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Processing of Subject and Object Case Markers in Turkish

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ABSTRACT

There is no consensus in terms of processing subject-object case markers (Bornkessel, et al., 2004; Schlesewsky & Frisch, 2005; Mueller, et al., 2005; Chow, et al., 2018). The purpose of this study is to determine how [±DEF] objects affect the processing cost and to reveal whether there is a processing difference in subject-object case markers. In the first analysis, it is observed that [+DEF] objects are processed easier than [-DEF] objects. Possible reasons are different definiteness and specificity of [±DEF] objects and [-DEF] objects creating pseudo incorporation with the verb, which causes additional processing cost. In the second analysis, it is observed that subject case creates more processing cost than object case. It is thought that the subject case assignment taking place in TP and object case in VP, linear distance between the subject and the verb, and involvement of extra features in subject case assignment may cause this difference.

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The authors accept the responsibility of this article and all the terms of the journal.

Statement of Publication Ethics

This study was conducted in accordance with publication ethical principles. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (İstanbul University Social and Humanities Research Ethics Committee) and with the Helsinki Declaration of 1975, as revised in 2000. The committee approval was received on 19/06/2020- issue: 68637. Before the data was collected, informed consent was obtained from all patients for being included in the study.

Authors' Contribution Rate

The authors equally contributed for the article.

Conflict of Interest

There is no conflict of interest in this study.

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Introduction

Although interpreting language is a process that takes place very quickly and effortlessly, this process is actually very complex. For this reason, different methods are used to explain the processing of the language, especially in recent years.

It is noteworthy that agreement and case assignment processes are among the topics studied extensively on the processing of syntactic structures in the literature. Agreement, with its most general definition, is expressed as the matching of morphological signs that reflect the relationship of the word in a sentence with other arguments in that sentence (Baker, 2013). The co-variance feature of agreement provides the opportunity to establish relationships between non-adjacent elements (Carreiras, Salillas, & Barber, 2015); in other words, it allows the matching of person, number, gender (φ-features) and case features among structures that are not in a contiguous relationship in the syntax. There are many studies in the literature that examine the matching relationship of features such as person, number or gender between the verb and the argument structure (Kutas & Hillyard, 1983; Carreiras, Quiñones, Mancini, Hernández-Cabrera, & Barber, 2004; Frenck-Mestre, Osterhout, McLaughlin, & Foucart, 2008). Moreover, it is also possible to mention studies that examine the processing of differences created by the agreement of φ-features between the subject and the verb (Hagoort, 2003; Pereyra, Klarman, Lin, & Kuhl, 2005; Nevins, Dillon, Malhotra, & Phillips, 2007; Frenck-Mestre et al., 2008; Zawiszewski & Friederici, 2009; Molinaro, Barber, & Carreiras, 2011; Aygüneş, 2013; Mancini, Molinaro, & Carreiras, 2013).

Another feature that agreement is frequently mentioned together is the case markers. Case markers are defined as the determination of the grammatical functions of an argument such as subject and object in a sentence (Spencer & Zwicky, 1998) and case assignment process is referred to as a highly interactive field that can affect all syntactic, morphological and semantic processes (Frisch & Schlesewsky, 2005). Especially, in the languages where free word order is possible, the word order does not provide a valid clue about the syntactic function of the arguments of the sentence, it is also necessary to analyse the case markers correctly to determine this function (Díaz, Sebastián-Gallés, Erdocia, Mueller, & Laka, 2011).

Considering the issue in Turkish framework, it is known that Turkish has a rich case marker repertoire, a predefined subject-object-verb canonical word order, but it is a language with free word order. As can be seen in the examples below, the subjects in Turkish are nominative case marked in the main clause (see 1 a / b / c) and genitive case marked in the subordinate clause (see 1d) (Kornfilt, 2003; Aygen, 2007; Bakırlı & Ercan, 2010). In addition, it is seen that the subjects in Turkish can be marked with accusative case in subordinate clauses through Exceptional Case Marking (as in 1e) (Aygen, 2002, 2004, 2006; Kornfilt, 2003):

(1a) Ali-Ø kitap aldı.

Ali-NOM book-NOM buy-PST.

‘‘Ali bought a book.’’

(1b) Ali-Ø kitab-ı aldı.

Ali-NOM book-ACC buy-PST.

‘‘Ali bought the book.’’

(1c) Ben-Ø [Ali-Ø okul-a gitti] sandım.

I-NOM [Ali- NOM school- DAT go- PST] think- PST.

‘‘I thought that Ali went to the school.’’

(1d) Ben-Ø [Ali-nin kitab-ı aldığını] biliyorum.

I-NOM [Ali- GEN book- ACC buy- PST- 3SG- GEN] know- PST.

‘‘I know that Ali bought the book.’’

(1e) Ben-Ø [Ali-yi okul-a gitti] sandım.

I-NOM [Ali- ACC school- DAT go- PST] think- PST.

‘‘I thought that Ali went to the school.’’

There is also a claim that the tense-aspect-modality features (Aygen, 2004) are determinative in the assignment of case markers as opposed to the view that agreement is determinative in the authorization of the subject's case (Kornfilt, 2003).

While nominative case feature of the subject is determined by the agreement between the head of Tense Phrase (TP) and the subject Determiner Phrase (DP), it is stated that the case features of the object is assigned by the verb. In other words, the relation between the head and its complement is established within the Verb Phrase (VP), so it is seen that the object case varies depending on the verb (see 2a / b):

(2a) Ben-Ø okul-a gidiyorum

I-NOM school- DAT go- PRE.

‘‘I am going to the school.’’

(2b) Ben-Ø okul-u seviyorum.

I-NOM school- ACC like- PRE.

‘‘I like the school.’’

In Turkish, it is seen that the subject case is determined with nominative or genitive case markers while the object case is determined according to the [+DEF] and [-DEF] object features. In Turkish, which is one of the languages in which Differential Object Marking (DOM) is seen, object case is affected by the semantic and pragmatic knowledge provided by the verb (Bossong, 1983; Comrie, 1981; Aissen, 2003). In DOM languages, Bussong (1983) mentions two kinds of semantic properties on differentiating an object: Animacy, which is independent from the context, and definiteness, which varies according to syntagmatic and pragmatic environments. While [HUM]> [+ANI]> [-ANI] scale is mentioned in term of animacy, personal pronoun>proper name>[+DEF] NP>[-DEF] NP>>[-SPEC] NP scale is emphasized for definiteness. At this point, it is suggested that prominence plays an active role in case marking, which suggests that objects in high prominence are case marked. Moreover, Aissen (2003) suggests that DOM is related to the phenomenon of object shift. According to this idea, [+DEF] objects can shift in general, but shifting an [+DEF] object is possible only when it can be interpreted as specific. Therefore, the [+DEF] and [-DEF] structures take an active role in determining referential object

features. Furthermore, it is suggested that [+DEF] structures cause less processing cost than [-DEF] structures (Aissen, 2003). This situation reveals that specificity should be mentioned in determining the [+DEF] and [-DEF] structures in the object position (Enç, 1991; Klein & Swart, 2011). For this reason, it is stated that if the object has the feature of specificity, it should be marked with accusative case, whereas the overt state marking is not observed in [-SPEC] and [-REF] objects (Enç, 1991; Erguvanlı Taylan & Zimmer, 1994; Heusinger & Kornfilt, 2005). When we look at the examples (3a) and (3c) below, the object in (3a) is [-DEF] but [+SPEC], therefore, the object is marked with accusative case, but in (3c), the object is [-DEF] and does not have specificity, so accusative case is not assigned (see 3a / 3c). When we look at the (3b) and (3d) examples, the object in (3b) is accusative case marked and it is known by the speaker which man is being mentioned. However, in the (3d) example, it is unlikely to know which ticket is mentioned or for what the ticket is (see 3b / d):

(3a) Ali-Ø bir kitab-ı al-dı. ([-DEF], [+SPEC])
Ali a book-ACC buy-PAST
‘‘A book is such that Ali bought it.’’

(3b) Zeynep-Ø adam-ı gör-dü. ([+DEF], [+SPEC])
Zeynep man-ACC See-PAST
‘‘Zeynep saw the man.’’

(3c) Ali-Ø bir kitap-Ø al-dı. ([-DEF], [-SPEC])
Ali a book buy-PAST
‘‘Ali bought some book or other.’’

(3d) Bilet-Ø sat-ıyor-lar. ([-REF])
ticket Sell-PRES-(3.PL)
‘‘They are selling ticket.’’ (Papadopoulou ve diğ, 2011)

Emeksiz (2003) argues that specificity stems from the fact that the verb provides real and unreal events in the [+DEF] and [-DEF] object situations and that the verb also has specificity, in other words, the specificity stems from the presumptive referents provided by the verb. In terms of definiteness, there is no need for presuppositions because it is affected by the grammatical features. She also opposes the approach where object specificity is determined by accusative case marking and argues that referential hints in [-DEF] situations give object specificity in real contexts.

As a result, determination of subject and object case markers are syntactically different processes. Agreement (Kornfilt, 1997; Kornfilt, 2003; Heusinger & Kornfilt, 2005) or tense-aspect-modality features (Aygen, 2004) are considered effective in determining the subject case marker in Turkish. On the other hand, it is seen that the verb is determinative for the case features of the objects. At this point, Differential Object Marking (DOM) plays an important role in determining referential object features because DOM allows to distinguish object in terms of animacy and definiteness. Moreover, definiteness brings specificity feature which plays a role in [+DEF] case assignment. By this way, it is suggested that differentiation of subject and overtly case-marked object might be easier.

As can be seen, case assignment is an important process in terms of evaluation of the sentence. In this study, it is aimed to explain the meaning of case processing and therefore, in literature review part, detailed information is given about the case processing and the factors affecting this process.

Literature review

In the literature, there are many studies examining the effect of case markers on syntactic and semantic processes (Cho, et al., 2002; Schlesewsky & Frisch, 2005; Mueller, Hahne, Fujii, & Friederici, 2005; Yang & Bergen, 2007; Mueller, Girgsdies, & Friederici, 2008; Zawiszewski & Friedericia, 2009; Chow, Nevins, & Carreiras, 2018).

Processing of subject and object case markers

In the studies on subject and object processing, it is seen that the Event-Related Brain Potentials (ERP) method is mostly used. Therefore, brief information should be given about ERP components before mentioning the studies in the literature. First, ERP is a method based on measuring the electrical activity produced by the brain against certain stimuli. In the ERP literature, it is suggested that components such as N400, P600, LAN are related to language processing. In this case, the N400 component is defined as a component that peaks in negative polarity 400 ms after stimulus presentation, and the increase in this component is associated with lexical-semantic matching difficulty (Kutas and Hillyard, 1980a, 1980b) and morphological and syntactic processing (Bornkessel, McElree, Schlesewsky, & Friederici, 2004). The P600 component is a component that peaks in positive polarity 600 ms after stimulus presentation and is associated with syntactic processing (Friederici & Mecklinger, 1996; Hagoort et al., 1993; Hagoort, Wassenaar, & Brown, 2003). The LAN component is a component that peaks at 250-500 ms post-stimulus interval and associated with the mismatches between subject and verb (Burkhardt, Fanselow & Schlesewsky, 2007; Coulson, King & Kutas 1998b; De Vincenzi et. al., 2003; Hagoort & Brown 2000; Roehm et. al., 2005) and verbal working memory (Kluender & Kutas, 1993; Münte et. al., 1998).

Schlesewsky and Frisch (2005) examine the process of subject and object case markers in German using the ERP method. In the first experiment of this study, there are non-grammatical structures in which both subject and object are used identically as nominative and dative case marked, and in the second experiment, non-grammatical structures in which both subject and object are used identically as nominative and accusative case marked. As a result of the study, it is stated that the N400 pattern, which reflects lexical-semantic processes, and the P600 pattern that occurs in syntactic disorders are observed in NOM- NOM and DAT- DAT sentence structures. It was also pointed out that if ungrammatical case marking is used in the subject and object position, the processing is negatively affected in both positions, however, it does not make a significant difference in terms of processing the case markers on the subject and the object.

Mueller et al. (2005), on the other hand, analyses the language processing of native speakers and second language learners in Japanese, where they include grammatical structures as well as non-grammatical structures in which the subject and the object are marked with nominative and accusative case. While the P600 pattern is observed in the

second language learners participating in the study, both the N400 and the P600 biphasic pattern are observed in native speakers. This finding reveals that there is a difference in the processing of case markers between native speakers and second language learners. Second language learners notice syntactic violations just like native speakers, but they do not show similar results when compared to native speakers in terms of processing of the semantic violations. For this reason, Mueller et al. (2008) examine the processing of case markers regardless of the meaning (semantics) in terms of the second language acquisition process with a following study. As a result of this study, the participants display the P600-N400 biphasic pattern like native speakers. When the two studies are compared, it is suggested that not using the semantic input facilitates language processing of second language learners like native speakers. This result reveals that case marker violations used in subjects and objects are noticed independently from semantic features. In addition, the effect of positional differences of case markers is not mentioned in both studies. This shows that case markers used in ungrammatical structures are affected by the verb and are effective in determining the positional values of the verb.

Aygüneş, Aydın, & Demiralp (2014) examine the relationship between the agreement and case markers in the embedded clauses in Turkish with the ERP, in which there are violations in the case marker (* *Benim ağladım sanıyordu* 'S/he thought I cried.') and the agreement marker on the verb (* *Ben ağladın sanıyordu* 'S/he thought I cried.'). In this study, findings are contrary to the arguments made in Diaz et al. (2011). They observed differences in the processing of the case markers and agreement in both matrix verb and the embedded verb. While N400 is seen in the processing of case morphology in the embedded verb, no such effect is seen in the processing of agreement. In the matrix verb, which provides more reliable information in the comparison of the two features, the right-lateralized N400 is seen in the processing of case morphology, while the left-lateralized N400 is seen in the processing of the agreement. In the study, activation of different neural sources in the processing of agreement and case markers in Turkish weakens the view that φ-features authorize the subject case, as standardly assumed in the literature (Kornfilt, 1984; Brendeomon & Csato, 1986, and others), and favours Aygen's (2002, 2007, 2011) view of case synchronism and φ-synchronism being independent from each other.

Bornkessel, McElree, Schlesewsky, & Friederici, (2004) focus on the case violations in subject-object positions in their study, in which they examine state properties in German structures with ERP study. In this study, structures in which the phrase structure begins with nominative or accusative case marked words, N400 response was observed in the structures where dative case marked words are used in the sentence initial position instead of nominative case marked words and it has been determined that the processing takes longer. As a result, it is claimed that the difference observed between nominative and the dative case markers is due to the expectation of using the subject in nominative case in German.

In the ERP study on Basque, an ergative language which allows both subject-verb and object-verb agreement, multiple verb agreement and case system are examined to determine whether the subject-verb agreement differs between transitive and intransitive clauses (Chow, et al., 2018). In the study, subject-verb agreement violations are compared in transitive (there is object-action agreement, subject is ergative) and intransitive (no object-

verb agreement, subject is absolutive) (Santesteban, Pickering, & Branigan, 2013) sentences. As a result of the study, it is found that the P600 pattern is observed in both ergative and absolutive case marked subjects while it has been found that the participants have difficulty because of early posterior negativity in the structures using absolutive case marked subject, and that different neurocognitive mechanisms are effective in the processing of the subject with ergative and absolutive case markers (Chow et al., 2018). It is claimed that the difference of the findings obtained in this study from Bornkessel, et al. (2004) may be due to the difference between languages. While the subject is nominative case marked in German, the subject in Basque is used in ergative case, which is not used in German. Although the studies show different results, it is seen that the position of the verb is effective in the processing of the case markers in both studies.

As reviewing the studies on the processing of subject and object case features, it is observed that different findings are obtained. Contrary to the studies that argue for a difference in the processing of subject and object case markers (Bornkessel, et al., 2004; Chow, et al., 2018), there are also studies suggesting that there is no difference (Schlesewsky & Frisch, 2005; Mueller, et al., 2005; Mueller, et al., 2008). In studies that argue that there is a difference in the processing of subject and object case markers, it is emphasized that case markers are syntactically effective in determining the subject and object position and semantically influencing the processing of the sentence. In studies that argue that there is no difference in the processing of subject and object case markers, it is argued that case markers are included in the processing without observing subject-object distinction.

Processing [+DEF] and [-DEF] objects

One of the issues discussed in the processing of object case markers is how this will affect the processing if the object is [+DEF] and [-DEF].

In Chinese, one of the languages which allows DOM (Bussong, 1983; Aissen, 2003), Yang & Bergen 2007 examined how scrambled case markers are determined. According to Aissen, case markers determine the importance degree of the objects used in terms of specificity and animacy. As a result of the study, the use of case markers in scrambled objects showing animacy and human characteristics in Chinese is obligatory while case markers in inanimate objects are optional. On the other hand, different results are obtained in the examinations made in terms of definiteness. It has been stated that case markers are mandatory in [-DEF] and [- SPEC] scrambled objects, and that case markers can optionally be omitted from the sentence in the [+DEF] and [+SPEC] scrambled objects. It is argued that this difference is since the case-marked words used in the pre-verbal position in Chinese are specified and they are [-DEF] in the postverbal position. They argue that the words used in the preverbal position show definiteness regardless of their grammatical task, and the fact reveals the effect of syntactic processes (Yang & Bergen, 2007).

In another study examining the processing of [+DEF] and [-DEF] object case markers in Spanish in terms of native speakers and second language learners, similar results a Mandarin Chinese (Jegerski, 2015). In Spanish, overt case marker *–a* suffix is used to distinguish the [+DEF] object from the subject. Also, the clitics la / lo ([+DEF] object) and le ([-DEF] object) are used to mark the object position in Spanish. As a result of this study,

it is determined that unlike native speakers, second language learners adhere to the clitics used in the preverbal position to distinguish the [± DEF] object. In addition, the participants are not sensitive to the *–a* case marking of the [+DEF] object when the lo / la clitics are not used in the processing. For this reason, it has been suggested that case marking in the second language does not depend on structural and categorical deficiencies during syntactic processing, and case marking does not have an effect on the distinction between [+DEF] and [-DEF] object. Similar results were obtained in another study on Quiteño, a Spanish dialect (Suñer & Yépez, 1988). The Quiteño dialect allows the position of the object to remain empty without the need to use any clitic. It is claimed in the study that there is no distinction between the [+DEF] and the [-DEF] object, and even when clitics are used in the sentence, no difference is observed in the meaning of the sentence. In short, the [± DEF] object distinction is not seen as an important linguistic variable in terms of processing.

Contrary to these studies which argue that there is no difference between the processing of [+DEF] and [-DEF] objects, it is possible to mention a study arguing that there is a difference in the processing of [+DEF] and [-DEF] objects. In a study conducted on the distinction between the [+DEF] and [-DEF] object in Korean, it is observed that second language learners of Korean prefer the [+DEF] object more than [-DEF] object (Cho, et al., 2002). This situation shows that similar to the Accessibility Hierarchy Hypothesis (Keenan & Comrie, 1979a), [+DEF] structures are more accessible than [-DEF] ones.

When we look at the studies focusing on the case of being [+DEF] and [-DEF] of the object location, it is emphasized that there is no difference between the two cases (Yang & Bergen, 2007; Jegerski, 2015; Suñer & Yépez, 1988). It is also possible to mention a study that defends the opposite of these studies (Cho, et al., 2002). For this reason, it is not possible to talk about a consensus in the studies on the [+DEF] and the [-DEF] object case. Based on these studies, it can be claimed that the characteristics of the case markers play an important role in the syntactic and semantic processing.

The aim of this study is to examine the processing of subject and object case markers in Turkish. Aim of this study is to analyse the subject-verb agreement and the effect of the information provided by the verb on the object processing and on the determination of the [+DEF] and [-DEF] object case markers.

Research hypothesis

Hypothesis 1: It is predicted that native speakers will process the object case [+DEF] structures faster than [-DEF] structures. As demonstrated by the Accessibility Hierarchy Hypothesis, [+DEF] structures are assumed to be more accessible than [-DEF] ones (Keenan & Comrie, 1979a). In addition, the fact that it is possible to talk about DOM supports this prediction (Comrie, 1981; Enç, 1991). Moreover, it is emphasized that the relation the object establishes with the verb rather than the case markers is effective in the interpretation of the [-DEF] objects. In other words, it is stated that the locations in which [-DEF] objects can be found in the sentence are limited because they are unmarked objects and the transportation of these structures is essentially carried as pied-piping the entire remnant VP (İşsever & Gracanin-Yüksek, 2011). It is assumed that this limitation of the [-DEF] structures will increase the processing cost.

Hypothesis 2: It is predicted that native speakers will process the object case markers faster than the subject case markers. Object- verb relationship is a more local than the subject-verb relationship. Except for structural cases, case markers are lexically assigned by the verb. It is stated that while the structural cases are mapped by certain functional heads in the derivation, the lexically assigned cases are assigned to its object by verb at the moment of the first Merger, thus occurring at a shorter distance. (Woolford, 2006). This distinction between structural and non-structural cases prolongs the processing, as the distance between processing creates a cost on working memory while processing subject-verb agreement (Zawiszewski & Friedericia, 2009; Haskell & MacDonald, 2005; Franck, Lassi, Frauenfelder, & Rizzi, 2006).

Methodology

Context

This study was carried out in Hatay where the first author lived and in Istanbul where the second author lived.

Participants

There are 23 participants (10 females, 13 males) whose native language is Turkish in the study. A statistical power analysis is performed for sample size estimation using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007). This study's effect size is 0.797, considered very close to the large using Cohen's (1988) criteria. With an alpha = .05, power (1-β) = 0.80, the projected sample size needed is 23 (N = 23) for this simplest within-group comparison. Thus, our proposed sample size of 23 is adequate for this study's main objective and allowed for expected attrition and our additional objectives of controlling for possible subgroup analysis. All participants are university students or university graduate. Participants are at least high school level and have no neurological or psychological disorders. All participants are right-handed and have normal or corrected vision. Before starting the study, all participants signed the informed consent form.

Materials

As the experimental conditions, there are two grammatical conditions in which the object has [+DEF] and the [-DEF], as well as two conditions in which there are violations in the object and the subject case (Table 1).

All sentences in the experimental set have SUBJECT-ADVERB OF TIME-OBJECT- VERB word order. Subjects in sentences are formed from occupational names. Past tense -DI suffix is used in verbs and all verbs are conjugated by the third person singular. As object case violation, dative case marker is used where there should normally be a [± DEF] case marker. For the subject case, instead of the correct nominative case marker, genitive case is used as a violation of the subject case. Moreover, fillers are used to both equalize the number between grammatical and non-grammatical conditions and to equalize the distribution between structures in the experiment. Grammatical fillers consist of the sentences which include nominative subject and dative object case marking (Aktör-Ø geçen ay filme çalıştı.

‘‘Actor-NOM worked on the movie-DAT last month’’) and genitive subject and accusative object case marking (Aktörün geçen ay filmi çekildi. ‘‘the movie-ACC of the actor-GEN was filmed last month’’). Non-grammatical fillers consist of the sentences which include nominative subject and the object case marking (*Aktör-Ø geçen ay film-Ø çalıştı. ‘’actor-NOM worked on a movie-NOM last month’’) and nominative subject and accusative object case marking (*Aktör-Ø geçen ay filmi çekildi. ‘‘The actor- NOM movie-ACC was shot last month.’’). The purpose of using these fillers is to prevent participants from gaining an advantage in the analysis of the sentence in favour of a condition and to make it possible to decide on the grammaticality of the sentence only by seeing the verb. Fillers are not included in the analysis process.

In the study, a repair test is conducted with 26 participants to determine whether the conditions about object case violation and subject case violation includes a mismatch in the relevant categories. As a result of the analysis, it is seen that there is a significant difference between the conditions, X^2 (25) = 13080,908, p <.001. In the object case violation, it is observed that 94.5% of the participants change the case feature of the object position, 2.9% of the participants change the verb at a rate of 2.2% and the remaining participants use the other forms of repair. Therefore, in the object case violation condition, it is seen that a reinterpretation is made in the object case by the participant. In subject case violation, it is seen that 73.6% of the participants repair the sentence by changing the subject's case feature and 12.7% of the participants change both the case feature of the subject and the action while the remaining participants apply other forms of repair or interpret the sentence grammatically. Therefore, in the subject case violation condition, it is seen that the participants associate the relevant mismatch significantly with the subject case.

Table 1. Examples of Sentences in the Experiment

Conditions	Example sentences	N
Grammatical 1	Aktör-Ø geçen ay film-Ø seyretti. Actor-NOM last month a movie-NOM watched. ‘‘Actor watched a movie last month.’’	30
Grammatical 2	Aktör-Ø geçen ay filmi seyretti. Actor-NOM last month the movie-ACC watched. ‘‘Actor watched the movie last month.’’	30
Object case violation	*Aktör-Ø geçen ay filme seyretti. * Actor-NOM last month to movie-DAT watched. ‘‘Actor watched to movie last month.’’	30
Subject case violation	*Aktörün geçen ay filmi seyretti. * Actor-GEN last month the movie-ACC watched. ‘‘Actor’s watched the movie last month.’’	30

Data collection procedures

Before starting the study, an application is made to the Istanbul University Social Sciences Ethics Committee and all procedures followed were in accordance with the ethical

standards of the responsible committee on human experimentation (İstanbul University Social and Humanities Research Ethics Committee) and with the Helsinki Declaration of 1975, as revised in 2000 (The committee approval is received on 19/06/2020- issue: 68637). As a result of the examination, it is unanimously decided that there is no ethical problem in the study. Moreover, informed consent was obtained from all patients for being included in the study.

The Self -Paced Reading task is used in the study. In the Self -Paced Reading task, the participants are asked to silently read the sentences presented as words on the computer screen as soon as possible, and then they are asked to evaluate the grammaticality of the sentences with the end each sentence. How long the words stay on the screen is under the control of the participant and they must press the space bar to see each word. The experiments last 30-40 minutes for each participant, including breaks. The response times of the participants to each word, and their responses regarding the evaluation of the grammaticality of the sentence are recorded.

The research is conducted in a quiet environment. Before starting the research, an exercise consists of 15 sentences is made for the participants to have information about the research. 240 sentences including the fillers are presented to the participants in 6 sections in random order. There are 5-10-minutes breaks between each section.

Statistical analysis

Statistical analysis is made on average reading time responses for subject, object and verb areas. However, the processing difference is expected to occur in the area where the verb is presented. In the analyses, the response times of the participants to 30 stimuli presented for each condition are averaged and then we compute a repeated-measures ANOVA. In the study, two statistical analyses are performed regarding the reaction times. In the first analysis, CONDITION (2 Level: [+DEF] objects, [-DEF] objects) is included within subject factors in the repeated measures ANOVA applied to determine the effect of the object being [± DEF]. In the study, a second statistic is applied to determine whether there is a difference in the processing of object agreement and subject agreement. In this second statistic, there is CONDITION (3 Level: grammatical, object-case violations, subject-case violations) within subject factors. In addition to this statistical analysis on reaction times, ANOVA is also applied on the correct response numbers given by the participants for each of the relevant factors.

In the statistical analysis, if the degree of freedom is more than one, Greenhouse-Geisser (Greenhouse-Geisser, 1959) correction is applied. In case of significant difference in the main effect created by the conditions, pair-wise comparisons are made to determine the source of the difference. Bonferroni correction (Bonferroni, 1936) is applied to *p* values in pair-wise comparisons. SPSS 24 software is used for statistical analysis.

Results

Reaction times related to the first analysis: Object being [+DEF], [-DEF]

In the first experiment, it is aimed whether there is a processing difference in the processing of two grammatical sentences containing [+DEF] and [-DEF] objects, and within this framework, participants' reading rates of subject-object-verb in the sentence are determined and compared. In other words, this analysis examines whether there is a difference in the form of the following two sentences in terms of in terms of the object being [± DEF]:

Table 2. Examples of sentences included in the first analysis

Conditions	Example sentences	N
Grammatical 1	Aktör-Ø geçen ay film-Ø seyretti. Actor-NOM last month a movie-NOM watched. ‘‘Actor watched a movie last month.’’	30
Grammatical 2	Aktör-Ø geçen ay filmi seyretti. Actor-NOM last month the movie-ACC watched. ‘‘Actor watched the movie last month.’’	30

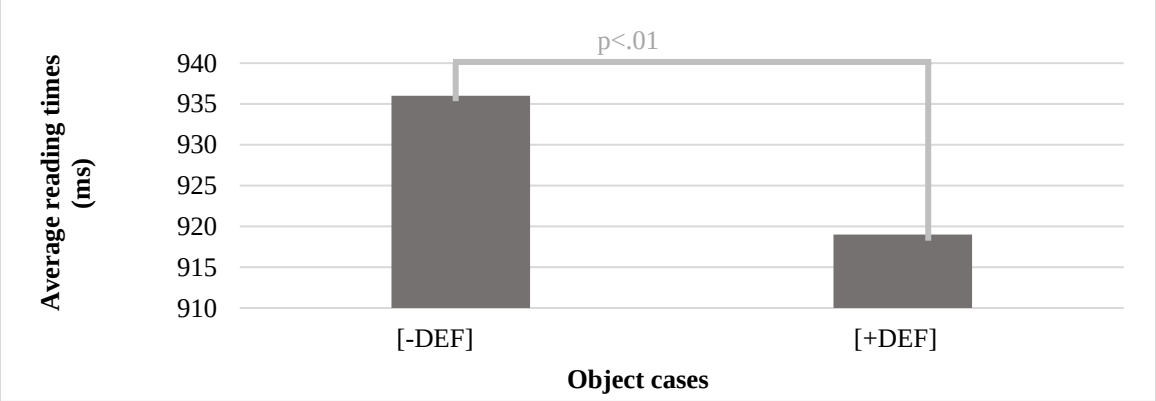
Reaction times related to subject position

When the reading times of the subjects are examined, there is no statistically significant difference in sentence forms in which the object is [+DEF] and [-DEF], $F\ (1,22) = 3.969$, $MSE = 31.788$, $p > .05$, $\eta p^2 = .153$. In other words, it is seen that the participants process the subjects of the sentences in the two conditions for a similar time and there is no significant difference between them.

Reaction times related to object position

When the reading times of the objects are examined, there is a statistically significant difference in the sentence forms in which the object is [+DEF] and [-DEF], $F\ (1,22) = 8.703$, $MSE = 6.614$, $p < .01$, $\eta p^2 = .283$. When pair-wise comparisons are considered, it is seen that reading times of [-DEF] structures are longer than [+DEF] structures. In other words, processing of [-DEF] structures create more cognitive cost (Figure 1).

Figure 1. Reaction Times About the Object



Reaction times related to the verb position

When the reading times of the verbs, which are the main critical area, are examined, there is a statistically significant difference in sentence forms in which the object is [+DEF] and [-DEF], $F\ (1,22) = 41.534$, $MSE = 75.188$, $p < .001$, $\eta p^2 = .654$. When looking at pairwise comparisons, it is seen that the reading times of [-DEF] structures are longer than the [+DEF] structures as in the object position (Figure 2).

Figure 2. Reaction Times About the Verb

Reaction times related to the number of correct answers

It appears that there is a significant difference between the two conditions in terms of the number of correct answers, $F\ (1,22) = 15.428$, $MSE = 3.113$, $p = .001$, $\eta p^2 = .412$. When looking at pair-wise comparisons, it is seen that the response is less accurate when the object is [-DEF] *(M = 26.217, Std Err = .522)* according to the condition that the object is [+DEF] *(M = 28.261, Std Err = .253).*

Reaction times related to the second analysis: Processing of case features of subject position and object position

In the second analysis, it is fundamentally questioned whether there is a difference between the processing of the subject case and the processing of the object case. In this framework, the subject, object and verb fields in the following sentence structures are analysed.

Table 3. Examples of sentences in the second analysis

Conditions	Example Sentences	N
Grammatical	Aktör-Ø geçen ay filmi seyretti. Actor-NOM last month the movie-ACC watched. ‘‘Actor watched the movie last month.’’	30
Object case violation	*Aktör-Ø geçen ay filme seyretti. Actor-NOM last month to movie-DAT watched. ‘‘Actor watched to movie last month.’’	30
Subject case violation	*Aktörün geçen ay filmi seyretti. Actor-GEN last month the movie-ACC watched . ‘‘Actor’s watched the movie last month.’’	30

Reaction times related to subject position

When the reading times of the subjects are examined, there is no statistically significant difference between the grammatical conditions, including the violations of the object case and the subject case, $F\ (1.214,26.706) = 0.651$, $MSE = 26.641$, $p > .05$, $\eta p^2 = .029$. In other words, it is seen that the participants process the subjects of the sentences in the three conditions for similar periods and genitive case on the subject does not create a processing difference.

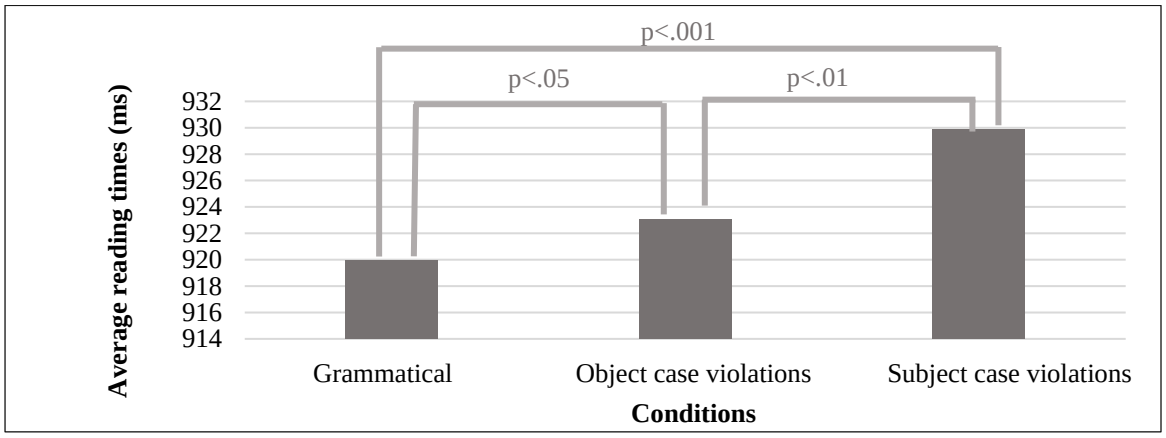
Reaction times related to object position

Considering the reading times of the object position, there is a statistically significant difference between the three conditions, $F\ (1.395,30.694) = 5.222$, $MSE = 3.358$, $p < .05$, $\eta p^2 = .192$. However, when the pair-wise comparisons are examined, it is seen that there is no significant difference between grammatical condition and object case violations $(p > .05)$, grammatical condition and subject case violations (p> .05), object case violations and subject case violations $(p > .05)$. In other words, it is seen that the participants process the objects of the sentences in the three conditions at similar times, and there is no meaningful differentiation reflected in their pair-wise comparison.

Reaction times related to verb position

Considering the reading times of the verb position, there is a statistically significant difference between the three conditions, $F\ (1.965,35.008) = 19.467$, $MSE = 38.277$, $p < .001$, $\eta p^2 = .469$. When the pair-wise comparisons are examined, it is seen that there is a significant difference between grammatical condition and object case violations $(p < .05)$, grammatical condition and subject case violations $(p < .001)$, object case violations and subject case violations $(p < .01)$. Looking at the average durations, it is seen that grammatical structures are processed the fastest, while the violation in the subject case is the structure that requires the longest time (Figure 3).

Figure 3. Reaction times regarding the verb



In summary, in the second experiment, it is observed that a pattern in the form of subject- case violations > object- case violations > grammatical structures in terms of the

length of the reading period in the verb field that constitutes the critical word of the study. In other words, it is seen that subject case violations create more cognitive cost than both object case violations and grammatical condition while object case violations create more cognitive cost than grammatical condition.

Reaction times related to the number of correct answers

It appears that there is a significant difference between the three conditions in terms of the number of correct answers, $F\ (2.44) = 6.714$, $MSE = 1.997$, $p < .01$, $\eta p^2 = .234$. Considering the pair-wise comparisons, significant differentiation occurs between object case violations *(M = 28.913, Std Err = .320)* and subject case violations *(M = 27.319, Std Err = .452) (p <.01)* and participants respond to the subject case violations condition with lower accuracy. On the other hand, it is seen that both object case violations and subject case violations do not differ *(p> .05)* from the grammatical condition *(M = 28.261, Std Err = .253)*.

Discussion

Discussion on the first analysis: The processing effect of the object being [+DEF] and [-DEF]

In the literature, there are also studies that indicate that there is no difference between the two structures (Suñer & Yépez, 1988; Yang & Bergen, 2007; Jegerski, 2015), in contrast to the study that suggests difference between the processing of [+DEF] and [-DEF] object case (Cho et al., 2002) is available. In a study on Korean (Cho, et al., 2002), participants defined [+DEF] structures as more noticeable, while in studies on Spanish (Jegerski, 2015), Chinese (Yang & Bergen, 2007), and Quiteno (Suñer & Yépez, 1988), it is suggested that definiteness can be achieved through verbal information, clitics or without any signs.

In DOM languages, it is suggested that case features give the object a quality in terms of definiteness and specificity, and the [+DEF] case marker are used to distinguish subject and object from each other (Heusinger & Kornfilt, 2005; von Heusinger & Kornfilt, 2017). Similarly, the study conducted on Korean shows that the participants prefer to use the [+DEF] object more than [-DEF] object (Cho et al., 2002). Özge, Küntay, and Snedeker (2019) in the study in which they evaluated [-DEF] object in terms of syntactic and semantic processes, it is claimed that some elements in the sentence preserve their position within the sentence for semantic, grammatical or syntactic reasons even though Turkish is a language with scrambling, and [-DEF] object should be in the position just before the verb. It is added that the noun case suffixes give certainty to the words and so, [+DEF] object can be used in different positions in the sentence (Gronbech, 1995).

On the other hand, it is seen that the findings of the first experiment differed with studies on Mandarin Chinese (Yang & Bergen, 2007) and Spanish (Suñer & Yépez, 1988; Jegerski, 2015). In the study conducted on Mandarin Chinese, it is claimed that the feature of definiteness is influenced by the [+ANI] and [-ANI] features and that animacy rather than definiteness is determinative on the object situation. In other words, it is stated that the object with the [+ANI] feature enables an idea about who is mentioned, but it is difficult to process

because [-ANI] object does not refer to something definite (Yang & Bergen, 2007). Similarly, in the study on the second language acquisition of Spanish, it is stated that there is no separation between the [+DEF] and [-DEF] object in the processing (Suñer & Yépez, 1988; Jegerski, 2015).

The findings of the first analysis show that both the object position and verb position [-DEF] structures have longer reading times compared to [+DEF] structures, in other words, they create a higher processing cost. The fact that the difference in processing is seen not only in the field of verb but also in the field where the objects are presented may be due to the non-specificity of [-DEF] objects and the consequence of the fact that they are always VP-internal (even though the entire VP may undergo movement) (İşsever & Gracanin-Yüksek, 2011). However, according to İşsever & Gracanin-Yüksek, this pied-piping does not involve the verb because by the time the VP movement happens, the VP contains only the [-DEF] object, after the verb has vacated it on the way to T^0. In other words, discrete processing of [-DEF] objects due to the pseudo-incorporation with verb increases the processing cost. Furthermore, they suggest the fact that [+DEF] objects are interpreted as [+SPEC] is not because of accusative case marking. Rather, it is because overt case marking (accusative case) makes it possible for the object to move out the VP. In short, object case marking allows constituents to move individually instead of pied-piping the whole VP phrase, as assumed for [-DEF] objects in İşsever & Gracanin Yüksek (2011). Overall, this situation causes [+SPEC] reading for [+DEF] objects. In this research, we can suggest the same processing features when we look at the findings. The findings imply that [-DEF] objects and their case-marked counterparts, when they are immediately preverbal, do not in fact occupy the same position, and we could assume that this causes the extra processing cost for [-DEF] objects: [-DEF] objects seem to be internal to the VP, while case-marked objects are not (Çağrı, 2005, 2009; İşsever, 2008) for further reading). If we assume that accusative case is assigned under SPEC-HEAD relation with v^o (İşsever & Gracanin-Yüksek, 2011), then this implies that [+DEF] objects are assigned accusative case in a local fashion with v^o, on the other hand, [-DEF] objects are always VP-internal and they lack the higher functional structure to bear overt case morphology, namely the DP and the KP layers (Arslan Kechriotis, 2006; Erguvanlı, 1984; Öztürk, 2005, 2009). For this reason, İşsever and Gracanin-Yüksek's findings and the arguments made therein might be a good explanation for the [+DEF] and [-DEF] object processing differences.

The reflection of the processing difference starting at the object position in the verb field might be caused by the relationship between the object position and the verb position in terms of assignment of the object case. Therefore, it can be thought that the processing difference, which starts with the formal analysis of the [± DEF] structures in the object field, continues in the verb field, and this might be due to the fact that verb plays a fundamental role in the authorization of the case features of the object. In other words, it is seen that the information provided by verb affects the use of object case features (Klein & de Swart, 2011). Emeksiz (2003) argues that specificity in cases of [± DEF] object stems from presupposition referrals provided by verb. Similarly, von Heusinger and Kornfilt (2017) reported in their studies on Turkish and related languages that case markers used in [+DEF] structures are related to specificity. Specificity provided by [+DEF] situation gives [+SPEC]

and distinctive information in contrast to the general information provided by [-DEF] case. Therefore, specificity might have a facilitating effect on the processing as it might be seen in this study.

Discussion on the second analysis: The processing of subject and object case markers

As a result of the second analysis in the processing of subject and object case, it is seen that there is no difference between the conditions in the processing of subject and object positions. Therefore, non-grammatical situations in the subject and object position do not affect the participants' processing, which might show us that case features do not affect the processing. Normally, nominative case used in the subject case is a feature that is expected to be observed in the subject in Turkish, and therefore the participants tend to expect the first element of the sentence in nominative case. On the other hand, genitive case is used to express the subject of the subordinate clause in Turkish and is considered as a category that fulfils the nominal function (Kornfilt, 2003; Aygen, 2007; Karataş, 2019). However, in this study, we can see that using different case features does not affect the processing. It is seen that this multiprobability does not make a difference in terms of processing. Like in subject position, object case violation does not affect the processing and the participants might not take case violations into consideration. Therefore, we might assume that subject and object stand in the same domain and the participants might take into consideration just the word. At this point, it is possible to mention subject-object symmetry in Turkish. Likely, Öztürk (2005) suggests that when the verb moves to a higher position like T, all arguments count as equidistant to verb, which means that all arguments have an equivalent relation to the verb because any argument can move to Spec of TP once verb moves to T. Moreover, Kayne (1994) proposes linear ordering among the segments of the same category. For this reason, we can see that subject and object positions are equidistant from each other and therefore, processing difference might not be the case in this study.

When the reading times of the verb position are examined, it is seen that there is a statistically significant difference between the three conditions, and when the pairwise comparisons are examined, there is a significant difference between the grammatical condition and the object case violation, the grammatical condition and the subject case violation, and the object case violation and the subject case violation. In terms of the length of the reading period in the verb, it is seen that subject case violation creates more cognitive cost than both object case violation and grammatical condition, while object case violation creates more cognitive cost than grammatical condition. These findings might show that the verb is important in the processing of case features and both object case and subject case are determined in this field.

Looking at the average durations, it is seen that while grammatical structures are processed in the fastest way, structures containing violations in subject case require the longest time; in other words, when participants do not see the subject-verb agreement, they need more processing time about the syntactic and semantic order of the sentence (Kutas and Hillyard, 1983; Spencer & Zwicky, 1998; Carreiras et al., 2015). In terms of the length of reading time in the field of verb, it is seen that object case violations create more cognitive cost than grammatical condition, whereas object case violations have a lower reading time

than subject case violations, in other words, it does not create a cognitive cost as much as subject case violations. Thus, besides processing subject-verb non-agreement, a speaker might also have to process the non-matching subject case. To say, while subject case violation causes two violations, object case violation is just one violation. Similarly, Karataş (2019) observes that the processing of genitive case takes longer than the other case markers (nominative, accusative and dative) in the ERP study on the processing of Turkish case features in the mother tongue and the second language and adds that genitive case is not an argument of the verb. She suggests that participants make use of the lexical and syntactic processing of the verb when deciding on non-grammatical case features.

In the study, there are some syntactic possible reasons why the subject case creates more processing cost than the object case. The nature of the relationship between subject-verb and object-verb seems to be one of the reasons for this difference. In subject-verb agreement, there is a pairing relationship between a subject determiner phrase (DP) which has [+PER] and [+NUM] properties, but has the [-CASE] feature, and T^0 head, which has [+CASE] (NOM) feature but has [-PER] and [-NUM] features. On the other hand, the relation between object-verb and the verb is also the result of agreement between the functional head V^0 of verb phrase (VP) and NP, so that V^0 assigns [+CASE] feature (ACC) to NP. Therefore, it can be thought that in the subject-verb agreement there is a need to match φ–features between the subject and the verb, which is raised to T^0, and this may result in a higher processing cost.

Another possible reason why the subject case creates more processing costs than the object case can be that there is an asymmetry in the repair processes of the conditions including subject violations and object violations in experimental conditions. In other words, while non-grammaticalness is noticed in the processing of (4a) while creating VP, there is a more complicated process to recognize the grammaticality in (4b). Because a noun phrase must either have a possessive structure (aktör-ün evi ‘‘actor’s house’’) or a genitive case must be mapped to the relevant unit by a nominalized N (head of the noun phrase) in order to assign a genitive case (Ali [aktör-ün filme git-ti-ğ-in]-i sanıyor. ‘‘Ali thinks that the actor went to the movie.’’) (Pesetsky & Torrego, 2011). Since these two possibilities are out of question for the structure (4b), the sentence is not grammatical. However, in contrast to the violations in the object case, the violation in the subject case requires more possibilities to be checked, such as the subject being in the possessive structure and in the subject position of the embedded clause. As it is referred in the previous section, subject case violation might cause two different violations and as it is seen here, subject case violation might cause different expectations in term of speakers. Therefore, it is possible that both the more possibilities to be checked and that these checks are not made within a limited area such as verb phrase (VP) and extend to tense phrase (TP) cause processing cost.

(4a) *Aktör geçen ay filme seyretti.

Actor- NOM last month movie-DAT watch-PST.

‘‘Actor watched to movie last month.’’

(4b) *Aktörün geçen ay filmi seyretti.

Actor- GEN last month movie-ACC watch-PST.

‘‘Actor’s watched the movie last month.’’

Another possible reason for the difference between object case marking and subject case marking might be because of feature inheritance approach (Richards, 2007). According to this approach, subject case marking takes place between the spec of TP and T^0 which mediated by phase head C because Chomsky (2005) proposes tense and agreement features related with inflectional system are not property of T; instead, they belong to phase head C. Moreover, object case marking occurs between verb head and object in complement position of the verb phrase (VP). In other words, it is seen that internal VP processing (object-verb agreement) is faster than external VP processing (subject-verb agreement). In internal VP processing, there are accusative case assigning functional head V^0 and its complement while it is seen that external VP processing extends until TP through C. In this case, the relationship between verb and object is within local merge, whereas the relation between T and subject is mediated by C (Richards, 2007). Therefore, the greater structural distance might cause the working memory to be loaded more as it can be seen in his study.

Conclusion

In terms of syntactic processes, it is stated that case features play an active role in the language processing (Cho et al., 2002; Schlesewsky & Frisch, 2005; Mueller et al., 2005; Yang & Bergen., 2007; Mueller et al., 2008; Zawiszewski & Friederici, 2009; Aygüneş, 2013; Aygüneş, et al., 2014; Chow et al., 2018). In this study, it is aimed to examine processing of subject and object case features and the cognitive effect of object being [± DEF] with Self- Paced Reading Study.

In the literature, there are studies that indicate that there is no difference between the two structures (Suñer & Yépez, 1988; Yang & Bergen, 2007; Jegerski, 2015), whereas there are also study suggesting difference between the processing of [+DEF] and [-DEF] object case (Cho et al., 2002) is available. Looking at the processing process of [± DEF] objects in this study, it is seen that the processing of [-DEF] objects create a greater processing cost, which is consistent with the Differential Case Marking. In DOM languages, case features add quality to the object in terms of definiteness, and [+DEF] structures cause less processing cost compared to [-DEF] structures (Aissen, 2003). More definiteness of the [+DEF] structures (von Heusinger & Kornfilt, 2005; von Heusinger & Kornfilt, 2017)) and [+ SPEC] of these structures (Emeksiz, 2003) provides more clues in terms of processing and facilitate processing. In addition to this, it is possible that [-DEF] objects cannot act independently of the verb and these structures are in a position within VP (İşsever & Gracanin-Yüksek, 2011). The findings of the first analysis also show that both in the object position and verb position, [-DEF] structures have longer reading times compared to [+DEF] structures, in other words, they create a higher processing cost. The reflection of the processing difference starting at the object position in the verb field may be caused by the relationship between the object position and the verb position in terms of assignment of the object case. In other words, it is seen that the information provided by verb affects the use of object case features (Klein & de Swart, 2011).

As a result of the second analysis in the processing of subject and object case, it is seen that there is no difference between the conditions in the processing of subject and object

positions. Therefore, we might assume that non-grammatical situations in the subject and object position do not affect the participants' processing. Even if different case features are used, the participants might not focus on the case in the study. Rather, they might focus on just the word and its relationship with the verb. Moreover, there are two possible interpretations on the first member of the subject case violations condition, NP (Aktör-ün ‘‘Of actor/ actor’s’’), such as being the subject of embedded sentence or the demonstrative position of a possessive phrase at this stage. It is seen that this multiprobability in terms of processing does not make a difference in terms of processing. Like in subject position, object case violation does not affect the processing. Therefore, we can also mention about another possibility which the participants might process the subject and object equidistant. Öztürk (2005) emphasizes that the subject remains in-situ within Specs of vP unless it needs to impose scope properties and the object also raises to adjoin to one of the Specs of vP to check its case feature in a local relation, which might suggest the any type of operation will see those two positions equidistant from each other.

In the second experiment, it is seen that subject case violation creates more cognitive cost than both object case violation and grammatical condition, while object case violation creates more cognitive cost than grammatical condition in terms of the length of the reading period in the verb. In other words, the participants might need more processing time about the syntactic and semantic order of the sentence when they do not see the subject-verb agreement, (Kutas and Hillyard, 1983; Spencer & Zwicky, 1998; Carreiras et al., 2015). Thus, the participants might also have to process the non-matching subject case besides processing subject- verb non-agreement. These findings might also suggest that the verb is important in the processing of case features and both object case and subject case are determined in this field. In the study, there are some syntactic possible reasons why the subject case creates more processing cost than the object case. The processing of the object case in VP and the short distance between the complement and the head; the realization of the subject case feature in TP and the fact that the structural distance between the two elements is long, and the need for some additional operations such as the matching of the agreement features between the subject and verb morpheme are considered as possible reasons under this difference (Pesetsky & Torrego, 2011; Richards, 2007).

Suggestions for Practice

It does not seem possible to determine exactly which or which of the possibilities including more space in the working memory, locality, pseudo-incorporation between verb-object, lexical determination that can underlie the difference of the case assignment processes are effective in the experimental design of this study. Therefore, the development of the issue with new experiment sets to test these sub-explanations will contribute to the literature.

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