experiment.2 – First fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.8	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	8,37	6,72	7,15	7,44	8,65	7,79
2	7,96	7,89	6,94	7,84	8,22	10,12
3	6,94	6,50	7,35	8,55	8,01	8,94
4	6,80	7,97	6,67	7,96	7,20	7,72
5	8,49	7,32	7,06	7,24	8,82	9,04
Total	**38,56**	**36,40**	**35,17**	**39,03**	**40,90**	**43,61**

Table 81 – First fixation durations in the eighth condition sentences

In table 81 above, the first fixation durations belonging to five target sentences of condition 8 is given. The word order in condition 8 is; s1 – s2 – wh – obj – ev – mv; the embedded verb type is ditransitive, and the biasing context is declarative [D]. As it is seen above, the total duration of first fixations made by 30 participant on the first subject of the sentence is 38.56 seconds, it is 36.40 seconds on the second subject of the sentence, 35.17 seconds on the wh-word region, 39.03 seconds on the object of the sentence, 40.90 seconds on the embedded verb region, and finally it is 43.61 seconds on the main verb of the sentence.

Through a general look at the 'first fixation durations' on the areas of interests specified earlier, it is seen that on wh-phrase, object, embedded verb and main verb regions, the durations tend to decrease in the second word order sentences (s1 – s2 – wh – obj – ev – mv). The outcomes are as follows; the total of first fixation durations on wh-word region in conditions 1, 2, 3, and 4 is 146.65 seconds while it is 143.71 seconds in sentences belonging to conditions 5, 6, 7, and 8. Although the difference is not statistically significant, it is worth to mention the decreasing tendency when the wh-word is located inside the embedded clause. The same tendency is also observed on the embedded verb and main verb regions as follows; condition 1, 2, 3, and 4, embedded verb total of first fixation durations is 165.72 seconds, while it is 162.16 seconds in conditions 5, 6, 7, and 8. The

total of first fixation durations is 186.3 seconds on main verb region in condition 1, 2, 3, and 4 sentences, while it is 182.47 seconds in condition 5, 6, 7, and 8 sentences which are formed with wh-word inside the embedded clause. Moreover, any significant divergence is not observed when the word order difference is compared according to verb type difference.

The statistically non-significant outcomes on 'first fixation durations' may relate the effect of the wh-adjunct nature of the fronted wh-word during processing. As it has been indicated beforehand in the study, due to the verb-final nature of Turkish, no divergence on the initial processing times of the units in the given sentences would occur until the readers come up with the first verb in the sentence. A divergence in the 'first fixation durations' had been observed in the first experiment (wh-argument), but in the second experiment (wh-adjunct); statistically significant divergence is not observed in that respect, although the decreasing tendency in the second word order sentences is observed as it had been in the first experiment. This finding illustrates that at least during the initial parsing phase, the behavior of the adjunct processing is different from the behavior of the argument processing. The existence of a wh-adjunct does not seem to have a major impact on the initial parsing decisions of the Turkish processor. The findings is not surprising since the outcomes of the wh-argument experiment on 'first fixation durations' also have created minor statistically significant values to interpret the processing mechanism which is formerly thought to be related to the verb-final nature of Turkish. The Turkish reader does not specify the gap for the fronted wh-phrase until coming up with the first predicate since the word order of Turkish allows scrambling up to a remarkable degree, and thus, does not need to order the objects according to case markers rigidly.

4.2.3.2. The Analysis and Discussion of the Total Fixation Duration Results

The raw data gathered through the examination of 'total fixation durations' on previously specifid areas of interests (AOIs) in the sentences will be given first in milliseconds (ms).

Then the outcomes will be discussed as it has been done in previous sections in the present study according to the comparison of the fixation durations on similar units in terms of word order (the place of the wh-adjunct) and the embedded verb type (transitive / ditransitive) alterations. Each grammatical unit in the sentence has been specified as an area of interest (AOI) as given below;

Order.1: subject1 (AOI1), wh (AOI2), subject 2 (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

Order.2: subject1 (AOI1), subject 2 (AOI2), wh (AOI3), object (AOI4), embedded verb (AOI5), main verb (AOI6)

The raw 'total fixation duration' data will be given in the following tables. The numerical values in the tables are given in *seconds, milliseconds*. Each condition represents the total values of 'total fixation durations' made by 30 participants in total on each area of interest. The data have been gathered through the recordings of five target sentences belonging to the same condition.

Experiment.2 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.1	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	16,56	20,69	20,12	14,97	29,37	20,84
2	0,34	22,75	13,23	14,69	18,31	13,04
3	13,27	14,07	16,71	13,91	19,82	13,17
4	13,79	23,26	18,13	18,99	25,35	20,12
5	3,49	20,63	11,44	12,44	14,29	11,87
Total	**47,45**	**101,5**	**79,63**	**75**	**107,14**	**79,04**

Table 82 – Total fixation durations in the first condition sentences

In table 82 given above, the total of total fixation durations on the given units belonging to the five target sentences of condition 1 in which the word order is s1 – wh – s2 – obj – ev – mv, the embedded verb type is transitive is given. As it is seen above, the total of total fixation durations on subject 1 is 47.45 seconds, it is 101.5 seconds on the wh-word region, 79.63 seconds on the subject 2 region, 75 seconds on the object region, 107.14 seconds on the embedded verb region and finally 79.04 seconds on the main verb region.

Experiment.2 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.2	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	13,57	25,33	14,88	13,36	23,84	13,39
2	0,83	23,22	13,53	18,84	18,45	10,66
3	15,55	21,29	18,45	17,20	26,72	19,83
4	10,07	20,47	19,66	17,04	18,28	17,32
5	5,28	26,62	14,84	12,96	18,76	12,76
Total	**45,3**	**116,93**	**81,36**	**79,4**	**106,05**	**73,96**

Table 83 – Total fixation durations in the second condition sentences

Table 83 given above indicates the total of total fixation durations of five target senteces in condition 2. The word order in condition 2 is as follows; s1 – wh – s2 – obj – ev – mv, the embedded verb type is transitive and the biasing context is declarative [D]. As it is seen, the total duration of fixation on subject 1 is 45.3 seconds, it is 116.93 seconds on the wh-word, 81.36 seconds on the subject 2 of the sentence, 79.4 seconds on the object, 106.05 seconds on the embedded verb and finally it is 73.96 seconds on the main verb.

Experiment.2 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.3	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	3,70	26,58	17,98	16,81	18,91	10,82
2	10,75	20,62	16,61	21,11	27,46	14,34
3	6,56	18,71	12,80	14,34	19,93	14,24
4	11,37	16,37	18,60	17,00	23,51	13,95
5	6,45	35,21	24,26	19,31	25,75	20,29
Total	**38,83**	**117,76**	**90,25**	**88,57**	**115,56**	**73,64**

Table 84 – Total fixation durations in the third condition sentences

Table 84 gives the results of total fixation durations of five target sentences in condition 3 in which the word order is s1 – wh – s2 – obj – ev – mv, the embedded verb is ditransitive and the biasing context is interrogative [Q]. As it is seen above, the total fixation duration on the first subject of the sentence is 38,83 seconds, it is 117,76 seconds on the wh-word region. The total fixation duration on the second subject of the sentence is 90,25 seconds, 88,57 seconds on the object region, 115,56 seconds on the embedded verb region and finally it is 73,64 seconds on the main verb region.

Experiment.2 – Total fixation durations						
Order.1 /**s1 – wh – s2 – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.4	**S1**	**Wh**	**S2**	**Obj**	**Ev**	**Mv**
1	1,54	22,16	14,37	12,96	16,78	11,71
2	8,34	21,85	14,38	18,58	25,76	12,67
3	7,50	24,94	15,17	18,12	23,69	17,36
4	11,37	21,50	14,35	15,44	19,15	17,56
5	9,24	17,91	13,86	11,40	17,99	13,01
Total	**37,99**	**108,36**	**72,13**	**76,5**	**103,37**	**72,31**

Table 85 – Total fixation durations in the fourth condition sentences

Table 85 above gives the results of the total fixation durations on the specified units of five target sentences in condition 4 in which the word order is s1 – wh – s2 – obj – ev – mv, the embedded verb type is ditransitive and the biasing context is declarative [D]. As it is seen above, the total fixation duration on the first subject of the sentence is 37,99 seconds, the total fixation duration on the wh-word is 108,36 seconds, it is 72,13 seconds on subject 2 of the sentence. The total fixation duration on the object of the sentence is 76,5 seconds, it s 103,37 seconds on the embedded verb and finally it is 72,31 seconds on the main verb region.

Experiment.2 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Interrogative [Q]**						
Condition.5	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	13,79	18,01	16,68	11,02	19,43	18,93
2	12,78	18,06	14,02	15,14	14,77	9,29
3	15,07	16,70	15,28	13,28	18,92	13,39
4	13,85	19,72	18,29	14,75	22,09	25,51
5	17,22	21,69	13,33	13,08	15,59	13,96
Total	**72,71**	**94,18**	**77,6**	**67,27**	**90,8**	**81,08**

Table 86 – Total fixation durations in the fifth condition sentences

In table 86 given above the total fixation durations on the previously specified units of five target sentences belonging to condition 5 are given. The word order in condition 5 is as follows; s1 – s2 – wh – obj – ev – mv, the embedded verb type is transitive and the biasing context is interrogative [Q]. The total duration of fixations on the first subject of condition 5 sentences is 72,71 seconds, while it is 94,18 seconds on the 2nd subject of the sentences. The total fixation duration on the wh-word region is 77,6 seconds, it is 67,27 seconds on

the object region, 90,8 seconds on the embedded verb region and finally it is 81,08 seconds on the main verb region.

Experiment.2 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Transitive** / Context: **Declarative [D]**						
Condition.6	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	13,27	19,17	16,09	9,23	18,11	11,62
2	13,61	15,66	13,76	12,79	13,90	9,51
3	10,74	16,19	16,46	12,14	20,35	13,99
4	13,79	18,01	16,68	11,02	19,43	18,93
5	15,30	17,86	13,73	12,24	15,71	13,30
Total	**66,71**	**86,89**	**76,72**	**57,42**	**87,5**	**67,35**

Table 87 – Total fixation durations in the sixth condition sentences

Table 87 above gives the total fixation duration outcomes of the five target sentences in condition 6 in which the word order is s1 – s2 – wh – obj – ev – mv, the embedded verb type is transitive, and the biasing context is declarative [D]. As it is seen in the table, the total of total fixation durations made by 30 participants during reading sentences in condition 6 on subject 1 is 66,71 seconds, while it is 86,89 seconds on the 2nd subject of the sentence. The total fixation duration on the wh-word is 76,72 seconds, on the object is 57,42 seconds, on the embedded verb is 87,5 seconds and finally 67,35 seconds on the main verb.

Experiment.2 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Interrogative [Q]**						
Condition.7	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	13,72	18,81	17,09	13,14	18,56	15,58
2	13,14	24,38	18,39	21,24	31,06	13,56
3	16,09	17,77	16,92	14,98	23,35	13,90
4	8,13	19,84	18,10	12,83	20,30	18,08
5	12,88	21,12	16,53	12,90	18,10	16,28
Total	**63,96**	**101,92**	**87,03**	**75,09**	**111,37**	**77,4**

Table 88 – Total fixation durations in the seventh condition sentences

Table 88 above gives the results of total of total fixation durations of five target sentences formed in condition 7 in which the word order is s1 – s2 – wh – obj – ev – mv, the embedded verb is ditransitive and the biasing context is interrogative [Q]. As it is seen above, the total of total fixation durations in five sentences on subject 1 is 63,96 seconds, it

is 101,92 seconds on subject 2, 87,03 seconds on wh-word, 75,09 seconds on the object of the sentence, 111,37 seconds on the embedded verb and finally it is 77,4 seconds on the main verb of the sentence.

Experiment.2 – Total fixation durations						
Order.2 /**s1 – s2 – wh – obj – ev – mv**/ Embedded verb type: **Ditransitive** / Context: **Declarative [D]**						
Condition.8	**S1**	**S2**	**Wh**	**Obj**	**Ev**	**Mv**
1	11,73	17,99	17,42	11,16	16,81	11,44
2	12,02	19,39	17,17	17,54	28,87	16,10
3	14,57	13,94	12,07	11,64	17,62	10,65
4	8,22	16,61	14,05	11,67	17,46	12,85
5	12,13	18,89	15,52	11,98	18,20	13,99
Total	**58,67**	**86,82**	**76,23**	**63,99**	**98,96**	**65,03**

Table 89 – Total fixation durations in the eighth condition sentences

In table 89 above, the total of total fixation durations on the units of five target sentences belonging to the 8th condition is given. The word order of condition 8 is as follows; s1 – s2 – wh – obj – ev – mv; the embedded verb is ditransitive, and the biasing context is declarative [D]. As it is seen above in the table, the total fixation duration on the first subject of the sentence is 58,67 seconds, it is 86,82 seconds on the second subject, 76,23 seconds on the wh-word, 63,99 seconds on the object of the sentence, 98,96 seconds on the embedded verb region and finally it is 65,03 seconds on the main verb region of the sentence.

When we have a general look at the 'total fixation durations' on the units (pre-specified areas of interest (AOIs) in the 40 target sentences (8 conditions), it is seen that the 'total fixation durations' on the wh-word show a clear divergence between two word orders. The first word order sentences (*s1 – wh – s2 – obj – ev – mv*) which include conditions 1, 2, 3, and 4, have the following total fixation durations on the wh-word region respectively; *condition 1 – 101.5 seconds, condition 2 – 116.93 seconds, condition 3 – 117.76 seconds, and condition 4 – 108.36 seconds*; while the second word order sentences (s1 – s2 – wh – obj – ev – mv) which include conditions 5, 6, 7, and 8, have the following total fixation durations on the wh-word region; *condition 5 – 77.6 seconds, condition 6 – 76.72 seconds, condition 7 – 87.03 seconds, and condition 8 – 76.23 seconds*. As it is seen, the total

fixation duration on the wh-word region in the first word order outnumbers the total fixation duration on the same region of the second word order sentences. The difference is statistically significant as seen below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E2_tfd_wh_order_dif	Equal variances assumed	4.18	.05	5.93	38.00	.00	6.33	1.07	4.17	8.49
	Equal variances not assumed			5.93	25.30	.00	6.33	1.07	4.13	8.53

Table.90 – t-test outcome of the word order difference on the total fixation durations recorded on the wh-phrases in all conditions

This outcome shows a parallelism with the regressive saccades specified on the same target sentences. As it has been stated before, the frequency of regressions to the wh-word region are observed to be clearly higher in the first word order than the second word order. This outcome has also been observed in the first experiment (wh-argument) in the same metrics (regressive saccades, first fixation durations, and total fixation durations). This general outcome supports to favor the same analysis on behalf of the word order effect (the place of the wh-word) on processing. Since the results of the two experiments indicate a parallel outcome it is possible to state that the closer a fronted wh-filler is to the first potential licenser, it is easier for the processor to process the sentence. When the wh-word (whether wh-argument, or wh-adjunct) is placed inside the embedded clause, the processor needs less time to process the sentence, which is an indication of a linear proximity, predicate-oriented analysis for the licensing of the wh-word. The place of the wh-word comes above all other options in the processing strategies of Turkish ambiguous complex sentences with fronted wh-words. The impact of the embedded verb and the argument and adjunct nature of the

wh-word seems to have an interaction with each other when the results are compared inside each word order separately. When the wh-word is inside the embedded clause, it is seen that the regressive saccades, the first and total fixation durations tend to decrease on wh-word and predicate regions in the sentences broadly. But when the wh-word is inside the embedded clause, the type of the embedded verb and the type of the wh-word (argument or adjunct) seem to have a role on processing.

The same divergence on the wh-word region in terms of 'total fixation durations' between the two word orders is also observed when the conditions are checked according to embedded verb types. The total fixation durations on the wh-word region are higher in the first word order than the second one when the conditions formed with transitive embedded verbs (conditions 1, 2 and conditions 5, 6) are compared. The total fixation durations on wh-word in conditions 1 and 2 are as follow respectively; 101.5 seconds, 116.93 seconds, while the total fixation durations on wh-word in conditions 5 and 6 are 77,6 seconds and 76.72 seconds, respectively. The difference is statistically valid as shown below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E2_wh_C12_56_orderdif	Equal variances assumed	1.70	.21	5.33	18.00	.00	6.40	1.20	3.88	8.93
	Equal variances not assumed			5.33	13.04	.00	6.40	1.20	3.81	9.00

Table.91 – t-test outcome of the word order difference on the total fixation durations recorded on the wh-phrases in sentences with transitive embedded verbs

The same effect is also observed when the conditions formed with ditransitive embedded verbs are compared (conditions 3, 4 and conditions 7, 8) according to word order difference in terms of total fixation durations on the wh-word region. The total fixation duration on

the wh-word in condition 3 is 117.76 seconds, and the total fixation duration on the wh-word in condition 4 is 108.36 seconds; while it is 87.03 seconds in condition 7 and 76.23 seconds in condition 8. The divergence is also significant as seen below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E2_wh_tfd_c34_78	Equal variances assumed	3.73	.07	3.45	18.00	.00	6.26	1.81	2.45	10.07
	Equal variances not assumed			3.45	11.31	.01	6.26	1.81	2.28	10.24

Table.92 – t-test outcome of the word order difference on the total fixation durations recorded on the wh-phrases in sentences with ditransitive embedded verbs

Besides the divergence in the total fixation durations on the wh-word region in comparison of the two word orders, no statistically significant outcome has been gathered throughout the comparison of total fixation durations on the other units in the conditions in terms of word order comparison. Although there is not a statistically divergent outcome on the total fixation durations on the other items in experiment two in terms of word order comparison, it is possible to mention the decreasing tendency on the 'total fixation durations' on the 'embedded verb' region in conditions formed in the 2nd word order (conditions 5, 6, 7, and 8). The total fixation durations on the embedded verb in the 1st word order conditions are as follows; *condition.1 – 107.14 seconds, condition.2 – 106.05 seconds, condition.3 – 115.56 seconds, and condition.4 – 103.37 seconds*; and also, the total fixation durations on the embedded verb in the 2nd word order conditions are as stated; *condition.5 – 90.8 seconds, condition.6 – 87.5 seconds, condition.7 – 111.37 seconds, and condition.8 – 98.96 seconds*. As it is seen, the durations decrease in the 2nd word order in which the wh-phrase is inside the embedded clause. This outcome contradicts with the comparison of the 'total fixation durations' on the same items in the first experiment (wh-argument), which is not a surprising result when the adjunct and argument nature of the wh-phrases are taken into

consideration. Since the wh-word in the 2nd experiment is an adjunct, the total fixation durations on the embedded verb region has not been affected (more processing load) negatively with the existence of the wh-word in the same clause with the embedded verb. The adjunct nature of the wh-word did not need to ascribe a burden for the verb to assign a theta role inside its theta-grid since adjuncts are not labeled inside the theta-grids of the predicates since they are not obligatory items (Carnie, 2007). The principle, the closer to the first predicate, the easier for the processing of the fronted wh-filler, seems to be at work here again. However, it is needed to indicate once more that the divergence between the 'total fixation durations' on the embedded verb region in terms word order difference is not statistically significant.

The same difference between the two word orders (the decreasing tendency towards the 2nd word order) is also observed in the 'total fixation durations' on the 'object' of the sentences. The total fixation durations on the object region in the first word order sentences are as follow; *condition.1 – 75 seconds, condition.2 – 79.4 seconds, condition.3 – 88,57 seconds, and condition.4 – 76.5 seconds*; while the total fixation durations on the object region in the 2nd word order sentences are as follow; *condition.5 – 67.27 seconds, condition.6 – 57.42 seconds, condition.7 – 75.09 seconds, and condition.8 – 63.99 seconds*. This outcome is in parallel with the outcomes on the 'embedded verb' region and may be interpreted in the same fashion with the discussion given just above. However, it is also important to indicate that although there is a decrease in the 'total fixation durations' on the 'object' regions between the two word orders, the divergence is not statistically significant. The discussion is based solely on the decreasing tendency towards the second word order sentences (s1 – s2 – wh – obj – ev – mv).

4.2.3.3. General Discussion on the Outcomes of the Second Experiment

Through a general look towards the general results obtained from the 'first fixation', 'total fixation', and 'regressive saccade frequency' analysis in the second experiment, it is possible to see that the divergences according to the linear ordering of the fronted wh-filler

does not give different results from the ones of the first experiment (implemented fronted wh-argument). The linear distance of the fronted wh-phrase (wh-adjunct) is crucial in processing complex ambiguous sentences with fronted wh-phrases in Turkish. Also, the results obtained through the 'first fixation records' on the embedded verb region makes it possible to propose the same claim that Turkish parser does not build an initial syntactic analysis during processing the mentioned type of sentences, but builds the whole structure at the mercy of the nearest verb in the linear order, and the constraints brought about by the verb. Thus, a predicate oriented, and possibly constraint based analysis should be favored in terms of Turkish complex sentence processing with wh-phrases.

On the other hand, the embedded verb type effect in the second experiment (applied with wh-adjunct) has not been observed to be as strong as the one specified in the first experiment (applied with wh-argument). The non-significant divergence on 'total fixation durations' between conditions formed with transitive and ditransitive embedded verbs are to be directly related with the wh-adjunct nature of the fronted wh-filler, especially when compared to the embedded verb type divergences observed in the first experiment. It is also needed to indicate that, when the total fixation durations on the wh-word, object, and the embedded verb regions all tend to increase in the sentences formed with transitive embedded verbs when the wh-word is inside the embedded clause, the total fixation durations on the same items tend to decrease in the sentences formed with the transitive embedded verbs in the second experiment, although the differences between conditions formed with transitive and ditransitive embedded verbs are not statistically significant. When the wh-word is inside the embedded clause, and when the wh-word is an adjunct, the readers have more trouble in processing the sentence with ditransitive embedded verbs since the wh-adjunct does not satisfy the need for the predicate in the same clause to license the second object DP since there is only one DP object in the same clause. The argument vs. adjunct nature of the wh-filler has the role for processing. If a similar outcome has been detected as the one in the first experiment, then the processing strategy of the Turkish readers for fronted wh-fillers could not be explained via the satisfaction of the thematic role and the effects of the subcategorization frame of the first predicate in the sentence.

It is observed that the processing of the fronted wh-fillers in Turkish complex sentence structure with ambiguity in two readings is highly affected, first with the place of the wh-word, and second, the subcategorization frame of the first predicate (the first possible predicate in the sentence due to the verb-final nature of Turkish) in the sentence. The Turkish processor tries to license the fronted wh-filler within the nearest gap position provided by the first verb it comes up with in the linear order.

4.3. COMPARATIVE ANALYSIS AND DISCUSSION OF THE TWO EXPERIMENTS: THE INFLUENCE OF ARGUMENT – ADJUNCT ASYMMETRY ON PROCESSING

As it has previously been stated, the study is composed of two experiments each of which included eight conditions with five target sentences, thus making a total of 40 target sentences in each experiment. The conditions in each experiment include two different word orders (s1 – wh – s2 – obj – ev – mv; s1 – s2 – wh – obj – ev – mv), two different embedded verb types (transitive, ditransitive), and two different biasing contexts (interrogative, declarative). The first experiment implemented a wh-argument (*kim(e)* 'who-Dat'); while the second experiment was conducted with a wh-adjunct (*ne zaman* 'when'). Other than the argument – adjunct distinction, the two experiments included no difference; i.e. the same variables (word order, embedded verb type, biasing context) and the same items are used in constructing the target sentences in each experiment. Thus, any divergence between the two experiments in terms of regressive saccade frequencies from and to locations in the sentences, first fixation durations on the pre-specified areas of interests (AOIs), and the total fixation durations on the same areas must stem from the argument – adjunct discrepancy, which is thought to be reflected also in sentence processing. The data gathered out of two experiments will be compared in terms of 'regressive saccades', 'first fixation durations' and 'total fixation durations'.

4.3.1. Comparative Analysis of the Two Experiments

In this section, the impact of the argument and adjunct nature of the fronted wh-word, on the processing of complex Turkish sentences with ambiguities will be analyzed and discussed through the comparison of the 'regressive saccade frequencies', 'first fixation durations', and the 'total fixation durations' recorded on the related units of sentences in two experiments. The regressions made to the wh-word region, made from main verb to the embedded verb (mv – ev), made from main verb to the wh-word (mv – wh) and regressions made from embedded verb to object (ev – obj) seem to relate significant outcomes on the argument – adjunct divergence being reflected on the processing difficulty of the target sentences in the study. Table 93 given below indicates the total number of regressive saccades in the two experiments in a condition-by-condition organization. As it has been previously mentioned, the total of 40 target sentences in each experiment are composed of eight different conditions including five target sentences in each. Each row in the table given below represents the total number of regressions made from and to the mentioned units in the sentences. Each column represents the source and the target of the regression in the sentences. The left part of the table shows the outcomes of the first experiment while the right part relates the outcomes of the second one. In each row, the total number of regressions made in the five target sentences belonging to the same condition is given, thus the numbers indicate the total number of regressions made from the source to the target location in sentences in each condition. Each condition represents a different type of target sentence formation in the study.

Frequency of regressive saccades in the first and second experiments										
	Experiment.1 – wh-argument					Experiment.2 – wh-adjunct				
	ev-obj	ev-wh	mv-ev	mv-wh	mv-s2	ev-obj	ev-wh	mv-ev	mv-wh	mv-s2
Condition.1 Order: s1-wh-s2-obj-ev-mv Emb.verb: Transitive Context: Interrogative [Q]	45	13	44	36	43	39	6	51	28	21
Condition.2 Order: s1-wh-s2-obj-ev-mv Emb.verb: Transitive Context: Declarative [D]	38	12	41	32	34	29	11	48	26	6
Condition.3 Order: s1-wh-s2-obj-ev-mv Emb.verb: Ditransitive Context: Interrogative [Q]	30	13	48	33	34	35	12	43	30	15
Condition.4 Order: s1-wh-s2-obj-ev-mv Emb.verb: Ditransitive Context: Declarative [D]	34	10	32	34	20	34	9	35	27	16
Total of regressive saccades in the first word order	**147**	**48**	**165**	**135**	**131**	**137**	**38**	**177**	**111**	**58**
Condition.5 Order: s1-s2-wh-obj-ev-mv Emb.verb: Transitive Context: Interrogative [Q]	47	20	38	13	43	20	9	33	7	27
Condition.6 Order: s1-s2-wh-obj-ev-mv Emb.verb: Transitive Context: Declarative [D]	57	17	38	16	42	13	3	30	10	28
Condition.7 Order: s1-s2-wh-obj-ev-mv Emb.verb: Ditransitive Context: Interrogative [Q]	37	14	20	21	36	29	7	38	16	29
Condition.8 Order: s1-s2-wh-obj-ev-mv Emb.verb: Ditransitive Context: Declarative [D]	36	9	34	18	24	19	6	30	14	24
Total of regressive saccades in the second word order	**177**	**60**	**130**	**68**	**145**	**81**	**25**	**131**	**47**	**108**

Table 93 – The total frequency of regressions made in the first and second experiments

When we have a look at table 93 given above, it is seen that the major type of regression made to the wh-word region seem to have similar results in the two experiments. In both of the experiments the regressive saccades to the wh-word region decreases in the second word order (s1 – s2- wh – obj – ev – mv). In the first experiment the total frequency of regressions to the wh-word region from main verb and from embedded verb is 183 in the first word order sentences, while it is 128 in the second word order. In the second experiment, the total number of regressive saccades to the wh-word from main verb and from embedded verb is 149 in the first word order while it is 73 in the second word order.

First experiment (wh-argument)

Regressive saccades towards wh-word in the 1st word order: 183

Regressive saccades towards wh-word in the 2nd word order: 128

Second experiment (wh-adjunct)
Regressive saccades towards wh-word in the 1st word order: 149
Regressive saccades towards wh-word in the 2nd word order: 73

It has been stated that since the regressive saccades indicate a processing difficulty with the processor's aim at resolving the potential ambiguity in the target of the regression, when the fronted wh-word is outside of the embedded clause, which means that being farther from the first predicate in the sentence due to the word order of Turkish, the processor had more difficulty in processing the sentence. The Turkish processor has a tendency to interpret the fronted wh-filler with the first verb in the sentence, thus the processor shows a linear distance sensitive, predicate-oriented processing strategy in the complex sentence structure with double reading (interrogative, declarative) ambiguity. This outcome seems to be valid for complex sentences with fronted wh-arguments and wh-adjuncts. The argument – adjunct asymmetry seems not to be powerful enough to prevail the importance of the linear position of the fronted wh-phrase during processing since the pattern of regressive saccades towards the wh-word region shows a similar tendency in both of the experiments. A parallel outcome is also observed in the 'first fixation durations' on the wh-word region when the two arguments and two word orders are compared. In the first experiment (wh-argument), the total duration of 'first fixations' on wh-word in the first word order is 121.2 seconds, while it is 98.51 seconds in the second word order. In the second experiment (wh-adjunct), the total of 'first fixation durations' on wh-word in the first word order is 146.65 seconds, while it is 143.71 seconds in the second word order. It is clear that the difference in the 'first fixation duration' on the wh-word across word orders in the second experiment is not statistically valid, but here the mentioned point is the decreasing tendency in the second word order in which the wh-word is located inside the embedded clause. When the tendency of regressive saccades is analyzed, the outcomes in terms of word order difference seem parallel also in terms of 'total fixation durations'. The 'total fixation duration' on the wh-word in the first experiment is 361.13 seconds in the first word order and it is 224.87

seconds in the second word order. In the second experiment, the 'total fixation duration' on the wh-word is 444.55 seconds in the first word order while it is 317.58 seconds in the second one. The decreasing tendency in regressive saccades towards the wh-word, and the recordings of the 'first' and 'total' fixation durations on the wh-word region in the second word order sentences are all the same in both of the experiments. When the wh-word is located farther from the first verb in the sentence, whether it is argument or adjunct, it is processed more difficultly. This is an outcome analyzed and discussed in terms of the place of the fronted wh-word and its effect on processing.

On the other hand, when the two experiments are compared, it is seen that the outcomes give a support for a universal divergence between argument and adjunct feature of the DPs in processing. In formal linguistic and psycholinguistic literature the distinction between arguments and adjuncts is a matter of interest for some time.

It is known that there is a syntactic distinction between arguments and adjuncts linguistically. While arguments ascribe an aspect of an action, which is central, adjuncts ascribe some other non-central aspect of an action (Radford, 1988). Also, Carnie (2007) states that while the theta-grid of a verb s consisted of only arguments (which are obligatory elements), adjuncts never appear in the theta-grid of verbs since adjuncts are entirely optional. 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. In their study, Boland and Boehm-Jernigan (1998) investigated how lexical constraints have an impact on syntactic analyses of ambiguous regions of isolated sentences and assert that arguments and adjuncts are attached through different mechanisms, while arguments are lexically specified, adjuncts are specified via global syntactic rules (also see Kennison (2002) for the similar distinction between arguments and adjuncts attachment strategies). It is further indicated that lexically specified attachments 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, whereas agents, and patients are. On the other hand, in MacDonald et al. (1994) claim that the difference between the processing of arguments and adjuncts only stem from their relative frequencies since both of them are lexically specified. Also, it is stated by Kennison (2002) that the two divergent perspectives on sentence processing (constraint satisfaction, and structurally oriented ones) both favor the processing of arguments being preliminary and easier to be processed. According to structural based theories arguments are processed more easily due to their attachment sites on 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 are not thought to predict either an argument or an adjunct NP. When these interpretations about the processing of arguments and adjuncts during sentence processing are applied in case of Turkish, it is crucial to put the word order of Turkish in the center. Turkish is verb-final, the processor comes up with the verb after reading the argument/adjunct NPs, wh-words in the sentence, thus it is wise to expect the first verb (verb of the embedded clause) in the complex sentence structure to be very effective in processing and licensing the fronted wh-word. It is important to state that the type of the verb (transitive/ditransitive), the type of the fronted wh-word (argument/adjunct) and the place of the fronted wh-word (out of the embedded clause/inside the embedded clause) gets into an interaction during processing which is clearly observed in the outcomes which are given and discussed below in details.

The outcomes gathered out of this study seem to support the views favoring a divergence in the processing load of arguments and adjuncts. When the 'first fixation' and the 'total fixation' durations on the wh-word region are compared across experiments, it is observed that in the second experiment, in which the fronted wh-word is a wh-adjunct, the mentioned durations on the wh-word region outnumbers the ones in the first experiment, in which the fronted wh-word is a wh-argument. The reading times of the wh-word are more costly when the wh-word is an adjunct than the situation when it is an argument. The 'first fixation durations' recorded on the 'wh-word' regions in the first and second experiments are as follow:

First experiment (wh-argument);

Condition.1: 31.48 seconds[10](first fixation durations on the wh-word)
Condition.2: 27.41 seconds (first fixation durations on the wh-word)
Condition.3: 31.21 seconds (first fixation durations on the wh-word)
Condition.4: 31.10 seconds (first fixation durations on the wh-word)

Second experiment (wh-adjunct)

Condition.1: 36.80 seconds (first fixation durations on the wh-word)
Condition.2: 39.40 seconds (first fixation durations on the wh-word)
Condition.3: 35.33 seconds (first fixation durations on the wh-word)
Condition.4: 35.12 seconds (first fixation durations on the wh-word)

The divergence between the 'first fixation durations' on the wh-word regions between two experiments is statistically significant as seen below;

[10] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_ffd_wh_Order1	Equal variances assumed	.00	.99	-4.61	6.00	.00	-6.36	1.38	-9.74	-2.98
	Equal variances not assumed			-4.61	6.00	.00	-6.36	1.38	-9.74	-2.98

Table.94 – t-test outcome of the comparison of first fixation durations recorded on the wh-phrases in sentences formed with the first word order across experiments

The comparison given above is related only to the first word order sentences (conditions 1, 2, 3, and 4) due to the reason that the place of the wh-phrase is thought to be handled separately from the argument – adjunct distinction. It is seen 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. A similar outcome in terms of the argument – adjunct distinction is also observed in the sentences formed in the 'second word order' as given below:

First experiment (wh-argument);

Condition.5: 23.47 seconds[11](first fixation durations on the wh-word)

Condition.6: 25.28 seconds (first fixation durations on the wh-word)

Condition.7: 24.72 seconds (first fixation durations on the wh-word)

Condition.8: 25.04 seconds (first fixation durations on the wh-word)

Second experiment (wh-adjunct)

Condition.5: 35.30 seconds (first fixation durations on the wh-word)

[11] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

Condition.6: 36.52 seconds (first fixation durations on the wh-word)

Condition.7: 36.72 seconds (first fixation durations on the wh-word)

Condition.8: 35.17 seconds (first fixation durations on the wh-word)

As it is seen, in the second experiment, in which the wh-word is an adjunct, the 'first fixation durations' on the wh-word outnumber the ones in the first experiment in which the wh-word is an argument. The difference is also statistically significant as given below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_ffd_wh_Order2	Equal variances assumed	22.79	.00	-25.10	6.00	.00	-11.05	.44	-12.13	-9.97
	Equal variances not assumed			-25.10	4.13	.00	-11.05	.44	-12.26	-9.84

Table.95 – t-test outcome of the comparison of first fixation durations recorded on the wh-phrases in sentences formed with the second word order across experiments

The data given above show the difference of 'first fixation durations' on the wh-words. But the outcomes are also strongly supported by the 'total fixation durations' on the same item. Below is the 'total fixation durations' recorded on the 'wh-word region' in the first and second experiments. The comparison will be carried out across the first word order (conditions 1, 2, 3, and 4) and second word order (conditions 5, 6, 7, and 8) sentences. The outcomes clearly show that the time spent for the processing of fronted wh-adjuncts outnumber the time consumed for processing the wh-arguments in the same type of sentences and in the same locations surrounded with the same items as seen below;

First experiment (wh-argument);

Condition.1: 92.77 seconds[12](total fixation duration on the wh-word)

Condition.2: 89.15 seconds (total fixation duration on the wh-word)

Condition.3: 89.97 seconds (total fixation duration on the wh-word)

Condition.4: 89.24 seconds (total fixation duration on the wh-word)

Second experiment (wh-adjunct)

Condition.1: 101.50 seconds (total fixation duration on the wh-word)

Condition.2: 116.93 seconds (total fixation duration on the wh-word)

Condition.3: 117.76 seconds (total fixation duration on the wh-word)

Condition.4: 108.36 seconds (total fixation duration on the wh-word)

The divergence between the 'total fixation durations' on the wh-region of the two experiments is also statistically significant as seen below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_tfd_wh_Order1	Equal variances assumed	11.22	.02	-5.29	6.00	.00	-20.86	3.94	-30.51	-11.20
	Equal variances not assumed			-5.29	3.29	.01	-20.86	3.94	-32.80	-8.91

Table.96 – t-test outcome of the comparison of total fixation durations recorded on the wh-phrases in sentences formed with the first word order across experiments

This divergence in the 'total fixation durations' on the wh-word region is also observed in the second word order sentences, in which the wh-word is inside the embedded clause, across two experiments as seen below;

[12] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

First experiment (wh-argument);

Condition.5: 57.76 seconds[13](total fixation duration on the wh-word)

Condition.6: 63.20 seconds (total fixation duration on the wh-word)

Condition.7: 50.41 seconds (total fixation duration on the wh-word)

Condition.8: 53.50 seconds (total fixation duration on the wh-word)

Second experiment (wh-adjunct)

Condition.5: 77.60 seconds (total fixation duration on the wh-word)

Condition.6: 76.72 seconds (total fixation duration on the wh-word)

Condition.7: 87.03 seconds (total fixation duration on the wh-word)

Condition.8: 76.23 seconds (total fixation duration on the wh-word)

This divergence is also statistically significant as given below;

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_tfd_wh_order2	Equal variances assumed	.06	.82	-6.14	6.00	.00	-23.18	3.77	-32.41	-13.94
	Equal variances not assumed			-6.14	5.96	.00	-23.18	3.77	-32.43	-13.93

Table.97 – t-test outcome of the comparison of total fixation durations recorded on the wh-phrases in sentences formed with the second word order across experiments

As it is seen above, the participants had more trouble in processing the wh-adjunct than processing wh-argument which is well reflected in the 'first fixation' and 'total fixation' durations on the wh-word region in 40 target sentences in each experiment. The comparison has been carried out taking into consideration the place of the wh-word, i.e. across two

[13] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

experiments, the sentences, which have the wh-word in the same location, with the same embedded verb type (transitive and ditransitive) and with the same biasing context (interrogative [Q] and declarative [D]) have been compared to obtain the mentioned results. The outcomes of the present study seem to be in parallel with the theories 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. It is important to mention that, the arguments and adjuncts used in the present study are not DPs or some other parts of speech, but wh-phrases. It is seen that even the fronted argument or adjunct is a wh-phrase it obeys the same patterns in processing as a DP. The licensing of the fronted wh-words is in the same fashion of licensing argument and adjunct DPs.

The finding is important not only with providing a support for an argument vs. adjunct processing approaches in literature, but also with a clue for the processing of fronted wh-fillers in complex sentences with ambiguity in Turkish. The clue comes from the 'regressive saccades', 'first fixation durations' and 'total fixation durations' in the embedded verb region in Turkish. As it will comprehensively be discussed in the following lines of this part, the processing strategy of the Turkish parser seems to be strongly related with the type of the fronted wh-filler (argument – adjunct) and the type of the embedded verb (transitive – ditransitive) when the wh-filler is located inside the embedded clause. As it has previously been stated throughout the analysis and discussion chapter of the present study, the place of the fronted wh-filler is directly related with the processing difficulty imposed on the processor, and this finding has been claimed to be related with the distance of the wh-filler to the first predicate (embedded verb) in Turkish complex sentence structure and the parser's realization of the clause-boundary at the end of the sentence during processing. The farther is the wh-filler from the verb linearly, which means being out of the smallest clause in the sentence, the harder it is for the processor to process the sentence.

Besides the eye-movement records on or to the 'wh-word' region, the adjunct – argument asymmetry in processing is also observed on the 'total fixation durations' on the 'embedded

verb region' of the sentences. When the 'total fixation durations' on the embedded verbs of the sentences in conditions 1, and 2 (*embedded verb: transitive; word order: s1 – wh – s2 – obj – ev - mv*) 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) outnumber the ones in the first experiment (wh-argument). The total fixation durations on the embedded verbs of the condition 1 and 2 sentences in the first and second experiments are as follow[14];

Experiment.1 (wh-argument)

Condition.1: 104.51 seconds[15] (total fixation duration on the embedded verb)

Condition.2: 90.72 seconds (total fixation duration on the embedded verb)

Experiment.2 (wh-adjunct)

Condition.1: 107.14 seconds (total fixation duration on the embedded verb)

Condition.2: 106.05 seconds (total fixation duration on the embedded verb)

As it is seen above, the 'total fixation durations' on the embedded verb in the wh-adjunct experiment outnumbers the one in wh-argument experiment. But it is a must to indicate that the two-tailed P value equals to 0.311, which denotes a statistically non-significant value. In condition 1 and 2 sentences, the wh-word is located before the embedded clause subject, and the embedded verb types are transitive. It is ought to be stated that this result may, at this point, be due to the type of the fronted wh-word (argument vs. adjunct) and its interaction with its place in the sentence and with its interaction with the embedded verb (transitive vs. ditransitive). A more robust interpretation on this matter can only be done

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[14] The reason that the 'total fixation durations' on the 'embedded verb' region of the two experiments have been compared in regard to the sentence types formed with different embedded verb types, which makes a different way of analysis from comparison of the 'total fixation durations' on the 'wh-word' region of the two experiments, is that the embedded verb type creates a divergence on the processing of wh-arguments and wh-adjuncts which is not observed on the total fixation durations on the wh-word region. The difference created during recording of the sentences on the total fixation durations on the wh-word region has stemmed from the place of the wh-word and the arguments vs. adjunct nature of the wh-word itself, as previously mentioned.

[15] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

after making the same comparison across conditions 3, and 4; across conditions 5, and 6; and across conditions 7, and 8 sentences, which are given as follow;

Experiment.1 (wh-argument)

Condition.3: 87.89 seconds (total fixation duration on the embedded verb)

Condition.4: 87.42 seconds (total fixation duration on the embedded verb)

Experiment.2 (wh-adjunct)

Condition.3: 115.56 seconds (total fixation duration on the embedded verb)

Condition.4: 103.37 seconds (total fixation duration on the embedded verb)

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 duration' on the 'embedded verb' region of conditions 3, and 4 in the second experiment (wh-adjunct) outnumbers the durations on the same region of the sentences in the same conditions of the first experiment (wh-argument) like the situation 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-word 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 as seen below:

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_ev_tfd_C34	Equal variances assumed	7.70	.01	-3.16	18.00	.01	-4.36	1.38	-7.27	-1.46
	Equal variances not assumed			-3.16	14.49	.01	-4.36	1.38	-7.32	-1.41

Table.98 – t-test outcome of the cross experimental comparison of total fixation durations recorded on the embedded verbs in sentences formed in the first word order, with ditransitive embedded verbs

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 parallel results with the conditions 1, and 2; and conditions 3, and 4 in which the sentences are formed with the first word order (s1 – wh – s2 – obj – ev – mv). The values are given below;

Experiment.1 (wh-argument)
Condition.5: 105.03 seconds[16] (total fixation duration on the embedded verb)
Condition.6: 111.89 seconds (total fixation duration on the embedded verb)

Experiment.2 (wh-adjunct)
Condition.5: 87.50 seconds (total fixation duration on the embedded verb)
Condition.6: 83.01 seconds (total fixation duration on the embedded verb)

As it is seen above, the total fixation durations on the 'embedded verb region' in the first experiment (wh-argument) outnumbers 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 as given below;

[16] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_ev_tfd_C5_6	Equal variances assumed	1.61	.22	2.43	18.00	.03	3.86	1.59	.52	7.21
	Equal variances not assumed			2.43	15.21	.03	3.86	1.59	.47	7.25

Table.99 – t-test outcome of the cross experimental comparison of total fixation durations recorded on the embedded verbs in sentences formed in the second word order, with transitive embedded verbs

Before discussing the reasons of this divergence, it is needed also to have a look at the 'total fixation durations' on the same items in the last two conditions (*second word order, ditransitive embedded verbs*) across two experiments. When we check the same values on the 'embedded verb' of the condition 7 and 8 sentences in the first and the second experiments, it is seen that the total fixation durations on the embedded verb region in the second experiment (wh-adjunct) outnumbers the values on the same item in the first experiment (wh-argument) as seen below;

Experiment.1 (wh-argument)

Condition.7: 87.50 seconds[17] (total fixation duration on the embedded verb)

Condition.8: 83.01 seconds (total fixation duration on the embedded verb)

Experiment.2 (wh-adjunct)

Condition.7: 111.37 seconds (total fixation duration on the embedded verb)

Condition.8: 98.96 seconds (total fixation duration on the embedded verb)

The divergence between the embedded verb total fixation durations in the 7th and 8th conditions of the two experiments is also statistically significant as given below;

[17] The duration indicates the total recording of 40 participants in five target sentences belonging to the same condition.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*Lower*	*Upper*
E1_2_tfd_ev_C7_8	Equal variances assumed	4.68	.04	-2.24	18.00	.04	-3.98	1.78	-7.72	-.24
	Equal variances not assumed			-2.24	12.87	.04	-3.98	1.78	-7.83	-.13

Table.100 – t-test outcome of the cross experimental comparison of total fixation durations recorded on the embedded verbs in sentences formed in the second word order, with ditransitive embedded verbs

When the 'total fixation durations' on the 'embedded verb' region of the sentences are compared according to the fronted wh-word type (argument – adjunct) 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, the total fixation durations on the 'embedded verb region' for sentences formed with fronted wh-adjuncts all outnumber the same fixation durations on the same item 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. This finding is correlated with Boland and Boehm-Jernigan (1998)'s and Liversedge et al. (2003)'s claims indicating a divergence in the processing of arguments and adjuncts with a further claim that while arguments, which are lexically specified have priority in processing over adjuncts which are syntactically specified causing a heavier processing load on adjuncts. Also, Kennison (2002) studies the processing of arguments and adjuncts following biased transitive and intransitive verbs in English sentences. 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. Also 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 processes 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) outnumbers the total fixation durations recorded on the embedded verb region of the second experiment (wh-adjunct). This divergence in the outcomes between the two experiments needs an explanation. In conditions 5 and 6, the fronted wh-word 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 seems to be occupied by the object DP in the sentence. For instance;

50. Cemal Demet'in kime kitabı gördüğünü söyledi
Cemal-Nom Demet-Gen who-Dat book-acc see-pst-ind-3rd say-pst-3rd

The sentences belonging to the 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 it is 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 existence of the wh-argument inside a clause, the predicate of which allows only one external theta-role (allowing only one argument except the subject of the clause) with a DP-object as seen above. This outcome is also supported with the embedded verb to object (ev – obj) regressive saccade patterns in the study. Embedded verb to object (ev – obj) regression pattern has the least frequency (*condition 5 – 20; condition 6 – 13*) in conditions 5 and 6 in the second experiment (wh-adjunct) among all the other conditions inside the same experiment, while the frequency of regressions from and to the same items in the sentence hits the highest amount in the first experiment implemented with fronted wh-argument (condition 5 – 47; condition 6 – 57). This should be interpreted as, although the processing of adjuncts are thought to be more costly than the processing of arguments, and which is

therefore in parallel with the findings of the present study according to the comparison of the two experiments, for that specific case, the processing of the fronted wh-word seems to be at the mercy of the subcategorization frame features of the verb when the wh-word is inside the boundaries of the clause formed with the first predicate in the linear order. Other than the position of the fronted wh-word (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 nature of the wh-word comes after the interaction of the subcategorization frame features of the first predicate in the sentence and the argument – adjunct nature of the fronted phrase in hierarchy of processing strategies of the Turkish parser.

The fact that the embedded verb type plays a major role in processing in the first experiment (wh-argument) when the fronted wh-filler is inside the embedded clause (second word order) has also been proposed beforehand. This has been thought to be in relation with the subcategorization frame features of the embedded verb and the argument nature of the fronted wh-filler. When the wh-argument is inside the embedded clause, the regression frequencies from embedded verb to object (ev – obj) and from embedded verb to wh-word (ev – wh) show a clear divergence between the conditions made with different embedded verbs as seen below;

Experiment.1 (wh-argument)
Conditions, 5 and 6 sentences: 104 (Regressive saccades from ev – obj; *transitive ev*)
Conditions, 7 and 8 sentences: 73 (Regressive saccades from ev – obj; *ditransitive ev*)

As it is seen, the frequency of regressive saccades from embedded verb to object (ev – obj) in sentences with transitive embedded verbs (conditions, 5 and 6) outnumber the ones with ditransitive embedded verbs (conditions 7, and 8). In conditions 5, 6, 7, and 8, the wh-filler is inside the embedded clause.

But when we have a look at the same regressive saccade type (ev – obj) in the same type of sentences (second word order) it is seen that the divergence related to the alteration of the embedded verb type is vice versa in the second experiment (wh-adjunct). The number of regressions from embedded verb to object (ev- obj) in conditions, 7 and 8 sentences outnumber the ones in condition 5 and 6 sentences, which means that when the fronted wh-adjunct is inside the embedded clause, the sentence is more difficultly processed with ditransitive embedded verbs than with transitive embedded verbs as seen below;

Experiment.2 (wh-adjunct)
Conditions, 5 and 6 sentences: 33 (Regressive saccades from ev – obj)
Conditions, 7 and 8 sentences: 48 (Regressive saccades from ev – obj)

This divergence is also supported with the 'total fixation durations' on the 'object' in the same sentences. When the total fixation durations on the 'object' region are 84.43 seconds, and 91.12 seconds in conditions 5 and 6; they are 71.67 seconds and 66.30 seconds in conditions 7 and 8 sentences in the first experiment (wh-argument). But in the second experiment (wh-adjunct), the 'total fixation durations' on the 'object' region are as follow in the second word order sentences; 67.27 seconds in condition 5 sentences, 57.42 sentences in condition 6 sentences, 75.09 seconds in condition 7 sentences and 63.99 seconds in condition 8 sentences. Shortly, the 'total fixation durations' tend to increase when the embedded verb is ditransitive in the second experiment, while the opposite is observed in the first experiment.

Experiment.1 (wh-argument)
Condition.5 (transitive): 84.43 seconds (total fixation duration on the object of the sentence)
Condition.6 (transitive): 91.12 seconds (total fixation duration on the object of the sentence)
Condition.7 (ditransitive): 71.67 seconds (total fixation duration on the object of the sentence)

Condition.8 (ditransitive): 66.30 seconds (total fixation duration on the object of the sentence)

Experiment.2 (wh-adjunct)

Condition.5 (transitive): 67.27 seconds (total fixation duration on the object of the sentence)

Condition.6 (transitive): 57.42 seconds (total fixation duration on the object of the sentence)

Condition.7 (ditransitive): 75.09 seconds (total fixation duration on the object of the sentence)

Condition.8 (ditransitive): 63.99 seconds (total fixation duration on the object of the sentence)

The regressive saccade and total fixation duration outcomes relate together that, when the embedded clause verb is a transitive one, it is more difficult for the parser to process the sentence if the fronted wh-filler is an argument, and is located inside the embedded clause; but when the fronted wh-filler is an adjunct, and placed inside the embedded clause, the parser processes it more easily when the embedded verb type is transitive. This is to be interpreted as follows. The argument and adjunct DPs (wh-filler in that case) are processed differently since their needs for case and thematic role assignments are treated differently as widely accepted. The argument needs to be licensed inside the subcategorization of the predicate, as an obligatory item, while an adjunct does not. So, the thematic-role assigning ability of the predicate seems to have a crucial role in that respect. The outcomes relates different results for the different types of embedded verbs in terms if transitivity and ditransitivity in relation with the argument – adjunct feature of the wh-filler. The result showing that the processor has more trouble when the fronted wh-adjunct is used with a ditransitive embedded verb, when the word order is like; s1 – s2 – wh – obj – ev – mv, clearly indicates that the processing of fronted wh-filler in Turkish complex sentence structure is obligatorily prone to the interaction of the place of the wh-word with the subcategorization frame of the first predicate that the parser comes up with after reading the

fronted wh-filler in the sentence. The processor has more trouble in the environment just mentioned because the ditransitive embedded verb needs to assign case and thematic role to two DPs in the same clause. One of the DPs (DP object in the sentence) satisfies this requirement, but the other slot for the second DP remains empty, thus causing a processing difficulty since the fronted wh-filler is an adjunct. But the situation is vice versa for the first experiment. The processor makes more regressive saccades to object from embedded verb and the total fixation durations on the object region is very high when the embedded verb is a transitive one due to the subcategorization frame features of the embedded verb. The transitive embedded verb allows only one internal theta role (the one for the object DP) but there are two arguments in the same clause (the DP object of the sentence and the wh-argument). Thus, the wh-argument does not get the case and the thematic role from the embedded verb in the same clause and this causes a processing difficulty during reading the sentence by the participants.

The same effect is also observed in the 'total fixation durations' on the embedded verb region of the sentences belonging to the second word order (wh-word inside the embedded clause). When the 'total fixation durations' on the embedded verb is compared according to the embedded verb types in each experiment, it is seen that the 'total fixation durations' in the sentences formed with transitive embedded verbs outnumber the ones formed with ditransitive embedded verbs in the first experiment in which the fronted wh-word is a wh-argument. But in the second experiment, in which the fronted wh-word is a wh-adjunct, a contradictory situation is observed. The total fixation durations on the embedded verb of the sentences formed with transitive embedded verbs are shorter than the ones formed with ditransitive embedded verbs. This means that the processor has more trouble in processing the sentences with wh-adjuncts when they are located inside the embedded clause which have been formed with ditransitive embedded verbs. The same effect has been observed in the 'total fixation durations' on the 'wh-word', 'object', and the 'embedded verb' in both of the experiments, in the second word order sentences. The total fixation durations on the 'embedded verb' region of the second word order sentences (conditions 5, 6, 7, and 8) of the two experiments are as follow;

Experiment.1 (wh-argument)

Condition.5 (transitive): 105.03 seconds (total fixation duration on the embedded verb of the sentence)

Condition.6 (transitive): 111.89 seconds (total fixation duration on the embedded verb of the sentence)

Condition.7 (ditransitive): 87.50 seconds (total fixation duration on the embedded verb of the sentence)

Condition.8 (ditransitive): 83.01 seconds (total fixation duration on the embedded verb of the sentence)

Experiment.2 (wh-adjunct)

Condition.5 (transitive): 90.80 seconds (total fixation duration on the embedded verb of the sentence)

Condition.6 (transitive): 87.50 seconds (total fixation duration on the embedded verb of the sentence)

Condition.7 (ditransitive): 111.37 seconds (total fixation duration on the embedded verb of the sentence)

Condition.8 (ditransitive): 98.96 seconds (total fixation duration on the embedded verb of the sentence)

As it has previously been stated, this divergence in the 'total fixation durations' on the embedded verb is also supported by the outcomes of the embedded verb to object (ev – obj) regressive saccade frequencies.

The same divergence is also observed on the wh-word itself. While the total fixation durations on the wh-word decreases in the ditransitive embedded verb sentences in the first experiment (wh-argument); it increases in the ditransitive embedded verb sentences in the second experiment (wh-adjunct).

Experiment.1 (wh-argument)

Condition.5 (transitive): 57.76 seconds (total fixation duration on the wh-word of the sentence)

Condition.6 (transitive): 63.20 seconds (total fixation duration on the wh-word of the sentence)

Condition.7 (ditransitive): 50.41 seconds (total fixation duration on the wh-word of the sentence)

Condition.8 (ditransitive): 53.50 seconds (total fixation duration on the wh-word of the sentence)

Experiment.2 (wh-adjunct)

Condition.5 (transitive): 77.60 seconds (total fixation duration on the wh-word of the sentence)

Condition.6 (transitive): 76.72 seconds (total fixation duration on the wh-word of the sentence)

Condition.7 (ditransitive): 87.03 seconds (total fixation duration on the wh-word of the sentence)

Condition.8 (ditransitive): 76.23 seconds (total fixation duration on the wh-word of the sentence)

The regressive saccade frequencies from embedded verb to object (ev – obj) regions and the 'total fixation durations' on the wh-word, object, and the embedded verb of the target sentences clearly indicate that the processor has a trouble in processing the sentence inside the embedded clause region which stems from the interaction of the type of the fronted wh-filler (argument vs. adjunct) with the type of the embedded verb (transitive vs. ditransitive). This very general outcome, which has been discussed in detail, indicates a linear distance sensitive, verb-oriented type of processing strategy for Turkish complex sentence structure with interrogative [Q] or declarative [D] matrix reading ambiguity. It can be stated that the processor realizes the clause boundary at the end of the sentence, also which is in parallel with the assertion made previously in the present study that the parser does not build an

initial syntactic structure during processing. After reaching the end of the sentence, having read the embedded and main verbs, has more trouble if the number of the items between the fronted wh-filler and the gap position, either the embedded or the main verb, increases which means that if the fronted wh-filler is farther from the gap position linearly. The fact that the same effect, i.e. the divergence in terms of regressive saccades, first and total fixation durations on the embedded verb, object and wh-word regions due to the type of the embedded verb, has not been observed as strongly as in the sentences in which the wh-word is located before the embedded clause subject (s1 – wh – s2 – obj – ev – mv) is also an indicator of the linearity based, predicate-oriented processing strategy of fronted wh-fillers in Turkish complex sentence structure. If the wh-filler is close to the first potential gap position, and if the sub-categorization frame features of the first verb in the order allows the licensing to be finalized, the processing is carried out much less problematic. When the fronted wh-filler is outside of the embedded clause, the processing strategy due to the embedded clause verb has not been affected as intensely as the wh-filler is inside the embedded clause. What makes the processing difficult is directly related with the place of the wh-word and the distance of the wh-word to the first verb in the sentence.

As a more general interpretation, all the types of outcomes related to the matter indicate that the processing of the fronted wh-filler is at the mercy of the first verb in the sentence, the distance of the fronted wh-phrase is influential, the farther it is from the first predicate, which means that being out of the embedded clause in the present study, the harder it is for the processor to analyze the ambiguity in the sentence, and the argument – adjunct and transitive – ditransitive embedded verb distinctions are diminished to a considerable degree. When the fronted wh-phrase is inside the embedded clause, the argument – adjunct distinction and its interaction with the predicate's subcategorization frame features (transitive – ditransitive distinction) play a crucial role for processing.

The regression frequencies to the wh-word region does not show an alteration according to the type of the wh-word but the tendency of the regression rates in terms of embedded verb to wh-word (ev – wh) and embedded verb to object (ev – obj) shows a divergence across

experiments especially in the second word order sentences. This outcome supports the interpretation that the fronted wh-fillers in Turkish are prone to the licensing capability of the first predicate in the sentence structure (naturally, due to the word order of Turkish, the embedded clause verb). At this phase, the interaction of the subcategorization frame features of the first predicate and the argument or adjunct nature of the wh-word is effective. The results showing that the regression tendency towards the wh-word region across word order types (when conditions 1, 2, 3, and 4, are compared with conditions 5, 6, 7, and 8) with interaction with the wh-word type in two experiments does not diverge but the outcomes on the regression frequencies from embedded verb to the wh-word and object regions in the same experiments indicate contradictory outcomes are to be interpreted as the robust indicators of a predicate-oriented analysis of processing in Turkish complex sentence structure with ambiguity due to the interpretation of the fronted wh-filler. It is clear that the place of the wh-word is crucial for the processing strategy of the sentence, but it comes in effect after the following verb is analyzed. After that, the subcategorization frame features of the first potential licenser play their roles in processing, which is then being observed in both regression frequencies inside the embedded clause and the first and total fixation durations on the items in the embedded clause as given above in details. The effective role of the place of the fronted wh-word in the sentence seems to have been reflected on the commonality of main verb to wh-word (mv – wh), main verb to embedded verb (mv – ev) regressive saccades, the first and total fixation durations on the wh-words and the main verbs of the sentences in both of the experiments. The languages analyzed in the psycholinguistic literature are majorly verb-initial ones and the proposed strategies and theories on sentence processing, which compete with each other, are mainly derived from the examination of verb-initial languages. In verb-initial languages the verb comes first and then the parser decides a strategy to license the fronted wh-filler with the possible gap position. Besides these studies, it is possible to see that there are some endeavors to analyze the processing of wh-phrases in Japanese, which is a verb-final language, as mentioned beforehand in the present study. However, Japanese, unlike Turkish, has an overt [Q] particle licensing the scope of the wh-word and also has a strict order for case-marked DPs in a complex sentence, which can create an expectance for the parser to specify a possible

position for a scrambled element marked with a case, and thus making it possible to observe what happens during processing complex wh-sentences with ambiguities when an unexpected DP occurs in the wrong position. However, in Turkish, it is mostly free for case marked DPs, i.e. the case marked wh-arguments, to scramble in a complex sentence structure (especially when the embedded clause verb allows two DP objects) as well as the wh-adjuncts. So, it is not very easy to observe, except a few formations, the reaction of the parser for a disorder during processing complex wh-sentences with ambiguities, thus, making it as an obligation to observe what happens during processing after the reader comes up with the first and the second predicates, which are at the end of the sentences. In that respect, it is not wrong to analyze the interaction of wh-word with embedded verb and the main verb in the sentences, the regressive saccade patterns between these units, and the first and total fixation durations on these units. Through the most general point of view on the outcomes, it is observed that the processor has more regressive saccades from main verb to wh-word and from main verb to embedded verb when the wh-word is outside of the embedded clause which is thought to be an indication of creating the smallest link with a fronted wh-phrase with the first predicate in the sentence (the embedded clause verb). In both of the experiments (wh-argument – wh-adjunct divergence) the first order sentences (wh-word out of the embedded clause) have produced more regressive saccades, and more fixations on the mentioned items than the ones in the second word order sentences (wh-word inside the embedded clause). Moreover, the regressive saccade patterns and fixation durations inside the embedded clause (items included are *object, wh-word* for the second set of sentences, and the *embedded verb* itself) show divergence according to the type of the fronted wh-word (argument – adjunct distinction) and the type of the embedded clause verb (transitive – ditransitive distinction) which is an indication of the importance of the interaction of the type of the wh-word and the type of the embedded verb in parsing complex ambiguous sentences with wh-words in Turkish. The findings indicate the role of the predicate during parsing in Turkish and if an expectance is created in order to build the structure during parsing, it can be done according to the type of the fronted wh-word and can only be satisfied or dissatisfied after coming up with the first predicate in the sentence,

the processing strategy is, obligatorily based on reanalysis of the structure after a mismatch is occurred.

CHAPTER 5

CONCLUSION

This study has investigated the processing of wh-phrases in Turkish complex sentence structure in an experimental way. The licensing of wh-phrases in complex sentence structure is studied through formal framework comprehensively, and the issue seems to be controversial in some respects. The wh-question formation in Turkish is thought to be in-situ, and the issue has been evaluated either in terms of a covert movement of the wh-phrases in the Logical Form (LF) or a [Q] operator licensing which forms an operator – variable chain to license the [+wh] feature. Especially what makes the issue problematic for Turkish is the highly free scrambling property of both DPs and wh-phrases especially when it is considered that scrambling is a major topic of debate in the formal literature (in terms of whether it is a kind of movement which forms new scope relations or it reconstructs the former interpretation although there is a replacement in overt syntax). For instance, in that respect, Karimi (2005) states, through the work on Persian, that since the ambiguity created by the operation scrambling is established by either interpreting the copy of the head at the chain's tail or by interpreting the head of the chain, in each phase the scope relation is specified in overt syntax which consequently necessitates the redundancy of covert XP movement as suggested by Chomsky (1995). When the problem of licensing issues in complex sentences with scrambled/moved wh-phrases in Turkish is handled through formal perspective it seems that the situation is highly controversial. On the other hand, it is possible to state that if the issue is handled through a psycholinguistic approach, especially when the processing of complex sentences with fronted wh-phrases is examined, the field may make use of the contributions provided by experimental data in order to speculate on what is going on while the human sentence processor is trying to interpret this problematic linguistic issue. Moreover, the field, particularly for Turkish linguistics, lacks psycholinguistic studies on the processing of complex ambiguous sentences with fronted wh-phrases. In that respect, the present study investigates the processing strategies carried out by the Turkish sentence processor during reading complex sentences formed with

fronted wh-phrases. The study has collected on-line data through eye – tracking method during silent reading. The eye – tracking device used in the present study is 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 used to run the hardware is Tobii software version 3.1.3. The experiment has been applied to 60 native speakers of Turkish all of whom are the undergraduate students studying linguistics at the University of Hacettepe, Department of English Linguistics. The present study is composed of two different experiments, the first of which tried to examine the 40 target sentences constructed with wh-argument *kim-E* (who-Dat), while the second experiment investigated other 40 target sentences formed with wh-adjunct *ne zaman* (when). Each experiment has been applied on 30 native speakers of Turkish making a total of 60 participants. The first experiment has been carried out in two phases in April and May of 2012, at METU HCI Lab (Middle East Technical University, Human – Computer Interaction Research Laboratory). The second experiment, on the other hand has been applied in November 2012 also in two different sessions. In each experiment, every participant was invited to the laboratory one by one. Before the experiment has begun an audio instruction has been read to the participants indicating that they had to read silently what was written on the computer screen, and then press the 'space' button on the keyboard in order to call for the next target sentence after they think that they have comprehended what has been showed on the screen. Each screen of sentence included two items, the above sentence was the biasing context (either declarative or interrogative) and the bottom one was the target sentence. All of the sentences in the experiment have been written on MS word and then converted into 'jpeg' file in order to be compatible with the eye tracker software. The font of the script characters are Calibri, with the size of 24, colored in black while the background color is white.

The variables in the data collection tool are two different word orders, two different biasing contexts and two different embedded verb types. The word orders used in the study are as follows; *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.* As it is seen, the wh-phrase has been placed before the embedded clause subject in the first word

order, while it has been located after the embedded clause subject in the second word order. By specifying these word orders for the target sentences, it is aimed to observe the 'first fixation durations', 'total fixation durations' on wh-phrases, embedded verbs and main verbs, and 'regressive saccades' from embedded verb and main verb to the wh-word region in order to evaluate the effect of the linear distance from predicates to the wh-phrase which has been located either inside or out of an embedded clause in a verb – final language like Turkish, and to examine if the Turkish parser builds an initial syntactic analysis during processing the sentence (as for instance the cases in 'minimal attachment hypothesis' which is a major component of garden - path theories) – Frazier (1979; 1984; Frazier and Rayner, 1982; De Vincenzi, 1991) or the processing strategy is based majorly on the sub-categorization information provided by the verbs in the sentences which is proposed to be an indication of interactive models based on constraint – based theories of parsing (MacDonald, 1994; MacDonald et al.,1994; Trueswell et al.,1993; Trueswell and Tanenhaus,1994). The organization of the target sentences, with the two embedded types used and two biasing contexts provides an eight – condition set for each experiment along with two different interpretations. In the first experiment, which has been conducted with argument wh-phrase, conditions 1 and 2 has obligatorily interrogative interpretation, conditions 3, 4, 7 and 8 have double interpretations (either interrogative or declarative) and conditions 5 and 6 are ungrammatical, while in the second experiment which has been carried out with a wh-adjunct, all eight conditions provide double interpretations.

As it is stated above, besides the word order alternation, the embedded verb types (transitive and ditransitive) used in the study also provide another variable. The reason for that specification is to observe the effect of the interaction of the sub-categorization frame features of the embedded verb with the fronted wh-phrase. While a wh-argument could need an empty position in the domain of the embedded verb for both case and thematic role assignment, a wh-adjunct would not necessarily need the same, thus a potential divergence could be observed related to this difference in terms of two distinct characteristics of the wh-phrases. The checking of 'first fixation durations' and 'total fixation durations' on the

embedded verb region has the potential to indicate the role of the embedded verb during initial parsing.

Another variable is the 'interrogative' and 'declarative' biasing context types. By biasing the readers both declaratively and interrogatively, it is aimed to derive both types of interpretations through the same target sentence and to make sure that the participants have interpreted all the target sentences in both ways if possible during reading.

As it has previously been stated, the two experiments included two different wh-phrases, one of which is a wh-argument and the other is a wh-adjunct. Besides the investigation of the expected impact of wh-argument – wh-adjunct distinction on the processing of ambiguous complex sentences in Turkish, the processing load difference of arguments and adjuncts themselves which has been a topic of concern in the literature (MacDonald et al., 1994; Boland and Boehm-Jernigan, 1998; Liversedge et al., 1998; Ferretti et al., 2001; Kennison, 2002) is also aimed to be studied in the context of Turkish, checking the issue of argument and adjunct processing in terms of wh-phrases constructed as wh-arguments and wh-adjuncts.

The present study tries to discover the processing strategies carried out during the processing of ambiguous complex sentences with fronted wh-phrases in Turkish considering the facts and procedures given above. Through a very general outlook on the findings, it can be stated that the Turkish parser does not make an initial syntactic parsing during on – line processing of the complex sentence structure, but makes use of the verbal information encoded in the embedded verb and main verb regions. Since the records of the '*first fixation durations*' relate data on the immediate processing of any linguistic written production, it may be the sole indicator of a possible 'initial syntactic structure building' during reading. The examination of the 'first fixation durations' indicates that when the readers come up with the accusative marked object DP in the sentence, which is the unique indicator of the complex sentence structure, do not build an initial syntactic analysis. This is inferred from the comparison of the '*first fixation duration*' records on the 'embedded verb

region' in conditions 5, 6, 7, and 8 (the variables forming each condition are given above) sentences in the first experiment. If the parser builds an initial syntactic analysis, it should have expected the upcoming verb to be 'ditransitive' in order to form a complex sentence structure tree, since the accusative marked DP object in the sentence is an indicator of a complex sentence structure as seen in the following example (*Ayşe Ali'nin kime kitabı_____ [expectation for a ditransitive verb on the underlined section if an initial syntactic structure is built]*). If an initial syntactic analysis is built during reading, the parser should have built a syntactic tree for a complex sentence structure and would expect a ditransitive verb in the embedded verb region in order to host the accusative marked DP object '*kitabı* (book-Acc)' and the wh-argument which are both inside the embedded clause. As a result of this, an increase in the '*first fixation durations*' should have been detected on the 'embedded verb region' if the embedded verb is a 'transitive' one (The increase in the fixation duration is the indicator of a processing difficulty; Frazier and Rayner, 1982; Liversedge and Finlay, 2000; Garrod, 2006; Rayner and Pollatsek, 2006). When the 'first fixation durations' on the 'embedded verb region' of the above given conditions are compared, no significant divergence has been observed (*the two-tailed P value equals 0.1798*). The readers almost have had the same time for processing the 'embedded verb region' whether it is a 'transitive' or a 'ditransitive' one. In the sense of parsing strategies, this should be evaluated as lacking of an initial syntactic parsing during processing which is a major component of garden – path theories of parsing. On the other hand, this finding seems to relate a verb – based account of processing for Turkish, at least during the initial stage of sentence reading. This seems to be also in accordance with the word order of Turkish. Turkish is verb final, and even if the accusative marked DP object in the related order could be an indicator of a complex structure, the Turkish parser seems to make use of the verbal information in the initial stage of parsing. The outcomes, which will be given below, mention the role of the place of the wh-phrase in complex sentences through '*regressive saccadic movement frequencies*' and '*total fixation durations*' in overall processing strategies; but it looks clear that during the first pass phase of reading, the Turkish parser uses the syntactic and semantic informational constraints brought by the first verb (the embedded verb) in order to build a structure to interpret the sentence.

Moreover, the examination of the outcomes of the first experiment shows that, in the processing of Turkish complex sentences with fronted wh-phrases, the linear distance between the fronted wh-phrase and its potential gap position is more important than the structural distance between the wh-phrase and the gap position. The analysis of the regressive saccade frequencies, which have been observed from main verb to wh-word (mv – wh) in sentences belonging to conditions 3, and 4 on the one hand, and conditions 7, and 8 on the other support the claim that linear distance is important in processing. Condition 3 and 4 sentences have double interpretations (either interrogative [Q] or declarative [D]), the wh-phrase is located before the embedded clause subject, and the embedded verb is ditransitive. Condition 7 and 8 sentences have also double interpretations, the wh-phrase is located inside the embedded clause and the embedded verb is ditransitive. The only difference between these two types of sentences is the place of the wh-phrase. In condition 3, and 4 sentences, the linear distance between the wh-phrase and its gap position is longer than the one in condition 7 and 8 sentences. On the contrary, the linear distance is shorter in condition 7 and 8 sentences while the structural distance is longer than the one in condition 3 and 4 sentences. If structural distance hypothesis had a major role, it could have been expected that the processing difficulty could be observed in condition 7 and 8 sentences, which have structurally more distant displaced wh-fillers from possible gap positions. On the other hand, if a linear distance hypothesis had a major role in processing, the results could have indicated a processing difficulty in condition 3 and 4 sentences. The outcomes relate that the regressive saccade frequency from main verb to wh-word (mv – wh) in condition 3 and 4 sentences (*having longer linear distance – shorter structural distance*) outnumbers the same regressive saccade frequencies in condition 7 and 8 sentences (*having shorter linear distance – longer linear distance*) which is a clear indication of a linear distance hypothesis to be at work in processing fronted wh-fillers in complex sentences with ambiguity in Turkish. Also the first and total fixation durations show a parallel outcome, since the recorded values in terms of first and total fixation durations increase dramatically on the wh-word regions in sentences belonging to the conditions 3 and 4. In terms of total fixation durations, besides the wh-word, the object DP and the embedded verb region also get higher fixation durations in the first word order in which the wh-phrase

in located before the embedded clause subject DP. Also, the same effect has been observed in the second experiment in which the fronted wh-phrase is an adjunct. All of the sentences belonging to the eight conditions in the second experiment provide double interpretations (either interrogative [Q] or declarative [D]) which extends the discussion carried out in the first experiment for conditions 3, 4 and 7, 8 (double interpretation sentences) on main verb to wh-word (mv – wh) regression frequencies to all of the eight conditions in the second experiment. Through a general look at the main verb to wh-word (mv – wh) regression frequencies comparing the word order alteration in the second experiment, it is seen that the regressive saccade frequencies decrease in the second word order in which the wh-phrase in inside the embedded clause (*linearly closer to the first verb in the sentence than the location in the first word order*). This outcome supports the findings gathered in the first experiment implemented with a fronted wh-argument indicating the importance of linear distance between the filler and the gap above structural distance in the processing of complex sentences with fronted wh-phrases in Turkish. The closer the wh-phrase to the first verb (embedded verb) in the sentence, the easier it is to be processed. This outcome also seems to be in parallel between Aoshima et al. (2004) reporting that Japanese (an SOV language like Turkish) readers prefers to interpret a fronted wh-filler within an embedded clause, and further indicated that the wh-phrase is related to the first verb which readers come up with. It may be interpreted throughout the findings of the present study as, the Turkish readers also try to relate the scrambled wh-filler with the first verb in the linear order, which is the verb of the embedded clause due to the word order of Turkish. Since both of the sentence types used in the present study include wh-phrases preceding the embedded and main verbs, it is the difference in the processing loads recorded among these two word order types making it possible to propose that the closer the wh-filler to the first verb in the sentence, the easier it is to be processed. Also, the finding relating a non-preference for an initial syntactic parsing for the type of sentences in the present study creates a parallel viewpoint on the matter. The parser takes into consideration the linear distance into consideration while licensing the wh-filler with the gap. This must also be due to the abundance of the items between the fronted wh-filler and the first verb in the sentence since it means that the more the wh-filler is placed to the leftmost location in the

sentence, the more elements occur between the filler and the gap position which creates a burden for the working memory load which resembles the findings of Ueno and Kluender (2003) reporting through an ERP experiment that both filler-gap dependencies and wh-Q dependencies evoke anterior negativity (R)AN in the form of slow potentials which has been been hypothesized to be the result of working memory load caused by the dependency between a wh-unit and its related Q-particle resembling the situation in wh-movement languages in which the parser needs to maintain actively a wh-filler until it is associated with its gap.

When we have a look at the eye movements recordings on the items in the embedded clause in terms of verb type divergence, it is observed that, in the first experiment (wh-argument) the embedded verb to object (ev – obj) regression frequencies and the total fixation durations increase when the embedded verb is a transitive one in the second word order (*wh-phrase is inside the embedded clause in the second word order, and also there is an object DP*), but when the embedded clause verb is a ditransitive one, the processing difficulty diminishes to a considerable degree. This relates that the Turkish processing strategy is bound to the constraints provided by the verb to license the fronted wh-filler. The same alternation between the verb types has not been observed in the first word order sentences (wh-phrase placed before the embedded clause subject). The processor tries to bind the wh-phrase with the first verb in the linear order, and if this is prohibited (*wh-argument + object DP + transitive embedded verb in the same clause*) the processor has come up with a trouble. If the locality is provided, the processing is carried out less problematically since the Turkish parser does not build an initial syntactic analysis. The 'regressions from the end of the sentence', and the 'total fixation durations', but not the 'first fixation durations' make it possible to derive such an analysis. Moreover, the processing difficulty caused by the cooperation of the place of the wh-phrase and the type of the embedded verb has not been observed in the second experiment. Embedded verb to object (ev – obj) regressive saccades decrease in the second word order in the second experiment (wh-adjunct), which is vice versa for the first experiment (wh-argument). The reason of this is clearly the type of the scrambled wh-phrase (either argument or adjunct).

The wh-phrase tested in the second experiment is a wh-adjunct and does not need to be in the sub-categorization frame of the embedded verb since it is not an obligatory element. So, when it is used with an object DP in the same clause with a transitive verb, the sentence is grammatical and the processing difficulty is observed in a much less significant manner. When the fronted wh-phrase is a wh-adjunct, the prevalence of the place of the wh-word is at work again, but when the wh-phrase is an argument, the processing difficulty occurs due to the sub-categorization frame of the first verb linearly in the sentence, and then it becomes more difficult for the processor to process the ambiguous sentence when the wh-phrase is farther from the first verb in the sentence. The difficulty in processing due to the linear distance between the fronted wh-filler and its gap position is also reflected via the main verb to embedded verb (mv – ev) regression pattern. In the first order (*s1 – **wh** – s2 – obj – ev – mv*) the regressive saccades outnumber the ones in the second word (*s1 – s2 – **wh** – obj – ev – mv*) order.

The 'first fixation duration' analysis on the embedded verb region of the second experiment also gives similar results with the ones in the first experiment. The proposal on the fact that Turkish processor does not build an initial syntactic analysis during first pass reading of the sentences seems also to be supported via the 'first fixation duration' comparisons in the second experiment. In none of the conditions, the first fixations recorded on the embedded verb show a significant divergence when the processor comes up with a transitive embedded verb while expecting a ditransitive one, which indicates that the processor does not build a preliminary syntactic analysis during reading, but waits for the verb and then makes the analysis based on the verbal constraints in the complex sentences formed with fronted wh-phrases with ambiguities.

Also the 'total fixation duration' analysis in the second experiment shows a parallelism with the regressive saccade frequencies in the same experiment and with the fixation and regressive saccade frequency examination of the first experiment. The recorded 'total fixation durations' on the wh-phrases in the first word order, in which the fronted wh-phrase is linearly more distant from the possible gap position, outnumber the ones in the

second word order, in which the fronted wh-phrase is linearly closer to the gap position. The outcomes on the 'total fixation durations' on the wh-phrases are also similar when the conditions are checked according to the embedded verb types one by one, cross experimentally. So, the theoretical claims purported on the processing strategies of the Turkish parser are also valid for the second experiment fixation results.

On the matter of adjunct vs. argument processing differences, the outcomes gathered in the present study seem to support the views favoring a divergence in the processing load of arguments and adjuncts in the psycholinguistic literature. When the 'first fixation' and the 'total fixation' durations on the wh-phrases are compared cross-experimentally, it is observed that in the second experiment, in which the fronted wh-word is a wh-adjunct, the fixations on the wh-word region outnumbers the ones in the first experiment, in which the fronted wh-phrase is a wh-argument. The processing of the fronted wh-adjunct is more problematic than the processing of the fronted wh-argument, which seems to support the proposals indicate that adjuncts impose a bigger processing load on the processor (Boland and Boehm-Jernigan, 1998; Liversedge et al., 2003).

On the other hand, although the 'first fixation' and 'total fixation' durations on the wh-arguments and wh-adjuncts give parallel outcomes with the universal claim on the processing of adjuncts to be more difficult than processing arguments, a contradictory result has been obtained through 'total fixation duration' analysis on the embedded verb region cross experimentally. The total fixation duration on the 'embedded verb region' in the first experiment (wh-argument) outnumbers 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. The divergence occurs in condition 5 and 6 sentences. Condition 5 and 6 sentences are formed with transitive embedded verb (allowing two DP arguments), the wh-filler is placed inside the embedded clause in the linear order, and these sentences in the first experiment are ungrammatical in Turkish. This is reflected through the processing difficulty observed in the embedded verb region. Each experiment in the present study includes eight conditions, and only the 5th and

the 6th conditions of the first experiment create ungrammatical sentences. The processing difficulty in these sentences seems to have stemmed from the mismatch between the placements of the wh-argument inside a clause with the embedded verb, which allows only one object position. This outcome is also supported with the embedded verb to object (ev – obj) regression frequencies. Embedded verb to object (ev – obj) regression pattern has the least frequency (*condition 5 – 20; condition 6 – 13*) in conditions 5 and 6 in the second experiment (wh-adjunct) among all the other conditions inside the same experiment, while the frequency of regressions of the same type gets the highest rate in the first experiment carried out with fronted wh-argument (condition 5 – 47; condition 6 – 57). This means that, even though the processing of adjuncts are more costly than the processing of arguments, and which is also parallel with the general findings of the present study; for that specific case, the processing of the fronted wh-phrases seems to be affected by the sub-categorization frame features of the verb when the wh-phrase is inside the boundaries of the clause formed with the first verb in the linear order. Besides the position of the fronted wh-phrase, the sole difference stemming from the argument – adjunct distinction of the wh-phrase comes after the interaction of the sub-categorization frame features of the first verb in the sentence and the argument – adjunct nature of the fronted phrase in the hierarchy of processing strategies of the Turkish parser. In short, the argument – adjunct asymmetry does not seem to be strong enough to overcome the importance of the linear position of the scrambled wh-phrase during processing.

Finally, the place of the wh-phrase precedes all other options in the processing strategies of Turkish ambiguous complex sentences with displaced wh-phrases. The impact of the type of the embedded verb and the argument and adjunct divergence of the wh-phrase seems to have an interaction with each other when the results are compared disregarding the word order alteration. When the wh-phrase is inside the embedded clause, it is seen that the regressive saccades, the first and total fixation durations tend to decrease on the wh-phrase and predicate regions in the sentences. But when the wh-phrase is inside the embedded clause, the type of the embedded verb and the type of the wh-phrase (argument or adjunct) seem to have a role on processing by increased fixations on the related items due to a clash

between the sub-categorization frame features of the verb and the items present in the scope of the related verb. It is found out that, during the processing of complex, ambiguous Turkish sentences with scrambled wh-phrases, the parser does not make an initial syntactic analysis, which is proved with 'first fixation durations', but necessarily constructs the whole structure within the limitations proposed by the verbs coming at the end of the sentence. In this regard, the embedded verb prevails the main verb. After completing the first pass of the sentence, the processor tries to solve the ambiguity by turning back to the problematic areas of interests, which is observed through 'regressive saccade frequencies' to the related areas of interests, and through 'total fixation durations' recorded on those areas of interests. The issue of processing ambiguous complex sentences formed with scrambled wh-phrases is bound to the linear distance of the scrambled wh-phrase to the first verb (embedded verb) in the sentence, the closer it is to the verb the easier it is processed, which seems to favor a constraint-based predicate oriented analysis of the ambiguous complex sentences with scrambled wh-phrases. The Turkish processor constructs the whole structure just after reaching the end of the sentence, before that, the ordering of the elements does not help the processor to build an initial syntactic analysis. Due to this finding, the linear distance of the wh-filler from the first predicate in the sentence causes a difficulty in processing. At the end of the sentence, after reading the embedded and the main verb consecutively the processor is able to form the syntactic structure but still the ambiguity remains which is evident from the high ratio of regressive saccades from the main verb region to the wh-word regions, especially when the wh-word is placed before the embedded clause subject. It may be expected that the placement of the wh-phrase in front of the embedded clause subject could provide a simplicity for the resolution of the ambiguity due to the creation of a shorter syntactic distance between the main verb and the wh-filler, but the regressive saccades towards the wh-phrase and the total fixation durations recorded on wh-phrase indicate that a linear distance has an important role in the processing difficulty which may be explained via a working memory load imposed by the intervening items in the word order until the main verb is read in complex sentences with scrambled wh-phrases in Turkish.

This study has been conducted through the pscycholinguistic investigation of the processing of ambiguous complex sentences in Turkish with two types of wh-phrases (wh-argument and wh-adjunct), in two different locations (preceding the subject of the embedded clause and following the subject of the embedded clause). For further analysis, the number of the wh-phrases used may be increased, and also the place of the wh-phrase in complex sentences may be diversified, for instance the very beginning of the sentence may give fruitful outcomes for understanding the long-distance dependency processing which necessarily constructs a matrix question reading. The outcomes of the present study may contribute to the investigation of processing filler – gap dependencies in terms of theories giving priority to initial syntactic building or theories handling the issue in terms of semantic and syntactic information provided by the verb in a parallel fashion. Since the languages studied in the related domain are mainly the ones having overt syntactic movement or having an overt [Q] marker to identify the scope of the displaced wh-phrase, the present study concerned with the case in Turkish, which proposes a fully covert operation for the scope specification of the displaced wh-phrase, may contribute to the discussions carried out in the field in terms of the mental processing for structure building of the long-distance dependencies.

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APPENDIX 1

Target and filler sentences in the first experiment

Target sentences in the first experiment
(first lines are the biasing context sentences)

Sen biliyor musun?
Ahmet kime Ayşe'nin kitabı gördüğünü söyledi

Ben de bilen herkese sordum ve öğrendim.
Ahmet kime Ayşe'nin kitabı gördüğünü söyledi

Bir türlü duyamadım.
Can kime Zeynep'in kitabı verdiğini söyledi

Daha fazla saklayamadı.
Can kime Zeynep'in kitabı verdiğini söyledi

Duyabildin mi?
Ali kime Aslı'nın oyuncağı kırdığını anlattı

Sonunda ben de öğrendim
Ali kime Aslı'nın oyuncağı kırdığını anlattı

Senden öğrenebilir miyim?
Emre kime Ece'nin oyuncağı götürdüğünü anlattı

Mehmet sonunda Emre'yi konuşturdu.
Emre kime Ece'nin oyuncağı götürdüğünü anlattı

Bir şey soracağım.
Mustafa kime Emel'in soruyu değiştirdiğini bildirdi

Ben de biraz once öğrendim.
Mustafa kime Emel'in soruyu değiştirdiğini bildirdi

Çok merak ediyorum.
Barış kime Yeliz'in soruyu açıkladığını bildirdi

Bence yapması gerektiğini yaptı
Barış kime Yeliz'in soruyu açıkladığını bildirdi

Hatırlıyor musun?
Burak kime Burcu'nun mektubu kaybettiğini hatırlattı

Eminim ki sen de biliyorsun.
Burak kime Burcu'nun mektubu kaybettiğini hatırlattı

Hiçbir fikrin var mı?
Murat kime Özge'nin mektubu gönderdiğini hatırlattı

Hepimiz unutmuştuk
Murat kime Özge'nin mektubu gönderdiğini hatırlattı

Biliyorsan bana da söyler misin?
Cem kime Pınar'ın raporu bitirdiğini duyurdu

Eminim ki sen de biliyorsun.
Cem kime Pınar'ın raporu bitirdiğini duyurdu

Bilmiyorum ama öğrenmem gerek.
Uğur kime İnci'nin raporu yolladığını duyurdu

Beklediğimiz duyuru yapıldı.
Uğur kime İnci'nin raporu yolladığını duyurdu

Senin haberin var mı?
Cemal Demet'in kime kitabı gördüğünü söyledi

Ben de bilen herkese sordum ve öğrendim.
Cemal Demet'in kime kitabı gördüğünü söyledi

Bir türlü duyamadım.
Alper Büşra'nin kime kitabı verdiğini söyledi

Daha fazla saklayamadı.
Alper Büşra'nin kime kitabı verdiğini söyledi

Duyabildin mi?
Mehmet Gülden'in kime oyuncağı kırdığını anlattı

Sonunda ben de öğrendim.
Mehmet Gülden'in kime oyuncağı kırdığını anlattı

Sen biliyor musun?
Fatih Sevgi'nin kime oyuncağı götürdüğünü anlattı

Ali sonunda Fatih'i konuşturdu.
Fatih Sevgi'nin kime oyuncağı götürdüğünü anlattı

Bir şey soracağım.
Selçuk Eda'nın kime soruyu değiştirdiğini bildirdi

Ben de biraz once öğrendim.
Selçuk Eda'nın kime soruyu değiştirdiğini bildirdi

Çok merak ediyorum.
Gökhan Seda'nın kime soruyu açıkladığını bildirdi

Bence yapması gerekeni yaptı.
Gökhan Seda'nın kime soruyu açıkladığını bildirdi

Hatırlıyor musun?
Özgür Fuda'nin kime mektubu kabettiğini hatırlattı

Eminim ki sen de biliyorsun.
Özgür Fuda'nin kime mektubu kabettiğini hatırlattı

Hiçbir fikrin var mı?
Mert Ezgi'nin kime mektubu gönderdiğini hatırlattı

Hepimiz unutmuştuk.
Mert Ezgi'nin kime mektubu gönderdiğini hatırlattı

Biliyorsan bana da söyler misin?
Serkan Fatma'nın kime raporu bitirdiğini duyurdu

Bildiğinden eminim.
Serkan Fatma'nın kime raporu bitirdiğini duyurdu

Bilmiyorum ama öğrenmem gerek.
Faruk Esra'nın kime raporu yolladığını duyurdu

Beklediğimiz gibi oldu.
Faruk Esra'nın kime raporu yolladığını duyurdu

Filler Sentences in the first experiment

Adam kapıyı kapattı
Tamirci camı değiştirdi
Çantayı çocuk buldu
Hırsız kasayı aradı
Aşçı yemeği yaptı
Tamirci arızayı tespit etti
Cem kitabı bitiremediğini söyledi
Mustafa telefonunu kaybetmiş
Müşteri siparişini iptal etti
Kuyumcu dükkanı digger sokakta
Esra ödevini biraz once tamamladı
Fotokopi makinası şu anda çalışmıyor
Tüm sorular öğrencilerin seviyesine uygundu
Bilgisayarda sorun var
Kitaplığın değişmesi gerekiyor
Çantasını evde unutmuş
Sadece kahve içmek istedi
Kahvaltıdan sonra aceleyle evden çıktı
Daha çok çalışması gerektiğini düşünüyor
Hata yaptığını çabuk fark etti

APPENDIX 2

Target and filler sentences in the second experiment

Target sentences in the second experiment

(first lines are the biasing context sentences)

Sen biliyor musun?
Ahmet ne zaman Ayşe'nin kitabı gördüğünü söyledi

Sebebini çok merak ediyordum ve artık öğrendim.
Ahmet ne zaman Ayşe'nin kitabı gördüğünü söyledi

Bir türlü duyamadım.
Ahmet ne zaman Ayşe'nin kitabı verdiğini söyledi

Daha fazla saklayamadı.
Ahmet ne zaman Ayşe'nin kitabı verdiğini söyledi

Duyabildin mi?
Emre ne zaman Özge'nin oyuncağı kırdığını anlattı

Sonunda ben de öğrendim.
Emre ne zaman Özge'nin oyuncağı kırdığını anlattı

Söyleyebilir misin?
Emre ne zaman Özge'nin oyuncağı götürdüğünü anlattı

Cenk sonunda Emre'yi konuşturdu.
Emre ne zaman Ayşe'nin oyuncağı götürdüğünü anlattı

Bir şey soracağım.
Cemal ne zaman Ezgi'nin soruyu değiştirdiğini bildirdi

Ben de biraz önce öğrendim.
Cemal ne zaman Ezgi'nin soruyu değiştirdiğini bildirdi

Çok merak ediyorum.
Cemal ne zaman Ezgi'nin soruyu açıkladığını bildirdi

Bence yapması gerekeni yaptı.
Cemal ne zaman Ezgi'nin soruyu açıkladığını bildirdi

Hatırlıyor musun?
Selim ne zaman Demet'in mektubu kaybettiğini hatırlattı

Eminim ki sen de biliyorsun.
Selim ne zaman Demet'in mektubu kaybettiğini hatırlattı

Hiç bir fikrin var mı?
Selim ne zaman Demet'in mektubu gönderdiğini hatırlattı

Hepimiz unutmuştuk.
Selim ne zaman Demet'in mektubu gönderdiğini hatırlattı

Biliyorsan bana da söyler misin?
Cem ne zaman Duygu'nun raporu bitirdiğini duyurdu?

Bildiğinden eminim ve bana da söylemelisin.

Cem ne zaman Duygu'nun raporu bitirdiğini duyurdu

Bilmiyorum, ama öğrenmem gerek.
Cem ne zaman Duygu'nun raporu yolladığını duyurdu

Beklediğimiz duyuru yapıldı.
Cem ne zaman Duygu'nun raporu yolladığını duyurdu

Senin haberin var mı?
Can Seda'nın ne zaman kitabı gördüğünü söyledi

Ben de bilen herkese sordum ve öğrendim.
Can Seda'nın ne zaman kitabı gördüğünü söyledi

Bir türlü duyamadım.
Can Seda'nın ne zaman kitabı verdiğini söyledi

Daha fazla saklayamadı.
Can Seda'nın ne zaman kitabı verdiğini söyledi

Duyabildin mi?
Murat Deniz'in ne zaman oyuncağı kırdığını anlattı

Sonunda ben de öğrendim.
Murat Deniz'in ne zaman oyuncağı kırdığını anlattı

Sen biliyor musun?
Murat Deniz'in ne zaman oyuncağı götürdüğünü anlattı

Biraz önce duydum.
Murat Deniz'in ne zaman oyuncağı götürdüğünü anlattı

Bir şey soracağım.
Onur Aslı'nın ne zaman soruyu değiştirdiğini bildirdi

Ben de biraz önce öğrendim.
Onur Aslı'nın ne zaman soruyu değiştirdiğini bildirdi

Çok merak ediyorum.
Onur Aslı'nın ne zaman soruyu açıkladığını bildirdi

Bence yapması gerekeni yaptı.
Onur Aslı'nın ne zaman soruyu açıkladığını bildirdi

Hatırlıyor musun?
Engin Büşra'nın ne zaman mektubu kaybettiğini hatırlattı

Unutmuş olamazsın.
Engin Büşra'nın ne zaman mektubu kaybettiğini hatırlattı

Hiç bir fikrin var mı?
Engin Büşra'nın ne zaman mektubu gönderdiğini hatırlattı

Hepimiz unutmuştuk.
Engin Büşra'nın ne zaman mektubu gönderdiğini hatırlattı

Biliyorsan bana da söyler misin?
Tolga Pınar'ın ne zaman raporu bitirdiğini duyurdu

Bildiğinden eminim.
Tolga Pınar'ın ne zaman raporu bitirdiğini duyurdu

Bilmiyorum, ama öğrenmem gerek.
Tolga Pınar'ın ne zaman raporu yolladığını duyurdu

Beklediğimiz gibi oldu.
Tolga Pınar'ın ne zaman raporu yolladığını duyurdu

Filler Sentences

Ahmet dün Ayşe'nin kitabı gördüğünü söyledi
Ahmet dün Ayşe'nin kitabı verdiğini söyledi
Emre geçen hafta Özge'nin oyuncağı kırdığını anlattı
Emre geçen hafta Özge'nin oyuncağı götürdüğünü anlattı
Cemal biraz önce Ezgi'nin soruyu değiştirdiğini bildirdi
Cemal biraz önce Ezgi'nin soruyu açıkladığını bildirdi
Selim iki gün önce Demet'in mektubu kaybettiğini hatırlattı
Selim iki gün önce Demet'in mektubu gönderdiğini hatırlattı
Cem öğleden önce Duygu'nun raporu bitirdiğini duyurdu
Cem öğleden önce Duygu'nun raporu yolladığını duyurdu
Can Seda'nın geçen hafta kitabı gördüğünü söyledi
Can Seda'nın geçen hafta kitabı verdiğini söyledi
Murat Deniz'in biraz önce oyuncağı kırdığını anlattı
Murat Deniz'in biraz önce oyuncağı götürdüğünü anlattı
Onur Aslı'nın iki gün önce soruyu değiştirdiğini bildirdi
Onur Aslı'nın iki gün önce soruyu açıkladığını bildirdi
Engin Büşra'nın dün mektubu kaybettiğini hatırlattı
Engin Büşra'nın dün mektubu gönderdiğini hatırlattı

Tolga Pınar'ın öğleden önce raporu bitirdiğini duyurdu
Tolga Pınar'ın öğleden önce raporu yolladığını duyurdu
Ahmet Tolga'ya Ayşe'nin kitabı gördüğünü söyledi
Can Onur'a Zeynep'in kitabı verdiğini söyledi
Ali Oktay'a Aslı'nın oyuncağı kırdığını anlattı
Emre Savaş'a Ece'nin oyuncağı götürdüğünü anlattı
Mustafa Elif'e Emel'in soruyu değiştirdiğini bildirdi
Barış Berna'ya Yeliz'in soruyu açıkladığını bildirdi
Burak Ceyda'ya Burcu'nun mektubu kaybettiğini hatırlattı
Murat Canan'a Özge'nin mektubu gönderdiğini hatırlattı
Cem Volkan'a Pınar'ın raporu bitirdiğini duyurdu
Uğur Kerem'e İnci'nin raporu yolladığını duyurdu
Cemal Demet'in İhsan'a kitabı gördüğünü söyledi
Alper Büşra'nın Cihan'a kitabı verdiğini söyledi
Mehmet Gülden'in Tarık'a oyuncağı kırdığını anlattı
Fatih Sevgi'nin Engin'e oyuncağı götürdüğünü anlattı
Selçuk Eda'nın Melih'e soruyu değiştirdiğini bildirdi
Gökhan Seda'nın Hatice'ye soruyu açıkladığını bildirdi
Özgür Funda'nın Ayhan'a mektubu kaybettiğini hatırlattı
Mert Ezgi'nin Aylin'e mektubu gönderdiğini hatırlattı
Serkan Fatma'nın Çiğdem'e raporu bitirdiğini duyurdu
Faruk Esra'nın Derya'ya raporu yolladığını duyurdu

ÖZGEÇMİŞ

Kişisel Bilgiler

Adı Soyadı : Taylan Akal

Doğum Yeri ve Tarihi : Samsun – 27.11.1981

Eğitim Durumu

Lisans Öğrenimi : Hacettepe Üniversitesi, İngiliz Dilbilimi Bölümü

Yüksek Lisans Öğrenimi : Hacettepe Üniversitesi, İngiliz Dilbilimi Anabilim Dalı

Bildiği Yabancı Diller : İngilizce, Almanca

Bilimsel Faaliyetleri :

Akal, T. (2010) The matter of homonymy and salience in terms of attention phenomenon in Turkish: A cognitive linguistic approach, *Journal of Faculty of Letters*, 27, (2), 1 – 22.

Akal, T. (2013) Türkçe karmaşık tümce yapısında ne-sözcüklerinin incelenmesi, *Türkbilig*, 25, 103 – 118.

Visiting Scholar at the University of Florida between August 2011, and January, 2012 with the award granted by Tübitak (2214 – Doktora Öğrencileri için Yurtdışı Araştırma Bursu).

İş Deneyimi

Stajlar :

Projeler :

Çalıştğı Kurumlar : Hacettepe Üniversitesi, İngiliz Dilbilimi Bölümü

İletişim

E-Posta Adresi : takal@hacettepe.edu.tr, takal@ufl.edu

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