A universal parser or language specific parsing strategies: A study on relative clause attachment preference in Turkish[1]

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APA: Başer, Z. (2019). A universal parser or language specific parsing strategies: A study on relative clause attachment preference in Turkish. *RumeliDE Dil ve Edebiyat Araştırmaları Dergisi*, (Ö6), 1-21. DOI: 10.29000/rumelide.648403

Abstract

This study investigated syntactic priming of relative clause (RC) attachment preferences in monolingual Turkish speakers through a series of experiments. Cross-linguistic variations in RC attachment preferences have implied that parsing strategies may not be guided by universal principles but language-specific parameters. Thus, several models put forth their assumptions about the universality of the parser and the underlying mechanisms working in the initial analysis, and the sources of information used in sentence processing. However, there is not one single model, the predictions of which could account for all the contradictory findings obtained in a myriad of studies using different materials and tasks in different languages. In order to investigate RC attachment preferences further in detail, we conducted two offline (pen-and-paper) tasks and an online (self-paced reading) task. The results showed that monolingual Turkish speakers had no clear attachment preferences on condition that several confounding factors were controlled. More precisely, RC attachment preferences varied depending on the semantic factors (e.g. semantic associations of the host NP with the proximal and the distal predicate), task requirements (e.g. implicit or directed), and techniques (e.g. offline or online) employed in the studies. Nonetheless, the effect of syntactic priming showed that monolingual Turkish speakers distinguished the tree hierarchical configuration of the alternative attachment interpretations. Furthermore, the results suggested that a tendency towards NP1 attachment preference might be attributed to processing difficulty, as a strategy to minimize cognitive demand, arising from conditions such as structural complexity (active vs. passive), task requirements, and research design (offline vs. online, or directed attention vs. implicit processing).

Keywords: Relative clause attachment, Turkish, sentence processing, syntactic priming.

Evrensel bir çözümleyici ya da dile özgü çözümleme stratejileri: Türkçe'de ilgi tümcelerini isim tamlamalarında tamlayan ya da tamlanan ile bağlama tercihleri

Öz

Bu çalışmada bir dizi deney ile tek dilli Türkçe konuşanların ilgi tümcesi bağlama tercihlerinde sözdizimsel hazırlama etkisi incelenmiştir. İlgi tümcesi bağlama tercihlerinin diller arasında farklılık göstermesi, çözümleme stratejilerinin evrensel ilkelere değil dile özgü değiştirgenlere bağlı olabileceği fikrini ortaya çıkarmıştır. Bu nedenle, birçok model çözümleyicinin evrenselliği, ilk analizde işleyen altta yatan mekanizma, ve cümle işlemlemede kullanılan bilgi kaynaklarıyla ilgili

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1 This paper was derived from a doctoral dissertation entitled "Syntactic Priming of Relative Clause Attachment in Monolingual Turkish Speakers and Turkish Learners of English".

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varsayımlarını ileri sürmüştür. Ancak, farklı materyaller ve yöntemler kullanılarak farklı dillerde yapılan bir çok çalışmada elde edilen bir biriyle çelişen bulguları açıklayacak tek bir model henüz mevcut değil. İlgi tümcesi bağlama tercihlerini detaylı bir şekilde incelemek için, bu çalışmada iki çevrimdışı (kağıt-kalem) ve bir çevrimiçi (kendi hızında okuma) yöntemi kullandık. Sonuçlar bir dizi etken kontrol edildiğinde tek dilli Türkçe konuşan bireylerin belirli bir bağlama tercihi göstermediğini ortaya koymuştur. Başka bir deyişle, ilgi tümcesi bağlama tercihlerinin anlamsal etkenlere (örn. tamlayan ve tamlanan isimlerin yakın ve uzak yüklem ile anlamsal ilişkisi), çalışma şartları (örn. örtülü işlemleme veya yönlendirilmiş değerlendirme), ve kullanılan tekniklere (örn. çevrimdışı veya çevrimiçi) bağlı olarak değişiklik göstermektedir. Yine de, sözdizimsel hazırlama etkisi, tek dilli Türkçe konuşan bireylerin alternatif bağlama yorumlarının ağaç yapısını (aşamalı oluşumunu) ayrıştırdığını göstermektedir. Ayrıca, sonuçlar NP1 (tamlayan) ile bağlama tercihi eğilimi göstermenin yapısal karmaşıklık (etken ve edilgen) ve çalışma deseni (çevrimiçi ve çevrimdışı, ya da dikkatin yönlendirilmesi veya örtük işlemle) gibi koşullardan doğan bilişsel talebi azaltma stratejisi olarak işlemleme zorluğu ile ilişkilendirilebileceğini önermektedir.

Anahtar kelimeler: İlgi tümcesi bağlama, Türkçe, cümle işlemleme, sözdizimsel hazırlama.

1. Introduction

This study aims to explore the effect of syntactic priming on relative clause (RC) attachment in monolingual Turkish speakers. The literature shows that RC attachment shows crosslinguistic variation. Some languages such as English (Cuetos & Mitchell, 1988), and Swedish (Ehrlich et al., 1999) show NP2 attachment preference whereas languages such as Spanish (Cuetos & Mitchell, 1988), and German (Hemforth et al., 1998) show NP1 attachment preference. Scholars have proposed several theories in order to explain these cross-linguistic variations in RC attachment. For many years, the dominant view has been late closure (Frazier & Fodor, 1978). Accordingly, parsing strategies are universal and RCs would be attached to the closest NP, which is NP2. However, this does not explain cross-linguistic variations. Several other hypothesis were put forth to explain these variations. These are the Tuning hypothesis (Mitchell et al., 1995), Recency and predicate proximity (Gibson et al., 1996), construal theory (Frazier and Clifton, 1996) and implicit prosody (Fodor, 1998). Nevertheless, there seems to be no single model which can account for explaining the cross-linguistic variations in RC attachment. Even though all these ideas have some basis, they have been strongly criticized due to the lack of enough evidence or some contradictory findings. Therefore, the present paper aims to reveal the influential factors affecting RC attachment in monolingual Turkish speakers and to reveal underlying mechanisms of ambiguity resolution in RC attachment. More precisely, the present paper focuses on revealing the effects of syntactic factors (i.e. active / passive RC condition), task requirements (directed attention / implicit processing) and research design (offline / online). For this purpose, syntactic priming phenomenon was used. Syntactic priming provides an understanding of how different structures are distinguished and processed by speakers of various languages, and to reveal the elements of language where different parsing strategies are followed (Branigan et al., 1995). In this regard, a series of experiments (offline and online) was conducted with monolingual Turkish speakers. The following sections first gives more details about the relevant literature on RC attachment ambiguity, RC attachment in Turkish, and syntactic priming of RC attachment.

1.1. Relative clause attachment ambiguity

Many researchers have been interested in the processing of syntactic ambiguities such as relative clause (RC) attachment as in (1).

(1) Someone shot [NP1 the servant] of [NP2 the actress] [RC who was on the balcony].

The sentence in (1) is ambiguous since it is not clear which noun phrase (NP) (i.e. the servant or the actress) the RC (who was on the balcony) modifies. Furthermore, the resolution of this ambiguity shows cross-linguistic variation and thus gathers attention in sentence processing research. For instance, monolingual English speakers show NP2 attachment preference (Cuetos & Mitchell, 1988; Carreiras & Clifton, 1999) whilst monolingual Spanish speakers have a tendency towards NP1 attachment preference (Cuetos & Mitchell, 1988; Carreiras & Clifton, 1999; Carreiras, Salillas, & Barber, 2004).

This cross-linguistic variation was first reported in Cuetos and Mitchell's seminal study (1988). Since then, a number of studies have been conducted to test attachment preferences in different languages. The findings revealed that languages fall into either NP1 (e.g. Spanish) or NP2 (e.g. English) attachment category. The languages that fall into NP2 attachment category include English (Cuetos & Mitchell, 1988; Carreiras & Clifton, 1999), Norwegian, Swedish, and Romanian (Ehrlich et al., 1999), Italian (DeVincenzi & Job, 1993), Portuguese (Maia et al., 2007), and Arabic (Abdelghany & Fodor, 1999 as cited in Abdelghany, 2010).

The languages that fall into NP1 attachment category, on the other hand, included Dutch (Brysbaert & Mitchell, 1996), German (Hemfort et al., 1998), Afrikaans (Mitchell et al., 2000, as cited in Fernández, 2003), Spanish (Cuetos & Mitchell, 1988; Carreiras & Clifton, 1999; Carreiras, Salillas, & Barber, 2004), French (Zagar et al., 1997), Russian (Sekerina, 1997), Polish (Nowak, 2000 as cited in Sekerina et al., 2004), Croatian (Lovrić, 2003), Bulgarian (Sekerina et al., 2004), Japanese (Kamide & Mitchell, 1997; Miyao & Omaki, 2006), Korean (Lee & Kweon, 2004), Persian (Arabmofrad & Marefat, 2008), Thai (Siriwittayakorn et al., 2014), and Greek (Papadopoulou & Clahsen, 2003).

All in all, the languages, neither in NP1 nor in NP2 attachment category, apparently have salient common properties which set these two categories apart from one another (Ehrlich et al., 1999). Besides, as Fernández (2003) noted, language-specific preferences in RC attachment are not actually very distinctive. Manipulations in the experimental materials, either in the complex genitive NP (Gilboy et al., 1995) or in RCs (Fernández, 2000; Hemforth et al., 2015), as well as in the task type and the complexity of the material (Kamide & Mitchell, 1997; Sekerina et al., 2004) might result in variations in RC attachment preferences in different languages. Individual differences such as working memory capacity might also contribute to variations in the RC attachment preference (Mendelson & Pearlmutter, 1999; Başer, 2018). Furthermore, the relevant literature has suggested that only a combination of multiple processes (e.g. syntactic, semantic, anaphoric etc.) will account for the cross-linguistic variations considering the fact that RC attachment preferences cannot be explained by a purely syntax-based mechanism (Hemfort et al., 1998). Nevertheless, it is essential to provide a better understanding of what these language-specific differences are, how they play a role in ambiguity resolution, and what the situation is with monolingual Turkish speakers.

1.2. Turkish sentence structure and complex genitive NPs modified by RCs

Turkish is a subject-object-verb (SOV) language - though it is relatively flexible in terms of word order. Additionally, it is an agglutinative language with rich derivational and inflectional morphology (Dinçtopal-Deniz, 2010). Turkish grammar requires the head of phrase to be placed in phrase-final position. In this regard, the Turkish equivalent of the construction given in the sentence (1) above will be as follows:

(2) Birisi [RC balkon-da duran] [NP2 aktris-in] [NP1 hizmetçi-si-ni] vurdu.

someone balcony-LOC stand-PART actress-GEN servant-3SG.POSS-ACC shoot-PAST

'someone shot the servant of the actress who was standing on the balcony'

In Turkish, complex genitive NPs are realized as genitive possessive constructions. They are marked with genitive (-in) and possessive suffixes (-i) on the first and the second NP respectively. However, Turkish does not allow two vowels to come together. Therefore, a combining letter is used before the suffix if a word ends with a vowel. Thus, (-n) is used before the genitive (-in), for instance, 'elma-nın', and similarly (-s) is used before the possessive suffix (-i) if a word ends with a vowel as in 'hizmetçi-si' above. The last suffix in 'hizmetçi-si-ni' is the accusative marker (-i) with (-n) used since the word ends with a vowel. In Turkish, relative clauses are pre-nominal. In other words, RC precedes the noun it relativizes. There is not an overt wh- element in Turkish, and RCs in Turkish consist of a non-finite verb with a nominal participle. Furthermore, the participial suffix -An in RC serves as the relativizing element in subject RCs in Turkish (Göksel & Kerslake, 2011).

In Turkish, the verbs of the RCs are formed with a participle suffix; namely -DIK and (y)An, both of which encode non-future tense. -(y)AcAK is used in RCs for the future tense, yet the focus here will be merely on the difference between -DIK, used for the relativization of a non-subject (an object) and -(y)An, used for the relativization of a subject. In the former, the object RC case , the subject of the participle needs to take a genitive mark (-ın) and the participle takes a possessive suffix (-ı), thereby forming a genitive-possessive compound. In the latter, the subject RC case, the relativization is carried out by the participle -(y)An with no extra morphology. Given the complexity of the object RCs with -DIK in Turkish (Göksel & Kerslake, 2005; Aydın, 2007), the experimental sentences included RCs only with the participle -(y)An as in the previous studies on RC attachment not only in Turkish but also in other languages, as well (e.g. Scheepers, 2003; Kırkıcı, 2004; Dinçtopal-Deniz, 2007, 2010).

In order to find out whether Turkish speakers have an attachment preference and which category Turkish falls into, there have been some attempts. Kırkıcı (2004) investigated ambiguity resolution in RC attachment with an offline study. For this purpose, he used sentences where RCs were followed by NP hosts with a genitive possessive construction as in (3a) or a postposition as in (3b).

(3) a. Şoför, şehir merkezinde oturan profesörün sekreterini gördü.

'the driver saw the secretary of the professor who lives in the city centre'

b.Şoför, şehir merkezinde oturan profesörün yanındaki sekreteri gördü.

'the driver saw the secretary next to the professor who lives in the city centre'

He found that Turkish speakers did not show a clear attachment preference if the experimental sentences consisted of ambiguous RCs with two animate NPs whilst they had a tendency towards NP2 attachment if the sentences had two inanimate NPs as potential attachment hosts. Furthermore, Turkish speakers preferred to attach the ambiguous RC to NP2 if two potential animate NP hosts were joined with a postposition as in (3b) above.

As Kırkıcı (2004) asserted, his findings might confirm the assumptions of the Construal Hypothesis. Accordingly, the presence of a theta-assigning pre-postposition might lead to NP2 attachment preference due to the thematic processing domain created by the postposition *yanında*. Considering the effect of animacy/inanimacy condition in the host NPs on RC attachment preference, the results supported the idea that the ambiguity resolution is influenced by the lexical-semantic information. However, there is no hypothesis which explains why Turkish speakers did not have a clear attachment preference in the animate condition whilst they had an NP2 attachment preference in the inanimate condition.

Afterwards, Dinçtopal-Deniz (2010) looked into ambiguity resolution in RC attachment with groups of monolingual Turkish speakers, Turkish speakers of English, and English speakers. She administered both offline and online tasks. The sets of stimuli consisted of temporarily and globally ambiguous sentences. More precisely, the sentences were disambiguated by using animacy / inanimacy information in the host NPs. She found that monolingual Turkish speakers and English native speakers favoured NP2 attachment with animate and inanimate antecedents both in online and offline tasks. However, Turkish learners of English showed different results. In the online task, they had an NP1 attachment tendency with animate NPs, yet NP2 with inanimate NPs. In the offline task, they displayed an NP1 attachment preference both with animate and inanimate antecedents. Table 1 below illustrates the results of the previous studies on RC attachment preference with Turkish speakers.

Table 1. Previous studies on RC attachment preference with Turkish speakers

	offline		**online**	
	animate	inanimate	animate	inanimate
Monolingual Turkish speakers (Kırkıcı, 2004)	No clear preference	NP2	-	-
Monolingual Turkish speakers (Dinçtopal-Deniz, 2010)	NP2	NP2	NP2	NP2
Turkish speakers of English (Dinçtopal-Deniz, 2010)	NP1	NP1	NP1	NP2

With regard to the different pattern observed with Turkish learners of English, Dinçtopal-Deniz suggested that RC attachment in Turkish learners of English might not be guided by syntactic information but the lexical-semantic information. However, it is not clear why they favoured NP1 attachment although both monolingual Turkish speakers and English native speakers displayed a tendency towards NP2 attachment as it can be seen in Table 1. Furthermore, although the set of stimuli might be structurally accepted as ambiguous given the fact that the syntax of the temporarily and globally ambiguous sentences allow both interpretations, ambiguous sentences were semantically biased for monolingual Turkish speakers (Başer, 2018). Thus, further research with a set of balanced

experimental sentences, void of confounding factors, is essential in order to provide a better understanding of RC attachment in Turkish.

1.3. Syntactic Priming of Relative Clause Attachment

Few though they are, there have been studies investigating syntactic priming of RC attachment. The seminal study was administered by Scheepers (2003). He conducted three experiments which required sentence completion in German. In Experiment 1 and 2, the prime sentences disambiguated towards NP1 or NP2 attachment were followed by ambiguous target sentences. In Experiment 3, the prime sentences were structurally incongruent with the target sentences. The primes consisted of anaphoric adverbial clauses whilst the target sentences were similar to those in Experiment 1 and 2. Syntactic priming was observed with the first two experiments, Experiment 1 and 2. However, Experiment 3 did not exhibit a significant priming effect, thereby suggesting that syntactic priming in RC attachment is dependent on syntactic overlap between prime and target sentences.

Cross-linguistic priming of RC attachments has been also studied. Desmet and Declerq (2006) conducted three experiments with Dutch L1-English L2 speakers. The first experiment was the Dutch replication of Scheepers (2003). The researchers translated the items in German into Dutch, used the same methodology and design in order to investigate the syntactic priming effect. Similarly, Desmet and Declerq also used gender agreement in order to force RC attachment in the prime. The only difference was that they did not use a comma before RCs because unlike German, the comma is not mandatory in Dutch. The results of the first experiment replicated Scheepers (2003). Desmet and Declerq also found that there was a significant priming effect in the presence of a syntactic overlap between the prime and target sentence. In the second experiment, the researchers sought to understand whether syntactic information is shared between two languages or represented separately. For this purpose, the same prime sentences in Dutch were used, but the target sentences were translated into English. The results showed that the syntactic information related to the hierarchical tree configuration is shared between languages. More precisely, the researchers reported that participants who just completed an NP1 attachment forced prime in Dutch were more likely to attach RC to NP1 in the English target sentence, as well than they do so after completing an NP2 attachment forced prime in Dutch. The third experiment was defined as a control experiment. Desmet and Declerq replaced the prime sentences in the second experiment with adverbial clauses, and expected not to find any significant syntactic priming effect if the effect they observed in the second experiment was truly a consequence of the syntactic overlap between the prime in Dutch and the target in English. The results of the third experiment were consistent with Scheepers (2003). The researchers did not find any priming effect in the absence of syntactic overlap between the prime and target sentence.

The studies by Scheepers (2003) and Desmet and Declerq (2006) investigated syntactic priming in production. Gertken (2013) examined whether there was any significant syntactic priming of RC attachment in comprehension in French as a first and a second language. He conducted a self-paced reading study. The prime sentences including RCs were disambiguated using number agreement . On the other hand, the target sentences were ambiguous. In addition to disambiguated prime and ambiguous target sentences containing RCs, he also included sentences preserving anaphoric binding and focus structure of RC sentences but differed in structures following the previous two studies.

The prime sentence including an adverbial phrase is identical to the prime sentences including an RC, apart from the fact that the relativizer "*qui*" (who-which) followed by an disambiguating verbal

information is replaced by the parce que (because) followed by a pronoun (celui-là; the former, celui-ci; the latter) to distinguish the association of the pronoun to NP1 or NP2. Gertken stated that the anaphoric binding is identical in both prime sentence types considering the fact that both contain pronouns referring to NP1 or NP2. Furthermore, focus structure is identical considering the fact that both sentences focalize NP1 or NP2 through the clauses elaborating on either one of the NPs. The results provided evidence for the priming of RC attachment in comprehension, which had been previously found in production (e.g. Scheepers, 2003; Desmet & Declerq, 2006). Similarly, there was no priming effect in French L1 speakers when the prime and target sentences differed in syntactic structure but shared discourse information such as focus structure and anaphoric binding, thereby suggesting that priming occurs at the level of abstract hierarchical configuration. However, Gertken observed priming effect in French L2 learners even when the sentences differed in syntactic structure but shared discourse information. Therefore, Gertken suggested that priming in L2 might be linked to discourse information, as well, and that non-syntactic representation persisted between the prime and target sentences.

In brief, the previous research has shown that the priming effect depends on syntactic overlap between the prime and the target sentence, especially in L1 processing, thereby suggesting that the priming occurs at the level of abstract hierarchical configuration. Furthermore, the previous studies on syntactic priming of RC attachment all used disambiguated sentences (i.e. NP1 or NP2 attachment forced sentences) as primes, and ambiguous sentences (where both NPs are potential attachment sites) as targets. It is important to note here that this methodology ignores some assumptions, such as those of serial processing which assumes that readers would rely on merely syntactic information available during their initial processing and that they would show bias to only one interpretation(Papadopoulou, 2006). This bias could be either a universal attachment preference or a particular attachment preference observed in the language. Given that there is not enough evidence for a universal attachment preference or that cross-linguistic variations in RC attachment preferences have not been explained yet, ambiguous sentences where RC attachment is not constrained can be used as target sentences to identify the effect of prime condition on attachment preference. The present study follows the same design in the investigation of syntactic priming of RC attachment in monolingual Turkish speakers.

2. Materials and Methods

In order to investigate the syntactic priming of RC attachment in monolingual Turkish speakers, experimental design (Kirk, 2009) was followed. Three experiments were conducted The first two experiments were offline (pen-and-paper) tasks. Experiment 1 required directed analysis of prime attachment site whereas Experiment 2 required implicit processing. On the other hand, Experiment 3 was an online (self-paced reading) task. The details of the experiments are presented below.

2.1. Experiment 1 (Offline Task / Directed Analysis of Prime Attachment Site)

The purpose of Experiment 1 was to investigate the effect of syntactic priming in comprehension with monolingual Turkish speakers. As in Scheepers (2003), the correctness of prime completion (i.e. whether the prime was interpreted by experimental manipulation or not) was evaluated. The research questions are as follows:

1. How does syntactic priming affect ambiguity resolution in RC attachment when directed assessment of prime attachment site is required?

2. How does syntactic priming change depending on syntactic constructions (active or passive) in RC? Does the presence of an active or a passive construction change the effect on RC attachment preference?

Below are the details of the experimental design.

2.1.1. Participants

In total, 30 monolingual Turkish speakers (19 female, 11 male) participated in Experiment 1. They were first year undergraduate students at beginner English level. The mean age of the participants was 19. The participants were chosen based on simple random sampling method (Saldanha & O'Brien, 2013). The participants were unaware of the purpose of the study, and took part in the study on a voluntary basis, filling out an informed consent form.

2.1.2. Materials

The set of stimulus was previously developed by Başer (2018). In order to obtain the stimulus set, a study had been conducted with monolingual Turkish speakers. First of all, the confounding effect of animacy / inanimacy information, which had been observed in the previous studies (Kırkıcı, 2004; Dinçtopal-Deniz, 2007, 2010; Başer, 2018) was avoided, and only animate NPs were used in the experimental sentences. Furthermore, a comparison of active/passive RC condition was aimed. Therefore, a list of sentences containing these structures were prepared and tested. The list of sentences to be tested included 42 sentences, 21 in the active RC condition and 21 in the passive RC condition. The prime sentences were temporarily ambiguous; in other words, they were semantically disambiguated towards NP1 or NP2 attachment. In total, 24 prime sentences were written. For the target sentences, globally ambiguous sentences, - sentences in which both host NPs were equally likely to be attached to RC- were written. In total, 18 sentences were written for this category. The other confounding factors revealed in the previous studies such as word repetition / lexical boost effect (Pickering & Branigan, 1998; Reitter, Keller, & Moore, 2011), the number of words and the length of sentences (Bahadır, 2012), semantic associations of NPs with the proximal and the distal predicate, and semantic relations between the host NPs (Başer, 2018) were also controlled. The sentences were followed by questions with two options (a) and (b), probing which NPs should be attached RC. The participants included 30 monolinguals. A descriptive analysis of the data obtained was conducted. Accordingly, 12 sentences which received the highest score overall were selected as the prime, and 12 sentences, the percentages of the responses to which did not differ from the chance level, 50% (thereby satisfying the criterion of a balanced attachment preference) were selected as target sentences. Thus, the set included 24 filler and 24 experimental sentences (12 prime and 12 target). The prime sentences were NP1 or NP2 attachment forced. Only animate NPs were used so as to avoid the risk of confounding role of animacy reported in the previous studies (Kırkıcı, 2004; Başer, 2018). The prime sentences were semantically disambiguated, yet target sentences were globally ambiguous (see Appendix). The set consisted of an equal number of sentences including active and passive RCs for a balanced comparison. Furthermore, the pairs of prime and target sentences shared the same construction in RCs so as to avoid the risk of any possible influence of varying structures between pairs. As a last note, the filler sentences of various structures were used to divert the attention of the participants from the structure under investigation.

2.1.3. Procedure

Experiment 1 was an offline, pen and paper study. Participants were instructed to read sentences in the given order and complete each simple sentence using only one word after reading each full sentence. Every experimental and filler sentence was followed by a simple hand-written sentence completion. They were given a booklet, the initial pages of which started with a consent form, demographic information form, and CEFR self-assessment grid for reporting their language background. Subsequently, a brief instruction page provided participants with an example. Later, the set of stimulus was presented. The design of the booklet allowed 6 sentences (one pair of fillers and two pairs of experimental sentences or vice versa) on each page in order to make sure that the order of the sentences was unpredictable as much as possible. The experiment took approximately 15 minutes.

2.2. Experiment 2 (Offline Task / Implicit Processing of Prime Attachment Site)

The purpose of Experiment 2 was to investigate whether there was still any syntactic priming effect in monolingual Turkish speakers when they were not asked to evaluate the prime attachment site or the effect of syntactic priming in Experiment 1 was only a consequence of participants' directed assessment of the prime attachment site. In this regard, the research questions are as follows:

1. How does syntactic priming affect ambiguity resolution in RC attachment when implicit processing of prime attachment site is required?

2. How does syntactic priming change depending on syntactic constructions (active or passive) in RC? Does the presence of an active or a passive construction change the effect on RC attachment preference?

Below are the details of the experimental design.

2.2.1. Participants

In total, 33 monolingual Turkish speakers (20 female, 13 male) participated in Experiment 2. They were first year undergraduate students at beginner English level. The mean age of the participants was 19. The participants were chosen based on simple random sampling method (Saldanha & O'brien, 2013). They were unaware of the purpose of the study, and took part in the study on a voluntary basis, filling out an informed consent form.. None of them took part in the previous study.

2.2.2. Materials

The same set of sentences in Experiment 1 was used. However, unlike the previous experiment, the participants were not asked to evaluate the prime attachment site in Experiment 2 in order to test whether the effect of syntactic priming in Experiment 1 was only because of directed analysis and conscious awareness of the forced attachment in the prime or a similar effect would be observed even if the participants implicitly processed the prime sentence and later evaluated the attachment site in the target sentence.

In accordance with that, there was a reduction for the simple sentence completion requirements following fillers. Previously, the participants were supposed to complete simple sentences after each one of the fillers in order not to distort the flow of the task and not to reveal the purpose of the study. Given that they would not evaluate the attachment site in the prime, but only the attachment site in the target,

half of the fillers were not followed by a simple sentence completion question any more. For the pairs of prime and target sentences, the sentence completion questions were always related to the target sentence. However, for the fillers, the distribution of these questions was randomized in such a way that half of the fillers were related to the first whilst the other half was related to the second filler sentence in the pairs of fillers preceding or following the pairs of prime and target sentences. This design was followed in order to make sure that the participants read each sentence in order and the flow of sentences was unpredictable for them as much as possible.

2.2.3. Procedure

Experiment 2 was also an offline, pen and paper study. Participants were instructed to read sentences in the given order and complete each simple sentence using only one word after reading each full sentence. Unlike the procedure in Experiment 1, only the target sentences and half of the filler sentences were followed by a simple hand-written sentence completion. The participants were not asked to evaluate the prime attachment site. The participants were given a booklet, the initial pages of which started with a consent form, demographic information form, and CEFR self-assessment grid for reporting their language background. Subsequently, a brief instruction page provided participants with an example. Later, the set of stimulus was presented. The experiment took approximately 15 minutes.

2.3. Experiment 3 (Online Self-Paced Reading Task)

This is an online (computerized self-paced reading task). The research questions are as follows:

1. How does syntactic priming affect ambiguity resolution in RC attachment when implicit processing of prime attachment site is required in an online (self-paced reading) task?

2. How does syntactic priming change depending on syntactic constructions (active or passive) in RC while reading online? Does the presence of an active or a passive construction change the effect on RC attachment preference in an online task?

Below are the details about the participants, materials, and procedure of the experiment.

2.3.1. Participants

In total, 21 monolingual Turkish speakers took part in Experiment 3. Participants were first year undergraduate students at beginner English level. The mean age of the participants was 19. They had normal or corrected-to-normal vision. The participants were chosen based on simple random sampling method (Saldanha & O'Brien, 2013). The participants were unaware of the purpose of the study, took part in the study on a voluntary basis, filling out an informed consent form. None of the participants took part in the previous two experiments.

2.3.2. Materials

The same set of sentences were used. In order to measure the reading time for each critical regions (i.e. attachment sites), however, the sentences were divided into four regions following Dinçtopal-Deniz (2007, 2010). The sentence (4) below displays an example of the division with slashes in an experimental sentence.

(4) [$_{RC}$ Beşikte uyuyan] / [$_{NP2}$ bebeğin] / [$_{NP1}$ annesi] / temizlik yapıyordu.

'the mother of the baby who was sleeping in the crib was cleaning'

The length of the experimental sentences and the words that appeared in the critical regions were balanced in order to control the effect of length on reading time. More precisely, there were always 6 words in each sentence and the words in the critical regions consisted of 3-5 syllables (mean=3.5 and 5-syllable word occurred only once).

2.3.3. Procedure

The participants were tested individually in a quiet room. First, they filled out a demographic information and consent form. Later the instructions were given to them and the experiment started. The participants saw 4 trial sentences for the practice session before the actual test.

The experiment was designed with OpenSesame 3.1.7. The stimuli were presented in a self-paced, phrase by phrase mode, in MS Sans Serif, in font size of 24. The moving window display technique was used to collect online measures of processing RC attachments (Juffs & Harrington, 1995). Accordingly, the sentences were divided into four regions as aforementioned. The regions appeared in the centre of the computer screen, one at a time. In order to see each region, the participants were required to press 'space bar' on the keyboard.

The targets were always immediately followed by a comprehension question probing which NP should be attached to the RC, and half of the filler sentences were followed by a question. The primes were not followed by any questions in order to avoid participants' directed assessment of the prime attachment site observed in Experiment 1. The questions had two options; A and B as shown in sentence (5) below.

(5) [$_{RC}$ Partiye katılan] / [$_{NP2}$ şarkıcının] / [$_{NP1}$ gitaristi] / otelde çalışıyordu.

Hangisi partiye katıldı?

A) şarkıcı B) gitarist

The participants responded to each question by pressing either 'A' or 'B' on the keyboard. Furthermore, the distribution of NP2 and NP1 to the options A and B were counterbalanced in order to make sure that participants would not develop any quick answering strategy.

Participants' reading times (RTs) for each region and their responses to the comprehension questions as well as the time they spent for answering these questions were recorded by the program in milliseconds.

3. Data Analysis and Results

3.1. Experiment 1 (Offline Task / Directed Analysis of Prime Attachment Site)

The data was analyzed both descriptively and statistically. The participants had also evaluated the prime attachment site, although the experimental sentences were tested by monolingual Turkish speakers before (Başer, 2018). The number of the unexpected responses were very few, however, we analysed the

data in two ways. In the first analysis, we excluded the pairs of experimental sentences from the analysis if a participant's response contradicted with the previous test result. Descriptively, there was a clear syntactic priming effect in all of the experimental conditions (i.e. active/ passive RC condition, NP1 / NP2 forced attachment). In order to find out whether there was a significant priming effect, a repeated measures ANOVA was also run. The results showed a significant interaction between the prime attachment site and the target attachment preference, F (1, 29) = 40.358, p < .001, η_p^2 =.582, and a significant interaction between the prime attachment site and active /passive RC condition, F (1, 29)= 11.013, p< .05 (p= .002), η_p^2 =.275.

In the second analysis, we included all of the experimental sentences regardless of the participants' evaluation of the prime attachment site in order to see if the results would change or not. Descriptively, similar results were obtained; there were syntactic priming in all of the experimental conditions. In order to find out whether there was a significant syntactic priming effect, a repeated measures ANOVA was run. The results showed a significant interaction between the prime attachment site and the target attachment preference, F (1, 29) = 21.887, p < .001, η_p^2 =.430. Figure (1) below illustrates the syntactic priming in Experiment 1.

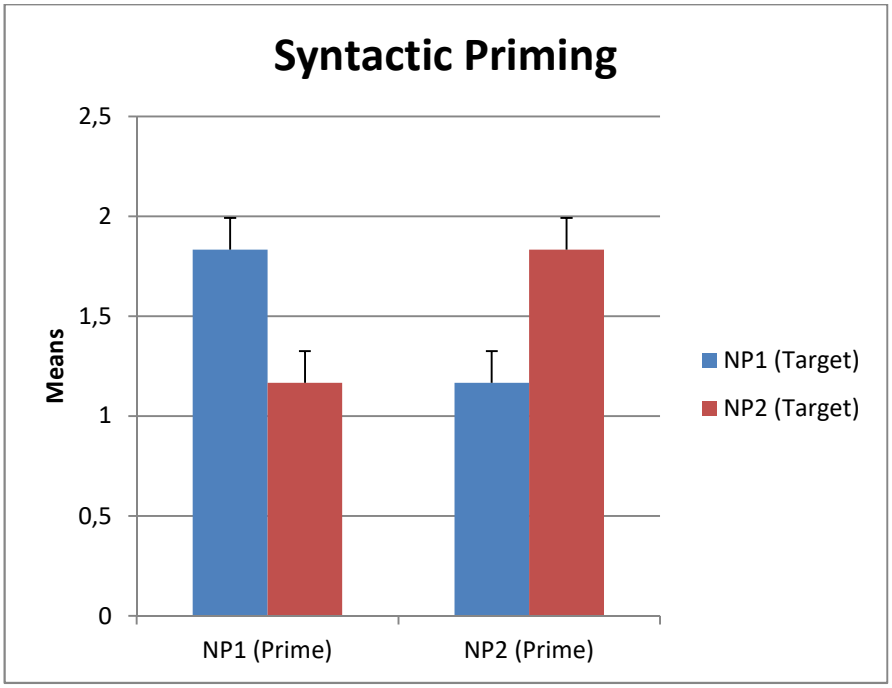

Figure 1. Syntactic priming in Experiment 1

Furthermore, there was a significant interaction between active/passive RC condition and the target attachment preference, F (1, 29) = 5.118, p < .05 (p = .031), η_p^2 =.150. More precisely, there were more NP2 preferences when there was an active RC, and more NP1 when there was a passive RC in the experimental sentence.

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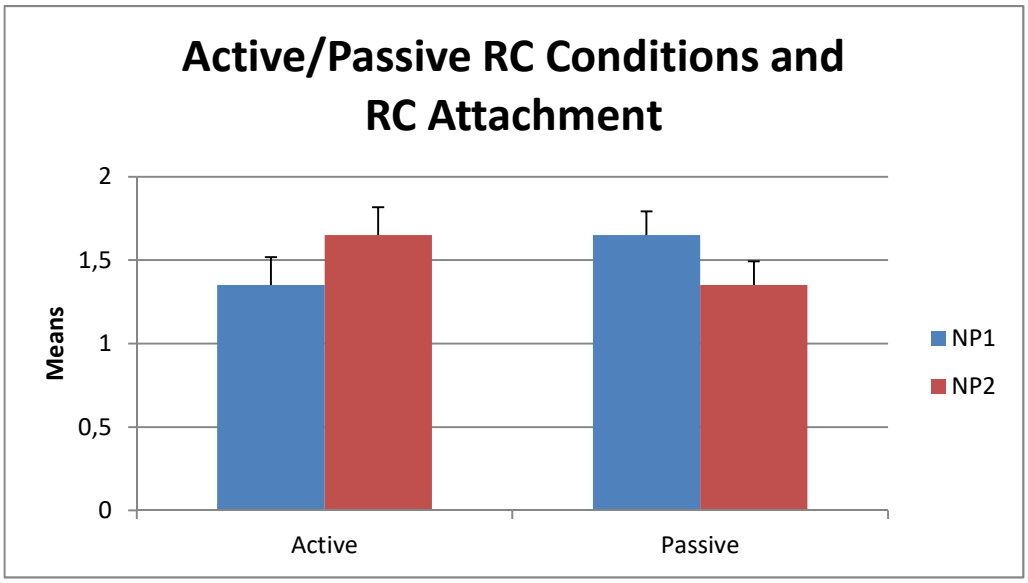

Figure 2. Interaction between active / passive RC condition and RC attachment

Figure 2 above shows the interaction in the second analysis. In the first analysis, this interaction between active/passive RC condition and RC attachment preference in the target was not significant, yet substantial, F (1, 29)= 4.005, p = .055, η_p^2=.121.

3.2. Experiment 2 (Offline Task / Implicit Processing of Prime Attachment Site)

The data was analysed both descriptively and statistically. In the descriptive analysis, there was a syntactic priming effect in the active RC condition with more NP1 attachment preferences in the target sentences after having read NP1 prime, and likewise more NP2 after NP2 prime. However, in the passive RC condition, there seemed to be a reversed priming effect with more NP1 preferences after NP2 prime, and more NP2 after NP1 prime.

In order to find out whether there was a significant syntactic priming effect, a repeated measures ANOVA was run. The results showed that there was no significant interaction between the prime attachment site and the target attachment preference, F (1, 32) = .051, p > .05 (p = .823), η_p^2 =.002. However, there was a significant interaction between the prime attachment site, the target attachment preference, and the active/passive RC condition, F (1, 32) = 7.184, p < .05 (p = .012), η_p^2 =.183. Accordingly, there were more NP1 preferences after NP1 prime and likewise more NP2 after NP2 prime in the active RC condition, yet there were more NP2 after NP1 prime and slightly more NP1 after NP2 prime in the passive RC condition, which confirmed the results obtained with the descriptive analysis.

3.3. Experiment 3 (Online Self-Paced Reading Task)

The data collected was analysed under three subheadings; analysis of the priming effect, analysis of RTs in the critical regions of the target sentences; analysis of RTs in the critical regions of the prime sentences. Each is presented in detail below.

3.3.1. Analysis of the priming effect

The data was analysed both descriptively and statistically. In the passive RC condition, descriptively, there seemed to be a priming effect with more NP1 after NP1 and likewise more NP2 after NP2, however, the results were not consistent in the active RC condition, which showed more NP2 attachment preferences not only after NP2 but also after NP1 prime.

In order to reveal whether there was a significant priming effect, a repeated measures ANOVA was run, the two-way and three-way interactions between conditions (i.e. prime attachment site, target attachment preference, and active/passive RC condition) were examined. The results did not show a significant priming effect. Additionally, there was no significant main effect of target attachment preference, thereby suggesting that there was not a significant attachment preference towards NP1 or NP2 in the online study. On the other hand, there was a significant three-way interaction among the prime attachment site, the active/passive RC condition, and the target attachment preference, F (1, 20) = 8.869, $p < .05$ ($p = .007$), η_p^2=.307. More precisely, as descriptively seen above, there were more NP1 preferences after NP1 and more NP2 after NP2 in the passive RC condition, yet there were slightly more NP2 after NP2 and also more NP2 after NP1 in the active RC condition.

3.3.2. Analysis of RTs in the critical regions of the target sentences

The critical regions were the second (e.g. [$_{NP2}$ şarkıcı-nın]) and the third (e.g. [$_{NP1}$ gitarist-i]) regions -the NPs of the complex genitive possessive construction following an RC construction (e.g. [$_{RC}$ partiye katılan]) in Turkish- considering the fact that these were the host NPs to which RC would be attached, and where ambiguity is resolved.

The purpose of this experiment was to see whether the recency of reading an NP1 or NP2 attachment forced sentence facilitated ambiguity resolution in RC attachment. Thus, participants were expected to show similar patterns in their attachment preference to the condition presented to them in the prime sentence. In other words, having read an NP1 attachment forced prime sentence, for instance, they were expected to show a tendency towards an NP1 attachment preference in the target sentence, which would be observed in their RTs. In order to see whether there was a significant difference between RTs, a repeated measures ANOVA was run. The results did not show a significant difference, which provides a consistent result with the previous analysis. Given that there was no syntactic priming effect in this experiment, the fact that there was no clear facilitation in reading for either NP1 or NP2 attachment preference in the ambiguous targets is an anticipated result.

3.3.3. Analysis of RTs in the critical regions of the prime sentences

In order to see whether monolingual Turkish speakers would show a tendency towards NP1 or NP2 attachment in online reading, the participants' RTs in the critical regions of the prime sentences were also evaluated. Accordingly, the assumption was that if monolingual Turkish speakers had an initial attachment preference in online reading, this would be observed in their RTs such that, for instance, they would spend more time when a syntactically unexpected attachment occurred. The critical regions were the second and the third regions. A repeated measures ANOVA was run. The analysis showed that there was no significant effect of the prime attachment site (whether it was forced to NP1 or NP2 attachment) and no significant interaction between the prime attachment site and the critical regions.

4. Discussion

In the present study, syntactic priming of RC attachment preference was investigated with monolingual Turkish speakers. In total, three experiments were conducted. The first two experiments were offline, pen-and-paper tasks. In Experiment 1, the participants were required to evaluate the prime attachment site, as well, unlike the design in Experiment 2. Therefore, the first experiment required a directed assessment of the prime attachment site whilst the second required implicit processing. In Experiment 1, there was a syntactic priming effect. Furthermore, there was a significant interaction between active / passive RC condition, attachment preference in the target sentence. Accordingly, monolingual Turkish speakers preferred significantly more NP2 in the active RC condition and more NP1 in the passive RC condition.

The Late Closure Hypothesis (Frazier & Fodor, 1978) might explain significantly more NP2 attachment preferences given the fact that the hypothesis will assume that there is a universal parsing strategy and there will be a tendency to stick to the closest NP in order to avoid cognitive demand. However, the hypothesis cannot explain the reason why there was a strong tendency towards NP1 attachment in the passive RC condition.

One explanation might be that monolingual Turkish speakers might tend to pause at the subject-verb boundary before attaching RC to either one of the host NPs if they encounter a syntactically complex structure, which will allow time for them to consider the distant NP, NP1, as a possible attachment site (Ferreira, 1991; Fodor, 1998; Townsend & Bever, 2001). This assumption seems to be more coherent with the Implicit Prosody Hypothesis (Fodor, 1998). Additionally, as opposed to the assumptions of Recency and Predicate Proximity Principle posited by Gibson et al. (1996), the strength of the main predicate might be determined by the complexity of structure embedded in a sentence rather than the distance of the head NP to the main predicate - which has not been clarified yet.

In Experiment 2, as opposed to the results of Experiment 1, there was no significant syntactic priming effect. The results showed only a significant three-way interaction between the prime attachment site, the active/passive RC condition, and the target attachment preference. In other words, the effect of syntactic priming depended on the active/passive RC condition when implicit processing of the prime attachment site was required. More precisely, an effect of regular syntactic priming was observed in the active RC condition whilst there was a reversed priming in the passive RC condition, which means there were more NP1 after NP2 prime and more NP2 preferences after NP1 prime. In the relevant literature, similar results have not been reported. This might be explained with the idea that monolingual Turkish speakers might be using different parsing strategies in ambiguity resolution of RC attachment in the passive RC condition as compared to the active. Additionally, the participants were not explicitly directed towards NP1 or NP2 attachment while reading the prime as in Experiment 1, which might have inhibited the response initially triggered by reading an attachment forced prime, thus facilitated the selection of an alternative response.

In the previous studies, Dinçtopal-Deniz (2007, 2010) reported that monolingual Turkish speakers had higher RTs and longer pause at critical regions while reading an NP1 attachment forced sentence online (but not while reading an NP2 attachment forced or an ambiguous sentence), thereby suggesting an initial attachment preference for NP2 attachment. In contrast, the present online study did not show a significant difference in RTs, thus confirmed the results of the previous offline tests indicating that

monolingual Turkish speakers would not have a tendency towards NP1 or NP2 attachment when confounding factors (e.g. semantic associations and syntactic factors) were controlled (Başer, 2018).

Experiment 3 did not show a significant priming effect (no significant interaction between the prime attachment site and the target attachment preference) as opposed to Experiment 1. However, there was a significant three-way interaction. Accordingly, the effect of syntactic priming was observed in the passive RC condition with more NP1 after NP1 prime and more NP2 preferences after NP2 prime. On the other hand, there was an NP2 attachment preference in the active RC condition regardless of the prime attachment site. Furthermore, the analysis of the critical regions in terms of RTs did not reveal a significant difference .

In brief, monolingual Turkish speakers had significant priming in the passive RC condition whilst they had a slight tendency towards NP2 attachment in the active RC condition. This could be explained with the fact that syntactic priming occurs more often with marked syntactic forms (Hartsuiker & Westenberg, 2000; Pickering & Ferreira, 2008).

5. Conclusion

This study aimed to investigate syntactic priming of RC attachment in monolingual Turkish speakers. The relevant literature has shown that there are cross-linguistic variations in RC attachment, which implies that parsing strategies may not be guided by universal principles but language-specific parameters. Several models of sentence processing have been put forth so as to explain these variations across languages. However, the models differed in their assumptions about the universality of the parser and the underlying mechanisms working in the initial analysis, and the sources of information used in sentence processing. There is no single model, the predictions of which could account for all the contradictory findings obtained in a myriad of studies using different materials and tasks in different languages. Thus, in order to provide further understanding, syntactic priming of RC attachment in Turkish was investigated. For this purpose, two offline and an online (self-paced reading) experiment was conducted with three different groups of participants.

Experiment 1 and 2 were offline (pen-and-paper) studies. They revealed the effect of active and passive RC conditions and the importance of task requirements in syntactic priming of RC attachment. More precisely, Experiment 1 required the participants' directed assessment of the prime attachment site whilst Experiment 2 required implicit processing. The results showed that the directed assessment might strengthen syntactic priming of RC attachment. Furthermore, Experiment 2 showed that syntactic priming might depend on active/passive RC condition. Accordingly, monolingual Turkish speakers had regular syntactic priming effect in the active RC condition whilst they had a reversed priming in the passive RC condition, which could be explained with implicit processing and masked priming effect leading to inhibition of initial attachment preference in the complex structure. Experiment 3 was an online self-paced reading study. As opposed to the offline studies, Experiment 3 showed that syntactic priming was more powerful in the passive RC condition and that the presentation mode (i.e. full sentence or phrase-by-phrase) influenced syntactic priming.

Acknowledgement

We wish to acknowledge TÜBİTAK (The Scientific and Technological Research Council of Turkey) for the doctoral scholarship granted to the first author.

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Appendix

PRIME SENTENCES				
No.	**NP2**		**No.**	**NP1**
	Active Sentences			Active Sentences
P1	Beşikte uyuyan bebeğin annesi temizlik yapıyordu.		**P1**	Muhabire saldıran başkanın yardımcısı gözaltına alındı.
	The mother of the baby who was sleeping in the crib was doing the cleaning.			*The assistant of the President who attacked the reporter was taken into the custody.*
P2	Fenerbahçe'de oynayan futbolcunun dedesi hastaneye kaldırıldı.		**P2**	Mesleği öğrenen aşçının yamağı lokanta kiraladı.
	The grandfather of the footballer who played for Fenerbahçe was taken to the hospital.			*The helper of the chef who learnt the job rented a diner.*
P3	Metni çeviren tercümanın müşterisi bürodan ayrıldı.		**P3**	Mutfağı düzenleyen ressamın hizmetçisi para buldu.
	The client of the interpreter who translated the text left the bureau.			*The servant of the painter who tidied the kitchen found some money.*
	Passive Sentences			Passive Sentences
P1	Kasabada aranan katilin teyzesi ihbarda bulundu.		**P1**	Okula kaydedilen müdürün yeğeni bahçede oynuyordu.
	The aunt of the murderer who was wanted in the village reported him.			*The nephew of the principal who was enrolled in the school was playing in the garden.*
P2	Galeride bıçaklanan adamın avukatı davayı kazandı.		**P2**	Sürekli azarlanan kasabın çırağı istifa etti.
	The lawyer of the man who was stabbed in the gallery won the case.			*The apprentice of the butcher who was always reprimanded resigned.*
P3	Kalabalıktan kurtarılan mankenin koruması oldukça kuvvetliydi.		**P3**	Sezaryene alınan dekanın karısı odada dinleniyordu.
	The bodyguard of the model who was saved from the crowd was very strong.			*The wife of the dean who was taken to cesarean was resting in the room.*

TARGET SENTENCES				
No.	**Active Sentences**		**No.**	**Passive Sentences**
T1	Uzaydan dönen astronotun ikizi dikkatle incelendi.		**T1**	Telefonda dolandırılan oyuncunun ablası ifade verdi.
	The twin of the astronaut who returned from the space was meticulously examined.			*The sister of the actress who was defrauded on the phone testified.*
T2	Soruları cevaplayan bakanın danışmanı sigara içiyordu.		**T2**	Ameliyata çağrılan doktorun asistanı yemek yiyordu.
	The consultant of the minister who answered the questions was smoking.			*The assistant of the doctor who was called for the surgery was eating a meal.*
T3	Partiye katılan şarkıcının gitaristi otelde çalışıyordu.		**T3**	Dün ödüllendirilen gazetecinin kameramanı yurtdışına gitti.
	The guitarist of the singer who attended the party was working at a hotel.			*The cameraman of the journalist who was rewarded yesterday went abroad.*
T4	Saatlerdir konuşan kadının arkadaşı kafenin sahibiydi.		**T4**	Törende alkışlanan valinin misafiri kibarca gülümsedi.
	The friend of the woman who talked for hours was the owner of the cafe.			*The guest of the governor who was applauded at the ceremony gently smiled.*
T5	Teklifi reddeden marangozun nişanlısı parkta oturuyordu.		**T5**	Fena yumruklanan yayıncının çalışanı polis çağırdı.
	The fiancée of the carpenter who declined the offer was sitting at the park.			*The employee of the publisher who was badly punched called the police.*
T6	Stüdyoya varan sunucunun kuaförü malzemeleri hazırlıyordu.		**T6**	Karakola getirilen hırsızın babası sorguya alındı.
	The hairdresser of the presenter who arrived at the studio was preparing the equipment.			*The father of the thief who was brought to the station was interrogated.*